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Retail customers' adoption of sustainable mobile banking self-service technologies within digital ecosystems: A performance-risk-sustainability perspective

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ABSTRACT

This study develops and tests a theoretically integrated model of sustainable mobile banking adoption by positioning trust as the central mechanism linking user evaluations to behavioural intention. Drawing on an extended Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), the study organises key determinants into three complementary dimensions: functional evaluations (effort expectancy, facilitating conditions, and self-service technology attributes), affective experience (hedonic motivation), and value-based and risk considerations (sustainability and perceived privacy risk). These dimensions are theoretically integrated through trust, a cognitive–affective construct that addresses performance uncertainty, emotional engagement, and value alignment in digital financial contexts. A quantitative survey of 430 retail banking customers in Zimbabwe was analysed using partial least squares structural equation modelling. The results indicate that functional, affective, and value-based perceptions do not independently drive adoption intention; instead, their effects converge through trust, which serves as a central mediating mechanism. Specifically, trust transmits the influence of these antecedents to behavioural intention, establishing a clear hierarchical pathway from perceptions to outcomes. Notably, hedonic motivation and sustainability, often viewed as competing motivational logics, operate coherently as affective and normative antecedents of trust. The study concludes that trust is the primary pathway through which diverse user perceptions translate into adoption behaviour. It contributes by advancing a trust-centric integration of technology adoption, sustainability, and risk perspectives, reconciling competing motivational logics within a unified framework, and providing empirical evidence from an under-researched African context. Importantly, the Zimbabwean context, characterised by economic volatility, infrastructural constraints and heightened uncertainty in financial systems amplifies the role of trust as a critical mechanism, thereby extending existing technology adoption models that are typically developed in more stable environments. These findings highlight the importance of aligning functional performance, user experience, and sustainability values to strengthen trust and promote the adoption of sustainable digital banking.

Introduction and research contextualisation

Sustainable mobile banking (m-banking) refers to the provision of digital financial services via mobile devices (Naruetharadhol et al., 2021; Shaji et al., 2025) to enhance equitable financial inclusion (Owusu et al., 2020; Micheler et al., 2019), and promote responsible and

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resilient economic practices (Bashar et al., 2025; Sajid, 2025), driven by global sustainability challenges and increasing adoption in underserved and developing regions, particularly Africa (UNCTAD, 2019). The development of digital disruptive financial technologies will unlock the potential for sustainable mobile banking (m-banking) (Nyagadza et al., 2025) and services innovation in emerging economies (Nyagadza et al., 2025), via creating strategic connections in the enhanced service production process. Benefits of the adoption of sustainable mobile banking include convenience and accessibility, reduced environmental impact, financial empowerment and operational efficiency for banks. This trajectory aims to achieve a net-zero economy by radically reversing traditional ways of thinking and driving progress towards a global ecological balance. Banks, environmental NGOs, and technology firms, may need to venture into co-development of eco-digital products that support multiple SDGs (SDG 17), such as carbon-tracking mobile apps or green savings products. However, in this study, sustainability is operationalised narrowly within the context of perceived value and responsible service use in digital banking, rather than as a direct environmental impact construct or macro-level SDG outcome, thereby ensuring clear construct boundaries and measurement consistency.

While the worldwide mobile penetration stood at 78.2 per cent (Tsokota et al., 2020), with a lower rate of 9 per cent, despite the current 103 per cent mobile penetration in Zimbabwe, sustainable m-banking adoption remains low. Devising strategies and tactics is imperative to enhance banks' viability and increase demand for sustainable m-banking. Furthermore, the degree to which sustainable m-banking is being adopted in developing countries, especially in Africa, is not comparable to the pace in developed countries (Makanyeza, 2017). In Zimbabwe, some banks are adopting 'sustainable banking models' such as First Capital Bank, which is leading in Environmental, Social and Governance (ESG) principles and paper reduction efforts. This has been supported by the country's 'National Financial Inclusion Strategy 2022-2026′, which notes mobile money as key to financial inclusion.

Trust plays an important role in digital financial contexts by reducing the uncertainty in users' perceptions and translating them into behavioural intentions (Alalwan et al., 2018; Cheng & Jiang, 2020). While prior studies on mobile banking adoption have mainly focused on widely accepted predictors of adoption such as perceived usefulness, ease of use and trust (Davis et al., 1989; Venkatesh et al., 2012; Alalwan et al., 2016; Agyei et al., 2020), they have largely overlooked sustainability-oriented dimensions of digital financial services. Emerging research on sustainable finance and green digital technologies, which include (Owusu et al., 2020; Micheler et al., 2019; Naruetharadhol et al., 2021) suggest that financial innovations are increasingly expected to contribute towards financial inclusion, environmental responsibility, as well as long-term behavioural change. However, these sustainability views are generally not strongly integrated into technology adoption frameworks as far as inclusion and risk is concerned as attempted by the present study. As a result, it can be inferred that there is limited theoretical and empirical understanding of how sustainability perceptions affect mobile banking adoption behaviour, particularly in emerging markets.

In addition, prior research on retail mobile banking adoption in emerging markets such as Africa has employed diverse methodological approaches, mostly focused on contextual factors, which have sometimes produced contradictory findings. This study, therefore, advances knowledge through a more robust nomothetic quantitative approach. This approach reflects the need theoretically grounded and empirically robust studies that integrate emerging dimensions such as sustainability within established adoption frameworks. The current study, therefore, attempts to address the following research questions (RQs):

RQ1: *How do technology adoption factors (performance expectancy, effort expectancy and social influence) shape retail customers' trust in sustainable mobile banking?*

RQ2: *How do perceived innovativeness, sustainability orientation, and perceived privacy risk influence retail customers' trust in sustainable mobile banking, and what role does attitude toward self-service technologies play in this relationship?*

RQ3: *To what extent does trust in mobile banking influence retail customers' intentions to adopt these services?*

There is limited research providing a comprehensive analysis of sustainable mobile banking in Zimbabwe and across much of Africa, highlighting the contextual relevance of the current study. The findings contribute to the existing body of knowledge by offering empirical insights, revisiting certain prevailing assumptions, and suggesting avenues for future research on sustainable digital financial services in emerging economies. Furthermore, this study employs UTAUT2 as contextually appropriate and widely applied framework for examining technology adoption model, alongside other models such as the Technology Adoption Model (TAM), Innovation Diffusion Theory (IDT), without asserting comparative superiority.

The remainder of this article is structured as follows: The first section presents a literature review, hypotheses, and the development of the research conceptual model. A section on materials and methods follows, followed by the analysis of results. Discussions, conclusions, practical and theoretical implications, study limitations and future research directions are also presented.

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Research originality and novelty

The originality and novelty of this study lie in its development of a theoretically integrated, trust-centric model of sustainable mobile banking adoption that moves beyond the fragmented predictor approach dominant in prior research. While existing studies grounded in the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) have largely treated determinants such as performance expectancy, effort expectancy, and hedonic motivation as independent drivers of behavioural intention, they often lack a unifying theoretical mechanism that explains how these diverse factors jointly shape adoption behaviour (Venkatesh et al., 2012; Alalwan et al., 2018). This study addresses this limitation by repositioning trust as a central mediating construct, thereby providing a coherent explanatory pathway for integrating functional evaluations, affective responses, and value-based considerations. In doing so, the study responds to calls for more theoretically grounded and parsimonious models in digital banking and fintech adoption research (Merhi et al., 2019; Sharma & Sharma, 2024). Importantly, this configuration also departs from prior trust-mediated models by specifying trust as the primary integrative mechanism through which all antecedent constructs converge, rather than as a generic intermediary between isolated predictors and intention, thereby yielding a more unified and theoretically constrained explanatory structure.

A second key contribution lies in the theoretical reconciliation of competing motivational logics, particularly hedonic motivation and sustainability. Prior literature has often treated these constructs as conceptually distinct or even incompatible, with hedonic motivation rooted in intrinsic enjoyment and experiential value (van der Heijden, 2004), and sustainability grounded in normative, ethical, and long-term value considerations (Micheler et al., 2019; Owusu et al., 2020). By conceptualising both as antecedents of trust operating through affective and normative pathways, respectively, this study demonstrates that these constructs are not contradictory but complementary within a broader cognitive–affective trust formation process. This integration extends existing technology adoption models by embedding sustainability within mainstream behavioural frameworks,

rather than treating it as an external or peripheral variable (Amnas et al., 2023).

