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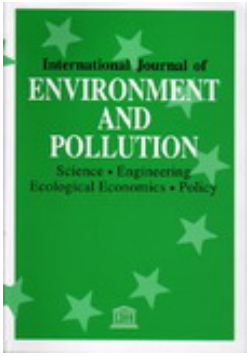

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Can mobile banking apps usage contribute towards the environmental sustainability: a mediation analysis

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Can mobile banking apps usage contribute towards the environmental sustainability: a mediation analysis

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Abstract: In digital transformation, digital finance has emerged as an alternative to conventional financial services. Currently, digital financial aspects and environmental sustainability are urgent issues receiving research attention for environmental mitigation. This empirical research addresses digital finance on environmental sustainability through mobile banking app usage. It is among the convenient digital financial technologies developed in recent years for the benefit of various stakeholders. The current model integrated UTAUT2 with perceived security and environmental sustainability. The partial least square structural equation modelling was used to test the hypothesis and other statistical power. This paper provides sustainable perspectives encouraging the Indian tribals to adopt digital technology in financial transactions. The findings have several important policy implications for developing countries, particularly vulnerable populace and those settled in remote areas. This research confirms the positive relations of mobile banking app usage on environmental sustainability through a cross-sectional approach.

Keywords: UTAUT2; northeast tribals; environmental sustainability; mobile banking apps; PLS; partial least squares structural equation modelling.

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1 Introduction

Technological development has advanced financial inclusion to digital financial inclusion and broadens its scope and applicability. Information and communication technology (ICT) is one technical piece of innovative digital equipment, but cannot ignore its contribution to the financial sector. ICT ushered in a new wave across industrial sectors, notably biotechnology and digital financial services (Shobande and Ogbeifun, 2022). Mobile technology is one of the ICT components, with innovative applications offering the most significant advantage in various fields (Alvarez-Risco et al., 2021). Recently, there have been radical transformations in the financial sectors under the ambit of rapid digital technology development in collaboration with ICT products (Cheng et al., 2021). According to Semerikova (2020), smartphone payments have become more secure and convenient than traditional cards. Smartphones act as mediators to transmit information through electronic coding and virtual-based and transform conventional banking into digital banking. Su and Moaniba (2017) insist on implementing environmentally friendly innovative technology. Technological innovations maximise efficient, clean use of resources in the social, environmental, and economic dimensions (Cancino et al., 2018). Anthropogenic pressures disrupt the earth's equilibrium. Therefore, there is much evidence to support concerns about environmental issues.

'Digital finance is financial services delivered through mobile phones and computer networks linked to a reliable payment system' (Ozili, 2020). It is essential in conducting daily activities with many advantages, like easy use, saving time, and reducing costs (Gomber et al., 2017). Recently, mobile banking has been gaining prominence in digital finance. Mobile banking applications (m-banking apps) are a recent digital technology innovation with enormous avenues to improve retail banking operations and customer experience (Thusi and Maduku, 2020). Digital finance has become a determining factor in achieving economic, social, and environmental sustainability (Klapper et al., 2016). The extant literature on digital finance concentrates on economic and social sustainability (Pece et al., 2015; Kazancoglu et al., 2021); very few acknowledged environmental dimensions of holistic sustainability by adhering to the United Nations framework climate change convention to address its resilience (UNFCCC, 2015). However, with climate change effects and global warming on the biotics, the environmental approach attracts researchers and policymakers' attention.

Digital finance provides exponential coverage of formal financial services for the elders, students, middle-aged, women and rural inhabitants (Zou et al., 2021). Monitoring digital finance's effects on environmental sustainability in India, with the second-highest population, is essential as India represents one of the most pollutant countries. Studying

these effects could provide policy recommendations for low-income individuals to avoid pollution in the future (Elheddad et al., 2021). Digital finance is only a means to the end, not an end. Thus, in this paper, the authors try to analyse the outcome of digital finance through m-banking app usage on environmental sustainability among tribals and identify the factors influencing m-banking app usage.