Third, the study contributes methodologically and conceptually by reframing sustainability as an indirect determinant of adoption, rather than a direct predictor. While prior studies have increasingly incorporated sustainability into digital finance research, they have often assumed a direct relationship between sustainability and behavioural intention (Naruetharadhol et al., 2021). In contrast, the present study demonstrates that sustainability influences adoption indirectly via trust, thereby offering a more nuanced understanding of how value-based perceptions translate into behavioural outcomes in digital financial ecosystems. This insight advances the emerging literature on sustainable fintech by highlighting the mediating role of psychological mechanisms in bridging values and behaviour (Cheng & Jiang, 2020; Gefen et al., 2003). This indirectly-only specification is further theoretically significant as it clarifies an alternative model structure in which sustainability loses explanatory power when trust is included, thereby addressing prior inconsistencies in the literature regarding whether sustainability exerts a direct behavioural effect.

Finally, the study provides contextually grounded yet theoretically generalisable evidence from an under-researched African setting, specifically Zimbabwe. While mobile banking adoption has been extensively studied in developed and Asian markets, there is limited empirical work integrating sustainability, risk, and trust within African digital ecosystems (Makanyeza, 2017). By testing a theoretically enriched model in this context, the study not only fills a geographical gap but also demonstrates the applicability and robustness of the proposed framework in emerging markets characterised by high uncertainty, infrastructural constraints, and evolving digital financial landscapes. Thus, the contribution of this study extends beyond mere contextual application by offering a theoretically novel, integrative framework that can be adapted and tested across diverse digital and sustainability-oriented settings.

Theory

The current study adopts the Unified Theory of Acceptance and Use of Technology 2 as the key theoretical framework because it effectively explains technology adoption. As extended by Viswanath Venkatesh et al. (2012), UTAUT2 provides a comprehensive model for predicting behavioural intentions towards technology use, with a particular focus on customer-centric factors relevant to digital service adoption (Nyagadza et al., 2025). The framework has demonstrated effectiveness across multiple technology contexts, including mobile banking, electronic banking, and digital payment systems. The main variables of the UTAUT2 model are presented in Figure 1.

To ensure theoretical coherence, this study positions trust as the central mediating construct which connects technology-related perceptions, risk considerations and sustainability evaluations to behavioural intention. While UTAUT2 explains how users form functional evaluations of digital technologies, including performance expectancy, effort expectancy and social influence (Venkatesh et al., 2012). Additionally, it does not explicitly account for uncertainty and risk in digital financial environments. In mobile banking contexts, trust plays a crucial role in lowering uncertainty and enabling users to translate perceptions into behavioural outcomes (Alalwan et al., 2018).

Accordingly, this study integrates perceived privacy risk and sustainability as theoretically grounded extensions to UTAUT2. Perceived privacy risk captures concerns related to data security and potential misuse of personal information, which have been shown to directly influence trust formation in digital financial services (Cheng & Jiang, 2020; Featherman & Pavlou, 2003). Sustainability, in turn, reflects users' perceptions of the environmental and social responsibility of mobile banking services, which increasingly shape trust and confidence in digital platforms (Micheler et al., 2019; Owusu et al., 2020). Importantly, both constructs influence behavioural intention indirectly through trust rather than acting as independent predictors.

In this way, trust operates as the central tool through which functional evaluations, risk perceptions and sustainability considerations are combined to create behavioural intention. This positioning ensures that the model remains theoretically consistent, avoiding construct fragmentation while aligning all predictors within a unified explanatory framework centred on trust (Alalwan et al., 2018; Gefen et al., 2003). Furthermore, to ensure conceptual clarity and construct validity, only constructs theoretically aligned with consumer trust in mobile banking were used for this study. This approach was necessary to ensure consistency between the theoretical framework and the empirical model. Based on this theoretical positioning, all antecedent constructs are modelled as predictors of trust, which in turn influences behavioural intention.

Accordingly, the inclusion of these constructs is not arbitrary but reflects a theoretically guided extension of UTAUT2 to capture sustainability-oriented and risk-sensitive dimensions of mobile banking adoption. Further to this, additional factors were incorporated into UTAUT2, including perceived innovativeness , attitude towards self-service technologies, inconvenience (Hill et al., 2015; Carter & Knol, 2019), perceived privacy risk (Sundar & Marathe, 2010; Cheng & Jiang, 2020), and sustainability, to enhance the robustness and contextual relevance of the conceptual model.

Literature review

Based on the theoretical positioning of this study, trust is conceptualised as the central construct through which users' evaluations, risk perceptions and sustainability decisions influence behavioural intention. Accordingly, all antecedent constructs are modelled as predictors of trust, which in turn drives mobile banking adoption intention.

Technology constructs

Performance expectancy

Performance expectancy captures the extent to which using information and communication technologies enhances users' task performance (Lew et al., 2020). Prior research indicates that when customers perceive technologies such as mobile banking as useful, efficient, and beneficial to their daily activities, they are more inclined to develop positive evaluations of the system (Alalwan et al., 2016; Davis et al., 1989). However, beyond adoption, performance expectancy also fosters trust through competence-based evaluations. When a system consistently delivers expected performance outcomes, users infer that it is reliable, capable, and dependable, which are foundational elements of trust (Oliveira et al., 2014; Gefen et al., 2003; Phan et al., 2025). Furthermore, the convenience, flexibility, and accessibility associated with mobile banking services reinforce perceptions of system reliability, thereby strengthening users' confidence in the technology (Alalwan et al., 2018; Agyei et al., 2020). Given that performance expectancy signals the system's ability to consistently deliver valuable, reliable, and efficient outcomes, it reduces uncertainty and strengthens users' confidence in the system's competence and dependability, which are core dimensions of trust rather than mere technology acceptance (Gefen et al., 2003; McKnight et al., 2011; Oliveira et al., 2016). Therefore, based on the foregoing discussion, it is hypothesised that:

H1: *Performance expectancy has a positive impact on retail customers' trust in sustainable mobile banking.*

Effort expectancy

Effort expectancy refers to the degree to which a system is perceived as easy to use. It has been widely established as a key determinant of user perceptions in technology acceptance models (Venkatesh et al., 2003; Davis et al., 1989). In the context of trust, ease of use reduces cognitive effort and uncertainty, thereby enhancing users' perceptions of system

transparency and predictability (Gefen et al., 2003). Studies show that when customers perceive mobile banking platforms as simple and user-friendly, they are more likely to trust the system due to reduced ambiguity and perceived risk (Zhou, 2011). Additionally, ease of navigation signals system integrity and reliability, thereby further strengthening perceptions of trust (Alalwan et al., 2018).Since systems that are easy to use are perceived as more transparent, predictable, and controllable, effort expectancy reduces ambiguity and perceived risk, thereby fostering users' confidence in the system's reliability and integrity, key foundations of trust beyond simple usability considerations (Gefen et al., 2003; Zhou, 2011; Venkatesh et al., 2003). Consequently, drawing from the preceding arguments, the following hypothesis is proposed:

H2: *Effort expectancy positively impacts retail customers' trust in sustainable mobile banking.*

Social influence

Social influence reflects the extent to which individuals perceive that important others believe they should use a particular system (Venkatesh et al., 2003). In mobile banking contexts, social environments, including family, peers, and opinion leaders, play a crucial role in shaping both behavioural and trust-related perceptions. Trust is often transferred through social networks, where individuals rely on others' experiences and recommendations to reduce uncertainty about new technologies (Gefen et al., 2003). Empirical studies further demonstrate that social influence positively affects both trust and intention to use mobile banking services (Nyagadza, 2022; Alalwan et al., 2016; Alalwan et al., 2018). Consequently, social validation and peer endorsement enhance the perceived credibility and trustworthiness of mobile banking systems. As individuals rely on the opinions and experiences of trusted others in uncertain environments, social influence facilitates trust transfer processes, whereby confidence in referent groups is extended to the technology itself, thus reinforcing perceived credibility and trustworthiness rather than only influencing behavioural intention (Lu et al., 2010; Gefen et al., 2003; Alalwan et al., 2017). In light of the above deliberations, it can be hypothesised that:

H3: Social influence positively affects retail customers' trust in sustainable mobile banking.

Hedonic motivations

Hedonic motivation refers to the enjoyment, pleasure, and intrinsic satisfaction derived from using a system (Agyei et al., 2020). In digital environments, positive emotional experiences play a critical role in shaping trust through affective mechanisms (van der Heijden, 2004). When users find mobile banking enjoyable and engaging, they develop favourable emotional associations with the system, which enhances trust. Additionally, hedonic experiences such as playfulness and interactivity increase user engagement and familiarity, both of which are key antecedents of trust formation (Loh et al., 2019; Gefen et al., 2003). As mobile banking interfaces become more engaging and enjoyable, users are more likely to perceive them as safe, reliable, and trustworthy (Yen & Chiang, 2020). Because enjoyable and engaging user experiences generate positive affective responses, hedonic motivation enhances emotional attachment and familiarity with the system, thereby reducing perceived risk and fostering affect-based trust rather than solely driving usage intentions (van der Heijden, 2004; Kim et al., 2009; Gefen et al., 2003). Accordingly, the preceding theoretical insights lead to the following hypothesis:

H4: Hedonic motivations positively affect retail customers' trust in sustainable mobile banking.

Habitual usage

Habitual usage reflects the extent to which individuals perform behaviours automatically due to repeated experience. Habit contributes to trust through experience-based learning, where repeated interactions with a system reinforce perceptions of reliability and consistency (Gefen, 2000). Prior behaviours significantly shape users' confidence in a system, as familiarity reduces uncertainty and perceived risk (Venkatesh et al., 2012). In mobile banking, frequent use enhances users' ability to perform transactions efficiently while reinforcing trust in the system's functionality and security (Penney et al., 2021). Therefore, habitual use strengthens trust by building a record of positive experiences over time. Through repeated interactions, habitual use enables users to accumulate experiential evidence of the system's reliability and consistency, thereby reducing uncertainty and reinforcing confidence in its dependability, which strengthens trust beyond mere behavioural routine (Gefen, 2000; Limayem et al., 2007; Zhou, 2013). Thus, informed by the reasoning, the study posits that:

H5: Habitual usage positively impacts retail customers' trust in sustainable mobile banking.

User evaluation

Attitude towards self-service technologies (SSTs)

Self-service technologies (SSTs) in mobile banking refer to customer-operated digital interfaces that enable users to perform financial transactions independently via mobile applications without direct interaction with service personnel (Dabholkar & Bagozzi, 2002; Alalwan et al., 2017). Attitude towards SSTs reflects users' assessment of interacting with such systems including their level of comfort, preference and acceptance of technology-mediated service delivery (Dabholkar & Bagozzi, 2002; Trivedi, 2019). In mobile banking contexts, positive attitudes towards SSTs enhance users' perceived control and reduce uncertainty thereby strengthening confidence in the system's functionality (Alalwan et al., 2018). As users become more comfortable engaging with self-service platforms they are more likely to perceive mobile banking systems as reliable and trustworthy. It is thus hypothesised that:

H6: Attitude towards self-service technologies influences (SSTs) retail customers' trust in sustainable mobile banking.

Perceived privacy risk

Perceived privacy risk

Perceived privacy risk refers to customers' concerns about potential loss, misuse, or unauthorised access to their personal and financial information when using mobile banking (Cheng & Jiang, 2020). Given the sensitive nature of financial data, privacy concerns remain a central determinant of trust in digital banking services. Higher levels of perceived privacy risk increase uncertainty and reduce users' confidence in the security of mobile banking platforms, thereby undermining trust (Featherman & Pavlou, 2003). Consequently, privacy risk is expected to negatively affect trust. Thus, it is hypothesised that:

H7: Perceived privacy risk negatively influences customers' trust in mobile banking.

Sustainability

Sustainability

The need for sustainable m-banking development and adoption is a bid to reverse traditional ways of thinking and foster trust in new technologies (Shankar et al., 2003). However, the challenges of sustainable m-banking may include, but are not limited to, sufficiency issues related to maturity, befitting disruption, and the affordability of costs associated with interoperability (Micheler et al., 2019). Since retail customers conduct numerous transactions through sustainable mobile banking, proper customer education and quality service are essential for

future engagements (Nyagadza et al., 2022b). Banks need to ensure that they minimise system downtime (Carter & Knol, 2019) and maintain the system's seamless, sustainable operation as expected (Hill et al., 2015), even during periods of high retail customer usage volumes. In mobile banking contexts, system reliability plays a critical role in trust formation, as customers expect uninterrupted access and secure processing of financial transactions (Melikoglu & Arslan, 2026). When users perceive mobile banking platforms as reliable and stable, their trust in the system is significantly strengthened. It is thus hypothesised that:

H8. Sustainability in mobile banking positively impacts retail customers' trust in sustainable mobile banking.

Trust and mobile banking adoption intention

In previous studies, trust has been conceptualised as retail customers' perceptions of a bank's integrity, benevolence, and ability in the context of sustainable mobile banking (Alalwan et al., 2018). Intention refers to an individual's subjective likelihood of performing a specific behaviour (Cheng & Jiang, 2020; Phan et al., 2025). The significance of sustainability in mobile banking trust is also emphasised in this study, as it explores how environmentally and socially sustainable banking practices can improve users' trust and confidence in mobile banking. Customers' intention to use sustainable mobile banking is strongly influenced by their trust in the service to conduct transactions and access e-banking features. Moreover, trust and usage intention are linked to brand loyalty and overall satisfaction with the bank (Papacharissi & Rubin, 2010; Penney et al., 2021). Drawing on this evidence, we hypothesised that:

H9. Retail Customers' trust in sustainable mobile banking positively influences their intentions to adopt it.

Methodology

This section explains the sample, the questionnaire design and measures, and the data collection methods used in the research. The investigation employed a quantitative research design, adhering to a positivist philosophy.

Design of questionnaire and measures

Choice of variables

The choice of variables for this study was not arbitrary but informed by well-established theoretical frameworks and the existing literature, specifically the Unified Theory of Acceptance and Use of Technology (UTAUT) and its extensions, which have been widely used in digital banking and financial technology research. The fundamental variables, such as performance expectancy (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC), hedonic motivation (HM), and habit (HU), are consistently robust in explaining users' adoption of digital technology in various digital platforms, including mobile banking. However, additional variables, such as perceived innovativeness (PI), automation (AUT), and self-service technology attributes (SSTA), were included to account for the ever-changing nature of digital platforms, in which banking services increasingly incorporate attributes initially examined in adjacent domains, such as chatbots and self-service technology. Inconvenience (INC) and perceived privacy risk (PPR) were also included, based on risk-based theories of adoption, in which risk factors are considered crucial in determining users' intention to engage with digital platforms. Sustainability (SUS) was specifically included to ensure contextual relevance to the constantly evolving concepts of green banking and sustainable finance. Importantly, although the study borrowed some of the measurement items from previous research in related domains (e.g., self-service technologies and digital interfaces), the items were all rigorously rewritten and contextualised in the mobile banking domain. A pre-test and pilot study were conducted with a selected group of participants to examine the clarity, relevance, and contextual appropriateness of the items. Moreover, expert opinions from both scholars and banking practitioners were also incorporated in the study. The mediator construct, i.e., sustainable mobile banking trust (SMBAT), and the dependent variable construct, i.e., sustainable mobile banking adoption intention (SMBAI), were developed to effectively capture the process of trust-building in the sustainability-oriented digital banking domain. The study, therefore, does not rely on the assumption that the constructs are transferable to the mobile banking domain in an absolute sense. Rather, the study relies on a more theoretically informed and empirically supported approach by borrowing constructs from well-established models and rigorously contextualizing them in the mobile banking domain. This is similar to other studies in related domains where the constructs were rigorously extended and contextualised to examine emerging technological and sustainability-oriented constructs. To address construct validity concerns arising from item adaptation, all measurement scales were subject to additional post-hoc validation procedures, including convergent and discriminant validity assessment, as well as cross-loadings inspection to ensure that each construct captures a distinct theory domain. Attention was given to the sustainability construct to confirm that items reflect value-based and responsible digital banking perceptions rather than general convenience or usefulness, and to trust construct to ensure conceptual separation from performance expectancy and usability-related dimensions, thereby minimizing potential measurement overlap and inflation of structural relationships.

Instrument constructs, items, statements, sources and reliability

The variables depicted in Table 1 were measured using item scales adapted from the literature related explicitly to sustainable m-banking adoption intention among customers. The items were examined using confirmatory factor analysis (CFA). Further to this, Cronbach's alpha coefficient (α), the average variance extracted (AVE), composite reliability (CR) coefficient, means, standard deviations and the correlation between the set of constructs were examined.