No empirical study has been undertaken to analyse the statistical relationship between m-banking apps on environmental sustainability. Most of the past studies undertaken examine the consumers' experience, intention to use and usage but failed to acknowledge the beneficial outcome (environmental sustainability). The current research addresses this gap and examines the mediating m-banking app usage effects on environmental sustainability among the Northeast Indian tribals. The indigenous people in India demonstrate assertive sustainable behaviour as their social practices and culture revolve around the ecological aspect.

2 Literature review and hypothesis development

2.1 Integrated UTAUT2 with perceived security and environmental sustainability

The UTAUT emerged from eight combined models of TRA, TAM, TPB, TAM and TPB model, MM, Model of PC utilisation, IDT, and SCT (Bhatiasevi, 2016; Lawson-Body et al., 2020). UTAUT adoption has been studied only within the organisation and represented certain shortcomings for individuals' focal behaviour. A revised model of UTAUT, which is UTAUT2, was published by Venkatesh et al. (2012) and has become one of the theoretical foundations and most cited models for technology among the individual users (Schmitz et al., 2022). UTAUT2 was chosen as the underlying theoretical model for the present study for its comprehensiveness and high explanatory power in predicting technology acceptance (Lawson-Body et al., 2020). Karjaluoto et al. (2020) consider UTAUT2 a well-established model concerning mobile technology adoption for individual consumers. However, it has certain limitations in explaining the emerging m-banking apps usage. Unlike the entertainment-focused technologies of mobile games and music, the factors of 'hedonic motivation, habit and social influence' are virtually meaningless to a mobile-related payment platform (Shin and Lee, 2021; Bommer et al., 2022) as mobile payment do not give pleasure, enjoyment and comfort (Al-Sabaawi et al., 2021). Gansser and Reich (2021) considered facilitating conditions insignificant when performance expectancy and effort expectancy constructs are present. Hence, our model omitted hedonic motivation, habit, facilitating needs, and social influence constructs as these were insignificant in mobile-related payments (Mohamed Merhi et al., 2019). Security is a significant concern given India's rising mobile-related financial transactions. Extant literature has found perceived security as crucial in consumers' willingness to engage in digital financial transactions due to uncertain risks and prevalent scams. Merhi et al. (2021) recommended exploring security issues in the UTAUT2 model. Therefore, this current research presents an opportunity to apply the integrated UTAUT2 to examine m-banking app usage outcomes on environmental sustainability.

2.2 Mobile banking apps usage

Cashless transactions have been getting attention in recent years. New payment factors enhance consumers' needs and making cashless payments has become effortless (Semerikova, 2020). 'M-banking apps consist of mobile computing providing customers with the support needed to bank irrespective of time and location with the help of a mobile handheld device' (Alavi and Ahuja, 2016). M-banking app is an innovative digital financial service delivered through smartphone and software applications (Ho et al., 2020). The banking sector is extending digital platform-wide to provide its self-service in the form of automated teller machines (ATMs), telephone banking, online banking and m-banking apps (Mullan et al., 2017; Shankar et al., 2020a, 2020b). Among all mobile commerce, m-banking apps are the major platforms (Shankar et al., 2020a, 2020b). The m-banking apps are considered a disruptive digital financial service instrument to efficiently deliver convenient and customised banking services without location and time constraints (Alavi and Ahuja, 2016; Malaquias and Hwang, 2016). It benefits the banks and customers (Chaouali and El Hedhli, 2019) with cost effect and efficient banking service (Shankar et al., 2019). The banks encourage customers to adopt m-banking apps to access banking services (Albashrawi et al., 2019). However, scant efforts have been made in the extant literature to explore the outcome of m-banking applications usage; hence, this study contributes to the existing literature by exploring the aspects of sustainability.