Sampling and data collection

The cross-sectional survey design was adopted in the study to sample and collect data from the population of sustainable mobile banking (m-banking) customers in Marondera, Zimbabwe, a locale that is home to five major commercial banks. The study population comprised registered and active mobile banking customers, identified in collaboration with the bank branch managers and the respective bank's customer service department, and those that were publicly available from the Reserve Bank of Zimbabwe (RBZ) and the Zimbabwe Stock Exchange (ZSE). Stratified random sampling was employed in the study to ensure the representativeness of the sample obtained from the larger population. Stratification was done along the five commercial banks in the locale. Within each bank, the study population was further stratified into regular and occasional service users, and the proportional allocation method was employed to determine the number of participants from each stratum. Permission to access the participants was granted in writing by the bank management before the research assistants were given the go-ahead to access the participants within the banking halls and waiting lounges. To ensure randomness in the selection of the participants, every nth customer entering the banking halls or seeking mobile banking services was targeted to participate in the study. A total of 430 responses were obtained from the study, and the questionnaire required approximately 20 minutes to complete. From the sample profile presented in Table 2, it is evident that most of the participants were female, aged between 20 and 39 years (69.2%), and the majority (67.2%) of the participants had attained at least a Bachelor's degree. A larger percentage (84.4%) of the participants reported having a monthly income of below $1,500.

Table 1
Instrument constructs, item, statements, sources and reliability.

Construct	Item	Statement	Source	*FL*	*α*
Performance expectancy (PE)	PE1	I find sustainable *m*-banking to be useful	Alalwan et al. (2016), Makanyeza (2017), Gu et al. (2009), Luarn and Lin (2005), Venkatesh et al. (2012) and Melián-González et al. (2021).	0.868	0.844
	PE2	Using sustainable *m*-banking helps me accomplish things quickly		0.921	
	PE3	Sustainable *m*-banking helps solve doubts		0.868	
Effort expectancy (EE)	EE1	Learning how to use sustainable *m*-banking is easy for me	Agyei et al. (2020), Alalwan et al. (2018), Venkatesh et al. (2012) and Melián-González et al. (2021).	0.853	0.859
	EE2	I find sustainable *m*-banking easy to use		0.870	
	EE3	It is easy for me to become skilled at using sustainable *m*-banking		0.879	
Social Influence (SI)	SI1	Many people I know use sustainable *m*-banking	Dabholkar and Baggozi, Alalwan et al. (2017), Melián-González et al. (2021).	0.878	0.838
	SI2	People who influence my behaviour use sustainable *m*-banking		0.874	
	SI3	People whose opinions I value use sustainable *m*-banking		0.856	
Hedonic Motivations (HM)	HM1	Using sustainable *m*-banking is fun	Brown and Venkatesh (2005), Püschel et al. (2010), van der Heijden (2004), Venkatesh et al. (2012), Alalwan et al. (2018) and Melián-González et al., (2021).	0.873	0.848
	HM2	Using sustainable *m*-banking is enjoyable		0.900	
	HM3	Using sustainable *m*-banking is very entertaining		0.839	
Self-Service Technology (SSTA)	SSTA1	I like receiving sustainable *m*-banking customer services via IT	Dabholkar and Baggozi, (2002), Alalwan et al. (2017) and Melián-González et al. (2021).	0.889	0.828
	SSTA2			0.854	
	SSTA3	I think it is alright to receive sustainable *m*-banking customer services via Self Service Technologies		0.839	
	SSTA4	I think receiving sustainable *m*-banking customer services via Self Service Technologies is good		0.846	
		Receiving sustainable *m*-banking customer services via Self Service Technologies is comfortable			
Facilitating Conditions (FC)	FC1	There is substantial support from the bank pertaining sustainable *m*-banking	Lew et al. (2020) and Melián-González et al. (2021).	0.865	0.875
	FC2			0.877	
	FC3	Clear instructions are provided to use sustainable *m*-banking		0.842	
	FC4	There is network coverage to do sustainable *m*-banking		0.844	
		Banks' helpdesk assists me when facing sustainable *m*-banking difficulties			
Perceived Privacy Risk (PPR)	PPR1	My information can be used in a way I do foresee (Reverse coded) via sustainable *m*-banking	Loh et al. (2019), Cheng and Jiang (2020) and Sundar and Marathe (2010).	0.870	0.828
	PPR2			0.873	
	PPR3	The information I submit to sustainable *m*-banking can be misused		0.889	
		There is too much uncertainty associated with sustainable *m*-banking customer service			
Sustainability (SUS)	SUS1	Sustainable *m*-banking service is environmentally friendly	Micheler et al., (2019), Carter and Knol (2019) and Hill et al. (2015).	0.858	
	SUS2			0.864	0.812
	SUS3	Sustainable *m*-banking enhances future transactional usage		0.893	
		Sustainable *m*-banking is less complex and advantageous			
Sustainable *m*-Banking Adoption Trust (SMBAT)	SMBAT1	The conversational sustainable *m*-banking customer service is trustworthy	Papacharissi and Rubin (2010) and Yen and Chiang (2020).	0.854	0.891
	SMBAT2			0.905	
	SMBAT3	I trust the sustainable *m*-banking application		0.893	
		The sustainable *m*-banking is adequate for my needs			
Sustainable *m*-Banking Acceptance (SMBAI)	SMBAI1	When required, I will use sustainable *m*-banking	Alalwan et al. (2018), Parra-López et al. (2011) and Melián-González et al. (2021).	0.884	
	SMBAI2			0.897	
	SMBAI3	I intend to use sustainable *m*-banking in the future		0.881	
		I think that more and more people will use sustainable *m*-banking			

Source: Theoretical and literature review

Common method variance

With respect to the nature of cross-sectional and single-source questionnaire data, several precautions have been taken to limit common method bias (CMB). First, the respondents were guaranteed anonymity and confidentiality to prevent social desirability bias and apprehension in terms of answering the questions, and the directions clearly stated that there were no right or wrong answers. Second, the items in the questionnaire have been written in a simple and clear manner in order to reduce misinterpretations and response biases. In addition, Harman's single-factor test has been conducted, which showed that no factor explained the major portion of variance (i.e., less than 50%), implying that CMB does not seem to be a problem. Finally, the results of an exhaustive collinearity test using variance inflation factors (VIFs) indicated that none of the values exceeded the conservative boundary of 3.3, suggesting that common method bias as well as multicollinearity do not pose any serious problems for the estimations. While there is no guarantee against CMB with one test alone, the above-

Table 2
Sample profile demographic characteristics.

Characteristics	Frequency	%
Gender		
Male	205	48.3
Female	225	51.7
Total	**430**	**100**
Age		
< 20 years	117	27.1
20-29 years	150	34.6
30-39 years	105	24.2
40-49 years	42	10.4
> 50 years	16	3.7
Total	**430**	**100**
Education		
High School Level	36	9.1
Certificate Level	53	12.2
Diploma Level	50	11.5
Bachelor's Degree Level	190	43.9
Master's Degree Level	91	21.0
Doctoral Degree Level	10	2.3
Total	**430**	**100**
Monthly Income (US$)		
< 500	139	32.2
500-999	145	34.1
1000-1499	79	18.2
1500-1999	49	11.3
> 2000	18	4.2
Total	**430**	**100**

Source: Field data

mentioned precautions are quite convincing in this regard.

Non-response bias test

To check for the non-response bias test, the researchers used Armstrong and Overton's test (1977) to examine the t-test functions to analyse the similarities and differences of each succeeding result.

Ethical considerations

Adherence to research ethics in line with principles of informed consent, response freedom, privacy and confidentiality, accuracy, integrity and research values, were all considered to avoid bias and establish credibility of the data collection process (Marketing Research Society, 2022).

Results and analysis

The data were analysed using partial least squares structural equation modelling (PLS-SEM), which enables the simultaneous estimation of measurement and structural models, manages complex models involving many constructs and indicator variables (Hair et al., 2024), and is increasingly employed in technology-acceptance research. Descriptive statistical analysis was achieved through the functional application of charts, tables, graphs, and diagrams, which informed inferential statistics (Hair et al., 2024). These included frequencies, mean and standard deviation. Software packages used for data visualisation were SmartPLS and SPSS, versions 3 and 25, respectively. Exploratory factor analysis (EFA) was used to identify the underlying relationships between the variables measured, Confirmatory Factor Analysis (CFA) to evaluate adequacy of the measurement model, and Principal Component Analysis (PCA) to assess total variance in the data, as well as Bartlett's test of sphericity to check for uncorrelated hypotheses.

Measurement model

The descriptive statistics were done using the Cronbach alpha (α), average variance extracted (AVE), and commonalities used to measure internal consistency. Table 3 presents the results.

Internal consistency exists and the measurement items are reliable since all the CA and CR values exceed 0.7, a recommended value by Hair et al., 2022. The AVE values are all above 0.5, a recommended value.

Convergent and discriminant validity

Discriminant validity was also examined through the Fornell-Larcker criterion, in which the square root of average variance extracted (AVE) for each construct is compared to its correlation with other constructs. From Table 4, it can be seen that the square root of AVE for each construct, represented by AUT (0.82), EE (0.85), FC (0.87), HM (0.88), HU (0.87), SMBAI (0.89), SMBAT (0.95), PE (0.85), PI (0.87), PPR (0.90), SI (0.84), SSTA (0.85), INC (0.84), and SUS (0.89), is greater than its correlation with other constructs for each construct. For instance, SMBAT (0.95) is greater than its highest correlation with SMBAI (0.81); FC (0.87) is greater than its highest correlation with SMBAT (0.76); and PPR (0.90) is greater than its highest correlation with HM (0.76). All of this points to sufficient discriminant validity (Hair et al., 2022). Furthermore, all AVEs fall within a range of 0.67 to 0.90, exceeding 0.50, thereby pointing to sufficient convergent validity.

In addition, to the Fornell-Larcker criterion, discriminant validity was further assessed using the Heterotrait-Monotrait (HTMT) ratio to address potential concerns regarding conceptual overlap among constructs. The HTMT approach provides a more stringent evaluation of discriminant validity, particularly in models with closely related psychological and behavioural constructs. The results indicate that all HTMT values remain below the recommended threshold of 0.85 (Hair et al., 2022), confirming adequate discriminant validity across the measurement model. Constructs exhibiting relatively high correlations in the Fornell-Larcker analysis, sustainable mobile banking trust and adoption intention, as well as facilitating conditions and performance-related constructs still demonstrate HTMT values within acceptable limits, thereby reinforcing their empirical distinctiveness. These findings provide additional support that the measurement model is not affected by problematic construct overlap and that latent variables capture distinct theoretical domains.

Structural model assessment

The variance inflation factor (VIF) values of most variables were below 5, which moderately supports multicollinearity assumptions (Hair et al., 2022). Sustainable *m*-banking adoption trust, sustainable mobile banking adoption intention and attitude towards self-service have R^2 (coefficient of determination) values of 0.987, 0.922 and 0.748, respectively and were explained by the predictors. Only sustainable *m*-banking adoption intention had an indirect relationship with the other predictors. Furthermore, the Q^2 (measure of predictive relevance) was medium to large, supporting that the path model's predictive relevance was adequate for the endogenous construct.

Collinearity issue of the structural model

Multicollinearity is one of the assumptions of SEM. Collinearity must be studied to ensure it does not bias the results before judging the structural interactions. VIF and tolerance are often used to evaluate collinearity among predictors. According to the SEM results, partial multicollinearity was a concern, as some VIF values exceeded 5 (Hair et al., 2022). PE → SMBAT, HU → SMBAT, PI → SSTA, INC→ SMBAT and SMBAT→ SMBAI VIF values were above 5 which shows the presence of multicollinearity (Table 5). EE → SMBAT, SI → SMBAT, HM → SMBAT, PI → SMBAT, SSTA→ SMBAT, FC → SMBAT, AUT → SMBAT, PPR → SMBAT and SUS→ SMBAT VIF values were lower than five. To manage multicollinearity, performance expectancy, habitual use, inconvenience and perceived innovativeness were removed from the

Table 3
Descriptive statistics.

Construct	Item	Descriptive Statistics				Cronbach alpha (α)	*AVE*	Result	Communalities
		Mean	SD	S_k	K_u				
Performance expectancy	PE1	4.76	1.23	0.842	1.54	0.845	0.721	Reliable	0.861
	PE2			0.853	1.34				
	PE3			0.932	1.73				
	PE4			1.45	1.86				
Effort expectancy	EE1	4.21	1.03	1.21	1.62	0.857	0.719	Reliable	0.857
	EE2			1.64	1.7				
	EE3			0.787	1.73				
Social influence	SI1	4.11	1.52	0.781	1.58	0.836	0.697	Reliable	0.87
	SI2			0.828	1.72				
	SI3			1.21	1.29				
Hedonic motivations	HM1	4.16	1.31	1.36	1.91	0.849	0.786	Reliable	0.835
	HM2			1.49	1.67				
	HM3			1.42	1.89				
Facilitating conditions	FC1	4.03	1.27	1.83	1.28	0.829	0.764	Reliable	0.901
	FC2			1.72	1.35				
	FC3			1.65	1.37				
	FC4			1.92	1.42				
Perceived risk	PPR1	4.51	1.24	1.14	1.52	0.876	0.812	Reliable	0.956
	PPR2			1.74	1.56				
	PPR3			1.54	1.47				
Attitude towards self-service technology	SSTA1	4.31	1.24	1.08	1.85	0.831	0.725	Reliable	0.926
	SSTA2			1.17	1.69				
	SSTA3			1.24	1.64				
Sustainability	SUS1	4.1	1.07	1.24	1.23	0.814	0.801	Reliable	0.817
	SUS2			1.18	.14				
	SUS3			1.12	1.16				
Sustainable mobile banking adoption trust	SMBAT1	4.25	1.16	1.36	1.47	0.893	0.90	Reliable	0.829
	SMBAT2			1.4	1.581				
	SMBAT3			1.43	1.47				
Sustainable mobile banking adoption intention	SMBAI1	4.2	1.27	1.57	1.35	0.886	0.793	Reliable	0.841
	SMBAI2			1.68	1.22				
	SMBAI3			1.43	1.37				

Source: *Field Data*

Table 4
Discriminant validity results - Fornell and Lacker criterion.

Latent Variables	AUT	EE	FC	HM	HU	MBAI	MBAT	PE	PI	PPR	SI	SSTA	INC	SUS
AUT	**0.82**													
EE	0.21	**0.85**												
FC	0.42	0.35	**0.87**											
HM	0.29	0.33	0.34	**0.88**										
HU	0.48	0.35	0.39	0.23	**0.87**									
SMBAI	0.31	0.48	0.69	0.48	0.23	**0.89**								
SMBAT	0.70	0.34	0.76	0.52	0.24	0.81	**0.95**							
PE	0.44	0.63	0.41	0.52	0.49	0.37	0.34	**0.85**						
PI	0.60	0.54	0.36	0.36	0.48	0.15	0.43	0.77	**0.87**					
PPR	0.45	0.61	0.16	0.76	0.37	0.31	0.12	0.39	0.51	**0.90**				
SI	0.64	0.47	0.34	0.43	0.32	0.18	0.16	0.58	0.62	0.42	**0.84**			
SSTA	0.41	0.44	0.39	0.57	0.65	0.17	0.15	0.65	0.65	0.48	0.45	**0.85**		
INC	0.15	0.29	0.27	0.33	0.25	0.23	0.26	0.19	0.39	0.32	0.46	0.29	**0.84**	
SUS	0.45	0.51	0.61	0.52	0.48	0.39	0.62	0.53	0.36	0.43	0.63	0.46	0.42	**0.89**
AVE	0.67	0.72	0.76	0.78	0.75	0.79	0.90	0.72	0.75	0.81	0.70	0.73	0.70	0.80

Source: *Field data*

model.

Coefficient of determination (R^2)

In the current study, sustainable *m*-banking adoption trust has a coefficient of determination (R^2) value of 0.782, which is explained by habitual use, perceived innovativeness, hedonic motivations and social influence, just to mention a few. The predictors have a direct effect on sustainable *m*-banking adoption trust. The sustainable mobile banking adoption intention R^2 value is 0.754, contributed by sustainable m-banking adoption trust, which links all the other explanatory variables in the model. The predictors have an indirect contribution, as indicated by the R-squared value. The developed model has a moderate to substantial explaining power (Hair et al., 2022).