2.3 Effort expectancy

Effort expectancy measures the degree of ease associated with using digital technology (Venkatesh et al., 2003, p.450) 'the extent to which consumers perceive digital technology used as free of effort and easy to learn' (Venkatesh et al., 2012). In this context, 'effort expectancy' refers to the degree to which users believe m-banking apps are easy to learn and require less effort. M-banking apps require digital banking knowledge and skill; thus, effort expectancy is salient in predicting customers' intention to use m-banking apps (Alalwan et al., 2017). Albashrawi et al. (2019) and Rahi et al. (2018) came to the same conclusion and revealed that effort expectancy influences innovative technology in internet banking use.

H1: Effort expectancy is positively related to m-banking apps usage.

2.4 Performance expectancy

'Performance expectancy indicates the extent to which user believes that technology helps to improve their job performance' (Venkatesh et al., 2003). It reflects customers' perceptions of profits acquired using m-banking apps, such as cost-benefit, time-saving, convenience or ubiquity, and immediacy. An extensive past literature supports performance expectancy's positive impact on users' mobile commerce behaviour (Alalwan et al., 2017). Performance expectancy and its equivalents (such as perceived usefulness) in m-banking are mentioned in past studies (Singh et al., 2020; Chand et al., 2022; Che Nawi et al., 2022; Hidayat-ur-Rehman et al., 2022).

H2: Performance expectancy positively impacts mobile banking apps usage.

2.5 Perceived security

According to Shin (2009, p.1346), 'perceived security is the degree to which a customer believes that using a particular mobile payment procedure is secured'. When customers have confidence in m-banking security, their perceived risk is low, and they are prone to use the applications (Luo et al., 2010). Security refers to consumers' information privacy and the safety of their financial transactions over the m-banking apps (Shankar and Jain, 2021). Consumers are cynical about performing financial transactions over mobile phone platforms; hence, customers prefer offline banking services. Consumers face the risk of hacks, scams, and misuse of their m-banking applications if they lose their mobile phones (Shankar et al., 2022). Customers expect banks to provide security from hackers. Ensuring customers' safety in financial transactions and private information via m-banking apps is a top priority (Saprikis et al., 2022). Hence, it is assumed that the greater the users' perceived security, the higher m-banking apps adoption and usage (Belanche-Gracia et al., 2015).

H3: Perceived security is positively related to m-banking apps usage.

2.6 Price value

'Price value (PV) is 'the consumers' cognitive trade-off between the perceived benefits of the applications and the monetary outcome benefits for using them' (Venkatesh et al., 2012, p.162). Users tend to compare the costs of digital technology and its benefits (Alalwan et al., 2014). According to Zhang et al. (2015), price values refer to the users' perception of the monetary value and benefits they can enjoy. As various technology emerges in the economy, the price value is one of the most important factors for mobile shopping (Shang and Wu, 2017). Consumers always look for money-saving opportunities and price benefits in an m-banking context (Loh et al., 2022; Sankaran and Chakraborty, 2022). The price value is essential as the customers need not spend money and time on online transactions compared to physical banking services.

H4: Price value is positively related to m-banking apps usage.

2.7 Environmental sustainability

Sustainability cannot achieve its goals without digital innovation (Silvestre and Țîrcă, 2019). ICT promotes sustainability by reducing transaction costs, enhancing innovation and development, and assisting the financial sector (Chatterjee, 2020). The core concept of sustainability elucidates the present and future generations (Ziolo et al., 2017), giving generations a secure present life and a promising future (Brundtland, 1987). Sustainability has complex coverage, and each country prioritises its strategies and implementation (Allen et al., 2019). Sustainability forms the triple bottom line of planet, people and profit (Svensson and Wagner, 2015; Hervani et al., 2017). It refers to any form of growth that does not harm the environment (Ferreira et al., 2020). This study concentrates on the environmental aspect and digital technology development trades-off. The concept of 'environmental sustainability' revolves around a responsible interaction with the ecosystem to support humankind's future with long-term environmental quality (Dhahri et al., 2021). Many banks have started to adopt policies and strategies addressing environmental sustainability. Green banking reflects their approach, with a strict

regulatory framework, transparency, and consistent adaptation for environmental sustainability (Ziolo et al., 2017). Daly (1990) defined environmental sustainability as 'renewable resources, sustainable waste disposal, and the development of renewable substitutes for non-renewable resources. Bansal (2005) stated that human activities should not erode the ecosystem. This present study uses Morelli's (2011) definition of environmental sustainability, which says that meeting the resource and services needs of current and without compromising ecosystems' health of the future generation. Anthropogenic disrupts the earth's equilibrium and results in high atmospheric greenhouse concentrations, rising sea levels, glacier meltdowns, and ocean acidification (Roxas et al., 2017; Danso et al., 2019). Digital finance significantly reduced pollution in China (Wang et al., 2022). Therefore, this study tries to empirically analyse the relation of m-wallets use to environmental sustainability in the Indian context. This study's environmental sustainability embraces the sustainable development goals 7,9,12, and 13 like that of Oláh et al. (2020).

H5: M-banking apps usage is positively related to environmental sustainability.

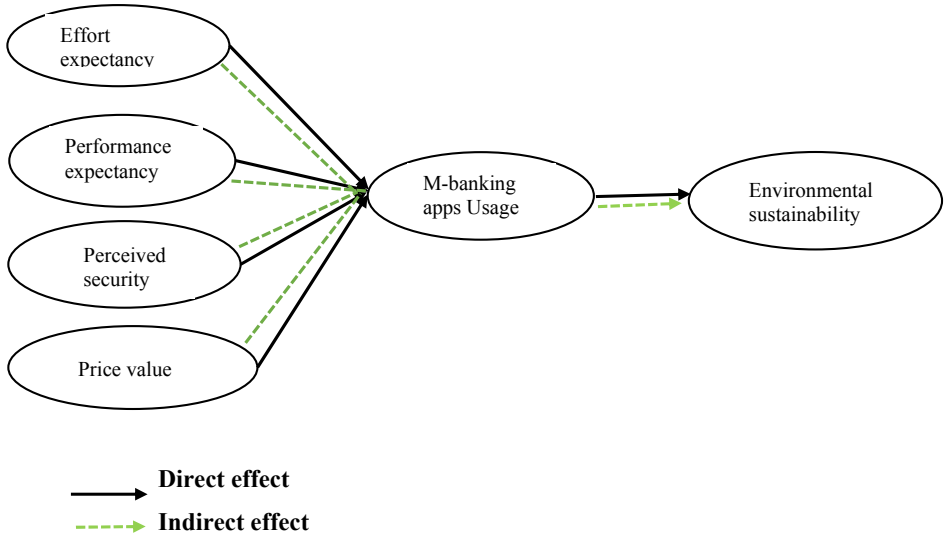
H6: M-banking apps usage positively mediates effort expectancy and environmental sustainability.

H7: M-banking apps usage positively mediates performance and environmental sustainability.

H8: M-banking apps usage positively mediates between perceived security and environmental sustainability.

H9: M-banking apps usage positively mediates between price value and environmental sustainability.

Figure 1 Conceptual model (see online version for colours)



3 Methodology

3.1 Measures

The survey instrument has two-part questionnaires, the demographic and the latent constructs items. The first part incorporates demographic questions like gender, age, occupation, income, and types of m-banking apps used in nominal and ordinal scales. The second part comprises six latent constructs in a seven-point Likert scale ranging from strongly disagree (1) to strongly agree (7), uses measurement items from existing literature, and incorporates them into current research. Four items each for perceived security (Shin, 2009; Chawla and Joshi, 2019), effort expectancy, performance expectancy, and price value (three items) are measured (Venkatesh et al., 2012). Concerning m-banking apps usage (DeLone and McLean, 2003; Singh et al., 2017 Baabdullah et al., 2019; Demirgüç-Kunt et al., 2020) and environmental sustainability (Katini and Amalanathan, 2022) seven items were adapted and modified in phrasing and look, and tested for their reliability. Each item is linked to its sources, as shown in Appendix 1. The close-ended survey questionnaire was administered in the English language. With the help of the concepts and theory constructs, the cross-sectional survey measures the proposed model with the partial least square structural equation modelling (PLS-SEM) technique.