Predictive Relevance (Q^2)

The predictive relevance (Q^2) values are explained in Table 5. The study obtains Q^2 values of 0.312 for sustainable m-banking adoption trust (Hair et al., 2022), and 0.219 for Sustainable m-banking adoption intention, which are within the required limit and support the adequacy of the path model's predictive relevance for the endogenous construct.

Effect Size (f^2)

From Table 6, effect size (f^2) values of the relationship between

Table 5
Collinearity issue of structural model.

Exogenous variables	VIF	Tolerance
PE → SMBAT	6.034	0.166
EE → SMBAT	3.503	0.285
SI → SMBAT	3.734	0.268
HM → SMBAT	4.615	0.217
HU → SMBAT	5.405	0.185
PI → SMBAT	3.980	0.251
PI → SSTA	6.893	0.145
SSTA→ SMBAT	4.037	0.248
INC→ SMBAT	5.285	0.189
FC → MBAT	3.741	0.267
AUT → SMBAT	2.949	0.339
PPR → SMBAT	3.179	0.315
SUS→ MBAT	3.739	0.267
SMBAT→ SMBAI	7.763	0.129

Source: Primary data

Table 6
Coefficient of determination (R^2), Effect size (f^2) and Predictive Relevance (Q^2).

Variables	*R* Square	Q^2	Effect size
Sustainable *m*-banking adoption trust	0.782	0.312	4.625
Sustainable *m*-banking adoption intention	0.754,	0.219	3.019

Source: Primary data

sustainable mobile banking adoption trust and sustainable mobile banking adoption intention are considered as strong.

Structural model

To assess the relationships in the model, SEM was applied using PLS version 3. The first conceptual structural equation model was produced, and final structural model (Appendix 1, Fig. 1) was constructed, showing the results.

The results presented in Table 7 show that there is a statistically significant positive link between sustainable and customers' trust in sustainable *m*-banking (β = 0.073, p<0.001), sustainable *m*-banking acceptance and customers' trust in sustainable *m*-banking (β = 0.815, p<0.001). Furthermore, there is a statistically significant positive link between facilitating conditions and customers' trust in sustainable *m*-banking (β = 0.198, p<0.001), sustainable *m*-banking perceived privacy risk and customers' trust in sustainable *m*-banking (β = 0.214, p<0.001) and customers' trust in sustainable *m*-banking and customers' sustainable *m*-banking adoption intentions (β = 0.815, p<0.001). However, there is a statistically significant negative link between automation and customers' trust in sustainable *m*-banking (β = -0.095, p<0.05). Moreover, there is a positive link between sustainable *m*-banking social influence and customers' trust in sustainable *m*-banking (β = 0.192, p<0.001), sustainable *m*-banking effort expectancy and customers' trust in *m*-banking (β = 0.012, p<0.001).

Mediation effect analysis

Table 8 presents the results of testing specific indirect effects that reflect the hypothesised indirect relationships using Sobel test.

The mediation effect of sustainable mobile banking trust (SMBAT) was examined using the Sobel test. Moreover, it is confirmed by bootstrapping with confidence intervals. The results show that the mediation effect of SMBAT is significant for the relationships between the predictors and sustainable mobile banking adoption intention (SMBAI). In other words, the results show that the mediation effect of SMBAT is significant for the relationships between effort expectancy (EE) (β = 0.01, t = 3.527, p < 0.001) with a 95% CI [0.005, 0.096], social influence (SI) (β = 0.156, t = 7.543, p < 0.001) with a 95% CI [0.128, 0.649], hedonic motivation (HM) (β = 0.205, t = 9.076, p < 0.001) with a 95% CI [0.109, 0.342], facilitating conditions (FC) (β = 0.161, t = 7.742, p < 0.001) with a 95% CI [0.097, 0.295], perceived privacy risk (PPR) (β = 0.174, t = 7.854, p < 0.001) with a 95% CI [0.129, 0.286], and sustainability (SUS) (β = 0.059, t = 3.987, p < 0.001) with a 95% CI [0.016, 0.175]. On the other hand, the mediation effect of SMBAT is not significant for the relationship between automation (AUT) and SMBAI, since the mediation effect is not significant at the level of 95%, with β = −0.077, t = 1.854, p = 0.085, with a 95% CI [−0.107, 0.075].

Table 8
Mediation effect analysis.

Path	Std beta	*t*-Statistics	*p*-Values	Decision	Bootstrapping confidence interval	
					95% CI LL	95% CI UL
EE→ SMBAT → SMBAI	0.01	3.527	<0.001	Supported	0.005	0.096.
SI→ SMBAT → SMBAI	0.156	7.543	<0.001	Supported	0.128	0.649
HM→ SMBAT → SMBAI	0.205	9.076	<0.001	Supported	0.109	0.342
FC→ MBAT → SMBAI	0.161	7.742	<0.001	Supported	0.097	0.295
AUT→ SMBAT → SMBAI	-0.077	1.854	0.085	Not supported	-0.107	0.075
PPR→ SMBAT → SMBAI	0.174	7.854	<0.001	Supported	0.0129	0.286
SUS→ SMBAT → SMBAI	0.059	3.987	<0.001	Supported	0.016	0.175

Source: Field data

Table 7
Structural model's PLS results.

Hypothesis	Relationship	Std beta	*t*-statistic	*p*-values	Confidence 2.5%	Intervals 97.5%	Decision
H_1	EE → SMBAT	0.012	4.014	<0.001	0.011	0.026	Supported
H_2	SI → SMBAT	0.192	7.034	<0.001	0.063	0.298	Supported
H_3	HM → SMBAT	0.252	9.914	<0.001	0.216	0.337	Supported
H_4	SSTA→ SMBAT	0.321	14.305	<0.001	0.214	0.482	Supported
H_5	FC → SMBAT	0.198	7.537	<0.001	0.082	0.296	Supported
H_6	AUT → SMBAT	-0.095	1.734	0.421	-0.172	0.076	Not supported
H_7	PPR → SMBAT	0.224	8.731	<0.001	0.183	0.307	Supported
H_8	SUS→ SMBAT	0.073	4.281	<0.001	0.002	0.183	Supported
H_9	SMBAT→ SMBAI	0.815	16.031	<0.001	0.747	0.921	Supported

Source: Field data

Discussion

The current research explores the impact factors of adopting sustainable mobile banking self-service technology among digital ecosystem customers from the perspective of performance, risk, and sustainability. Based on the use of structural equation modelling (SEM) and mediation analysis, the results reveal that almost all hypothesised factors have significant effects on the dependent variable of sustainable mobile banking trust (SMBAT), which in turn significantly affects sustainable mobile banking adoption intention (SMBAI). Effort expectancy, social influence, hedonic motivation, self-service technology attributes, facilitating conditions, privacy risk, and sustainability were found to have significant positive effects on SMBAT, thus establishing the necessary conditions for mediation. On the contrary, automation was not found to be significantly associated with SMBAT, consistent with the insignificant indirect effect found for the same. Most importantly, SMBAT was observed to have a strong positive relationship with SMBAI, indicating its crucial mediating role in transferring the effects of technological, behaviour-related, and sustainability considerations to adoption intention.

In light of the theories (UTAUT2, trust, as well as the general literature on digital banking and fintech), the study highlights some of the main determinants of SMBAT and SMBAI through the analysis of the SEM results. Namely, effort expectancy, social influence, hedonic motivation, SSTs attributes, facilitating conditions, privacy risk perception, and sustainability are identified as the factors having a statistically significant and positive effect on SMBAT. It is important to note that such findings prove to be empirically as well as theoretically sound. Thus, for instance, if a person perceives the system as being easy to use, his/her trust in the system will grow due to the absence of complexities involved. Furthermore, social influence acts as another critical factor because it allows creating social proof by relying on peers and networks, thereby building trust. On top of that, hedonic motivation adds to the development of trust by associating a positive experience of using the system with its reliability and beneficence. Moreover, the high quality of SSTs is also linked to competence and dependability. Meanwhile, facilitating conditions increase the level of institutional trust due to their role in making using the platform simpler. The statistically significant association between perceived privacy risk and trust should also be considered, as such a relationship means that risk management and data protection measures can create the basis for trust and confidence. Finally, sustainability also proves to be an important variable since value congruence helps develop deeper trust and confidence.