3.2 Data collection procedures

Employed the convenient and simple random sampling method as the target group of the study was the adult Mao-Naga tribals prominently living in Manipur and Nagaland states of India aged above 18 years. The pilot study was carried out before the actual research. Given out 250 data, collected back 230, after filtering the outliers and incomplete data, considered 206 for the studies. The current paper analyses the direct and mediation relationships of the region's prominent operating banks with m-banking apps. Surveyed the major operational banks providing m-banking apps in Northeast India using qualitative questions during the pilot studies with an informed questionnaire. The m-baking apps include Axis mobile, Fedmobile, HDFC PayZapp, PNBONE, M-connect plus, SIB mirror, and Yono SBI.

3.3 Respondents' profile

As depicted in Table 1, there are substantial participants in the age group of 18–29 years (n = 113 54.9%), most of which are students 45 (21.8%) by occupation. And they are primarily in their postgraduates' level (n = 100, 48.5%) and do not have an income of (n = 70, 34%). Most use the Yono SBI (n = 146, 70.9%) among m-banking apps. The high usage of YONO SBI in the present study indicates that SBI (State Bank of India, semi-government bank) is one of the largest banks in India; most government-related schemes are disbursed through this particular bank.

Table 1 Respondents' profile

Profile		*N*	*Percentage* (%)
Age	18–29	113	54.9
	30–39	62	30.1
	40–49	21	10.2
	50–59	5	2.4
	60 above	5	2.4
Occupation	Self-employed/ work for yourself	43	20.9
	Looking for work/unemployed	32	15.5
	Student	45	21.8
	Government salaried	23	11.2
	Private Salaried	50	24.3
	Housewife/Homemaker	9	4.4
	Retired person	4	1.9
Education level	No formal Education	1	0.5
	Lower secondary school/ Class 7–9	3	1.5
	Higher Secondary/ Class 10–12	28	13.6
	Under Graduate	73	35.4
	Post Graduate	100	48.5
	PhD	1	0.5
Income in Indian currency (Rs)	10,000	11	5.3
	10,000–50000	38	18.4
	50001–200000	44	21.4
	200001–500000	26	12.6
	Above 500001	17	8.3
	No income	70	34
M-banking apps	Axis bankapp	15	7.3
	Febmobile app	5	2.4
	HDFC Payzapp	17	8.3
	PNBONE	3	1.5
	M-connect plus	2	1
	SIB Mirror	5	2.4
	Yono SBI	146	70.9
	Other banking apps	12	5.8
	Others	1	0.5

4 Data analysis and results

Using SMART-PLS 3.3.7 software, the PLS-SEM was used to test the hypotheses and other statistical power. The PLS-SEM is a multivariate technique used in management, accounting, financial behaviour, and marketing (Hair et al., 2012). It is desirable to use

the PLS-SEM technique when assessing models with mediation variables (Oliveira et al., 2016; Beckers et al., 2018). PLS-SEM is chosen in preference to the conventional SEM technique (CB-SEM) due to the prediction-oriented feature (Hair and Sarstedt, 2019; Chin et al., 2020). The PLS-SEM evaluate how well the exogenous constructs can predict the endogenous constructs (Foroughi et al., 2019a, 2019b; Ali et al., 2019) and yields robust results with a small sample size above 100 (n = 206) (Hair et al., 2019; Yang et al., 2021). Therefore, the PLS-SEM technique was chosen to estimate the relationships of the present study.