Another important point is the central position of trust as a variable that affects the adoption of the system under consideration, since the relationship between SMBAT and SMBAI is also identified as statistically significant and strong. This fact implies that, in the case of intangible and automated services, trust serves as a key psychological factor affecting users' behavioural intentions, which is rather important to understand. Specifically, by reducing perceived risk and increasing readiness to rely on the system, trust becomes a critical factor in engaging users with the service. At the same time, it should be noted that the lack of impact of automation on SMBAT can be regarded as a critical finding, as automation does not necessarily help build trust. It can be due to fears associated with the loss of control, lack of interaction, and impersonality, among others. Therefore, even though all other technological and contextual variables increase trust, automation should be handled carefully.

Mediation analysis through the application of the Sobel test and the bootstrapping technique provides compelling evidence that sustainable mobile banking trust is a core psychological mediator of different predictors of sustainable mobile banking adoption intention. The mediation effects of effort expectancy, social influence, hedonic motivation, facilitating conditions, privacy risk, and sustainability have been revealed, confirming that trust plays an important role as the intervening variable. These variables affect the adoption intention by means of their influence on creating trust in the system at the first stage of adoption. The main reason for such effect stems from the fact that trust helps to alleviate the uncertainty associated with digital banking, thus making the process of conversion of the ease of use, social validation, enjoyment, facilitating conditions, risk, and value alignment into trust in the system feasible. In cases where both direct and indirect effects are significant, partial mediation is found, meaning that while trust remains the primary factor mediating the relationships between the predictor and adoption intention, the former can affect the latter through other variables such as habit formation. Hedonic motivation, facilitating conditions, and perceived privacy risk show relatively strong mediation effects, implying that the most effective ways of creating trust in the system are the ones related to users' pleasant experiences, infrastructural support, and clear risk management.

In turn, no mediation effect of automation has been found, which is due to the insignificant direct relationship between the variable and trust in the system. Such a result indicates that automation does not play a key role in trust formation. Reasons for the lack of influence involve potential disadvantages of automated systems, including less personal contact, reduced users' control over the process, and inflexibility of actions. Automated systems are perceived as being impersonal, which makes users less responsive to any issues occurring during transactions. Besides, users tend to associate automated solutions with potential challenges that arise in the process, including technical problems, transaction-related issues, and security risks. Within the framework of complicated digital ecosystems, especially those that incorporate advanced AI, users may not be able to differentiate real transactions from fraudulent ones, thus causing additional uncertainty. As such, customers prefer hybrid solutions involving automation supplemented with human assistance. On balance, it can be stated that only some variables can influence users' trust, namely hedonic motivation, facilitating conditions, and privacy risks; automation requires additional factors to have a positive influence on the adoption process.

The findings of the current study support and build on prior research on mobile banking adoption grounded in the UTAUT2 model. Consistent with previous studies, trust turns out to be an important predictor of behavioural intention, in conformity with Parayil Iqbal et al. (2023), who found that the factor positively and significantly influences mobile banking adoption in the case of Islamic banking customers in the Maldives. Also, similar results have been presented by Mironova and Vasanthakumar (2026), who found that the inclusion of trust, security, and privacy improved the validity of UTAUT2 in cross-cultural mobile banking settings, underlining the crucial role of trust for digital banking. The current paper contributes by demonstrating that hedonic motivation, social influence, and effort expectancy significantly affect behavioural intention in a way analogous to that described by Parayil Iqbal et al. (2023). In turn, the significance of performance expectancy, effort expectancy, and social influence as determinants for extending UTAUT2 has been emphasised by Farzin et al. (2021) in relation to mobile banking adoption. The crucial role played by trust as a mediator is also in line with Merhi et al. (2019), who found that trust acts as a mediator between security, privacy issues, and intention to adopt the technology. Moreover, the importance of trust and service quality for the real adoption of mobile banking services has been highlighted by Sharma and Sharma et al (2024).

Despite the agreement with prior research, there are also several unique contributions made by the current study in terms of mobile banking adoption and its prediction by means of the UTAUT2 model. Unlike previous papers, such as Luu et al. (2024), focusing on word-of-mouth communication, in the current study, trust was identified as a mediator between multiple exogenous variables and behavioural intention. At that, whereas examined self-service technologies in Jordanian banks and Hassan et al. (2023) included security and privacy aspects in their study, in the current investigation, sustainability was introduced as a separate predictor in the UTAUT2-based framework that has been relatively little studied in mobile banking research. The

positive impact of sustainability on trust and adoption intention found in the study makes its contribution to the fintech research and answers Amnas et al. (2023)'s recommendations to extend the UTAUT2 model. At that, the lack of a significant impact of automation on trust differs from emerging research on artificial intelligence in the banking sector, where, for example, Schrank (2025) finds that perceived intelligence and anthropomorphism of AI significantly influence adoption intentions. By contrast, in the current study, the mere automation of processes does not necessarily foster trust. It should also be noted that industry experts argue that human interaction is preferred when AI restricts accessibility. Finally, unlike most research on developed economies, the present study offers unique insights into mobile banking adoption in Zimbabwe.

Theoretical implications

Several important theoretical contributions to existing research have been made in this paper. First, this study extends the UTAUT2 model by considering sustainability and perceived privacy risk as new predictors for the model. Although previous studies have used trust and risk to integrate within UTAUT2, including sustainability as an additional predictor is novel to current literature, considering the increasing use of environmental, social and governance (ESG) principles in the business practices of financial institutions. Furthermore, the findings of this paper show that the sustainability variable positively affects trust (SMBAT), meaning that value congruence between customers and banks significantly facilitates trust development. It should also be noted that incorporating self-service technology attributes and automation allows one to address the gap identified in existing literature, calling for an increased focus on digital self-service environment dynamics. However, while self-service technology attributes (SSTA) significantly increase the trust in the mobile bank, automation does not facilitate trust formation, which highlights the importance of human or relational support in building customer trust in technology.

Secondly, this paper defines trust as a crucial mediating mechanism rather than just a predictor. As the findings show, effort expectancy, social influence, hedonic motivation, facilitating conditions, perceived privacy risk, and sustainability have a major impact on the adoption intention (SMBAI) via trust. Therefore, trust becomes an important psychological pathway for translating perceptions into actual behaviours. Besides, this study expands the research agenda of the digital ecosystems and sustainable fintech by identifying several dimensions influencing the process of trust creation, including functional, affective, and value-based. Finally, the contribution of this paper lies in exploring trust in relation to a developing country, namely Zimbabwe, where little research is done in mobile finance and technology adoption because most scholars have focused on developed countries and Asia. The high explanatory power of the proposed model shows how important it is to define trust as the mediating mechanism.

Practical implications

Firstly, since the mediating effect of SMBAT on SMBAI is statistically significant, this implies that the importance of trust should be prioritised in mobile banking. In other words, banks should make deliberate efforts to enhance transparency, reliability, and accountability to ensure that their clients perceive their service to be trustworthy enough to adopt mobile banking. Therefore, banks are recommended to have strong data governance policies, robust security measures, reputable certificates, and dispute resolution mechanisms in place to foster trust. Additionally, there should be continuous improvement in usability, which refers to effort expectancy. Since the use of social influence positively affects both trust and adoption intentions, banks should employ marketing tactics such as referrals, testimonials, and community engagement campaigns to boost adoption intentions among potential customers. For example, when users recommend mobile banking to others and receive positive feedback from friends and family members, their adoption intention increases. Furthermore, it is critical to provide users with engaging and aesthetically pleasing interfaces as part of the effort to improve user experience and enjoyment, which may lead to higher levels of affective trust.

On the other hand, facilitating conditions play an important role in enhancing adoption intention. Banks should strive to create enabling environments by ensuring the availability of resources and technologies required for mobile banking. For instance, digital infrastructure development and reliable customer support are key factors that contribute to facilitating conditions. Besides, it may be prudent to focus on the relationship between value perception and trust. The findings reveal that users who believe that the bank adds value to them perceive it to be more trustworthy than those with negative value perceptions. Therefore, it is imperative to emphasise value addition, especially through sustainability initiatives. Lastly, it is critical to pay attention to privacy concerns and sustainability perceptions as drivers of trust and adoption intentions. Banks should address privacy concerns explicitly to assure users that their personal data will not be misused and that the bank will provide adequate protection measures. In other words, privacy concerns can be turned into positive aspects of mobile banking services if properly managed. On the same note, banks should communicate clearly about their sustainability efforts to enhance value perception and trust. However, the insignificant role of automation implies that it is necessary to avoid relying on technology too much without considering the human element. Automation alone is not sufficient to increase trust because users require access to relevant information when needed. Therefore, it is advisable to develop hybrid models with efficient automated systems complemented by easily accessible human operators to ensure that users' concerns are addressed effectively and promptly.

Limitations of the study

The current research is limited by several issues that must be considered during the interpretation of the findings. Firstly, a cross-sectional approach limits the possibility of drawing any conclusions about causality between variables, as perception is measured only once. Secondly, collecting information through surveys creates risks associated with self-reporting bias, particularly when respondents tend to distort their answers for the sake of being socially acceptable. Thirdly, the study was limited to one geographical location – Marondera –, thus potentially limiting the applicability of results for different socio-economic and technological environments. Lastly, the scope of analysis was limited to a set of variables defined as most important within the broad theoretical UTAUT2 framework, meaning that other variables affecting sustainable adoption of m-banking might have been ignored. In the current study, we also acknowledged the limitation of multicollinearity, this may have affected the interpretation of path coefficients and the robustness of the proposed trust-centric structure. This had some implications for theory as well as methodological orientation, and not merely a statistical adjustment.

Future research directions

Future research can adopt a multifaceted agenda to further our understanding of sustainable mobile banking technology adoption, informed by the findings of this study. First, the theoretical incorporation of sustainability into the UTAUT2 model should be the focus of future research. This entails creating a Sustainable UTAUT2 framework by combining concepts from theories like the Value-Belief-Norm model, such as moral obligation, green trust, and environmental concern. To improve the model's ability to predict eco-digital behaviours outside of banking research, it must empirically examine whether these variables function as direct determinants, mediators, or moderators. Second, it is important to conduct contextual and cross-cultural research. It is possible to ascertain whether adoption determinants are influenced by

local factors or are universal through comparative studies between developed and developing economies. One of the most important questions is how cultural values (e. A g., collectivism) moderate the impact of social norms and how a region's adherence to UN Sustainable Development Goals (SDGs) affects consumer expectations. Investigating the relationship between eco-consciousness and demographic profiles is also necessary for focused tactics. Lastly, improvements in methodology are crucial. Beyond single-point snapshots longitudinal research is required to monitor how adoption behaviour changes over time. In complex datasets, advanced analytics techniques such as machine learning can reveal hidden user segments and nonlinear relationships. Deeper causal insights will also be obtained by using mixed-methods or experimental designs and by creating validated scales for new constructs such as green digital trust. In the end correlating survey data with actual behavioural usage data will greatly improve future models' empirical validity.

Conclusion

In this study, the factors influencing the adoption of sustainable mobile banking self-service technologies among retail customers were analysed using the performance-risk-sustainability approach based on an extended version of the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2). Applying a structural equation model (SEM) and mediation effect analysis to the dataset comprising 430 customers of Marondera, Zimbabwe, the results reveal that sustainable mobile banking trust (SMBAT) plays the role of the key mediating mechanism linking effort expectancy, social influence, hedonic motivation, self-service technology characteristics, facilitating conditions, privacy risk, and sustainability to adoption intention, with trust being the main predictor of mobile banking adoption. The highest mediation effects can be attributed to hedonic motivation, facilitating conditions, and privacy risk. Automation was found to exert no significant impact on trust in mobile banking services, which indicates that automation alone is not sufficient to enhance users' trust without human assistance. From the theoretical viewpoint, this paper adds the aspects of sustainability and privacy risks to UTAUT2. Trust is considered a mediating factor, rather than a predictor of adoption behavior. In terms of practical significance, the results imply that banks should consider building trust through the means of improving usability and user experience, promoting social influence, developing infrastructure, addressing privacy concerns and sustainability-related issues, and limiting automation. For policymakers, including the Reserve Bank of Zimbabwe, it might mean focusing on secure digital infrastructure, consumer protection measures, and digital literacy enhancement initiatives. Despite the limitations associated with the cross-sectional research design and a narrow scope of sampling, further research in the field could benefit from longitudinal designs and data on user behavior. It is particularly important to focus on advanced digital technologies and innovations, such as artificial intelligence and blockchain solutions. Nevertheless, the study proves once again that sustainable mobile banking adoption depends on building trust among users.

Ethics approval and consent to participate

All procedures performed in this study involving human participants were in accordance with the ethical standards and informed consent was obtained from all individual participants included in the study.

Consent for publication

The authors consent publication of the article.

Availability of data and materials

The article has no data associated with, or published on, any digital repository.

Disclaimer

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Brighton Nyagadza: Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Gideon Mazuruse:** Methodology, Investigation, Funding acquisition, Formal analysis, Data curation. **Tendai Makoni:** Visualization, Supervision, Resources, Methodology. **Tinashe Chuchu:** Methodology, Investigation, Formal analysis, Data curation. **Eugine Tafadzwa Maziriri:** Visualization, Validation, Supervision, Project administration. **Abu Bashar:** Writing – original draft, Resources.

Declaration of competing interest

Authors declare that there's no financial/personal interest or belief that could affect their objectivity in carrying out the research.

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Appendix 1

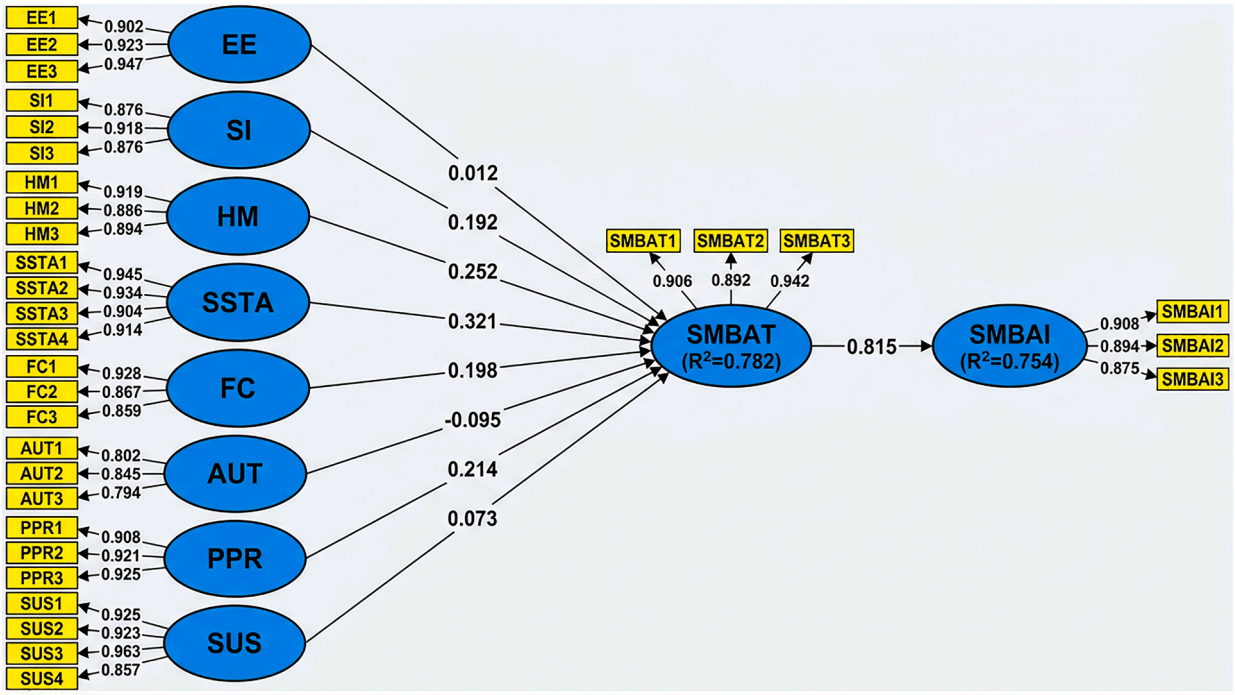

Figure 1. Validated final structural model's showing PLS results.
Key: Performance expectancy (PE), effort expectancy (EE), social influence (SI), hedonic motivations (HM), habitual use (HU), perceived innovativeness (PI), self-service technology (SSTA), inconvenience (INC), facilitating conditions (FC), automation (AUT), perceived privacy risk (PPR), sustainability (SUS), sustainable mobile banking trust (SMBAT) and sustainable mobile banking adoption intention (SMBAI).
Source: Authors' conception.

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