4.1 Measurement model assessment

The PLS-SEM is a two-step procedure, the first is the measurement, and the second is the structural model (Hair et al., 2014). According to Hair et al. (2019), the first step for measurement assessment is examining the factor loadings, which should be greater than 0.50. In this study, factor loading ranges between 0.711–0.921. The constructs' internal consistency is assessed through Cronbach's alpha (α) and Composite Reliability (CR) (Hair et al., 2019); the acceptable value of (α) should be between 0.6 and 0.7. Table 2 indicates the estimation of (α) ranging between 0.845–0.933, and CR 0.896–0.952, affirming the constructs' reliability. The average variance extracted (AVE) metric measures the convergent validity; all values should be greater than 0.50 (Hair et al., 2019). The values obtained for each construct range between 0.627 to 0.832. The discriminant validity determines how empirically distinct one construct is from the other (Hair et al., 2019). Henseler et al. (2015) propose to replace the Fornell-Lacker ratio with an HTMT ratio. Discriminant validity exists when HTMT values are above 0.85; in this paper, all values are below 0.85, as shown in Table 3. Therefore, there is no discriminant validity issue. Variance inflation factor (VIF) investigates collinearity for biased free regression results. VIF values above 5 indicate the presence of collinearity among the endogenous constructs, all values in this study are below 5. Thus, there is no multicollinearity among the constructs. The measurement model diagram is shown in Figure 2 and Table 2 indicates their algorithm, which is relevant and robust to proceed with the structural assessment.

Table 2 Measurement results

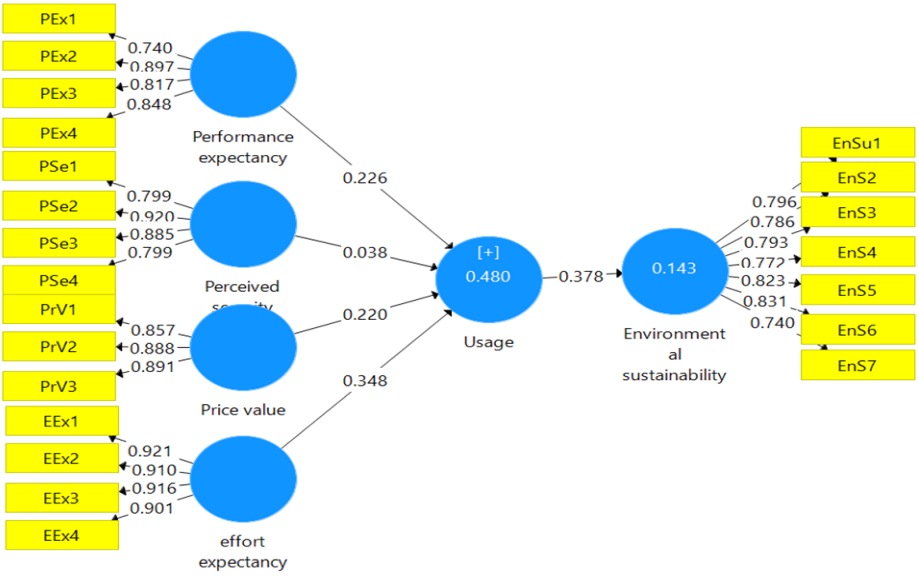
Constructs	*Items*	*Loadings*	*VIF*	*A*	*CR*	*AVE*
Effort expectancy	EEx1	0.921	3.648	0.933	0.952	0.832
	EEx2	0.910	3.401			
	EEx3	0.916	3.579			
	EEx4	0.901	3.246			
Performance expectancy	PEx1	0.740	1.523	0.845	0.896	0.684
	PEx2	0.897	2.384			
	PEx3	0.817	1.968			
	PEx4	0.848	2.154			
Perceived security	PSe1	0.799	2.02	0.873	0.914	0.727
	PSe2	0.920	3.747			
	PSe3	0.885	2.818			
	PSe4	0.799	1.787			

Table 2 Measurement results (continued)

Constructs	*Items*	*Loadings*	*VIF*	*A*	*CR*	*AVE*
Price value	PrV1	0.857	2.046	0.853	0.911	0.772
	PrV2	0.888	2.069			
	PrV3	0.891	2.218			
Usage	Us1	0.840	2.963	0.900	0.921	0.627
	Us2	0.737	1.746			
	Us3	0.866	3.737			
	Us4	0.846	2.742			
	Us6	0.825	2.22			
	Us7	0.711	1.661			
Environmental sustainability	EnS1	0.796	3.015	0.901	0.922	0.627
	EnS2	0.786	2.955			
	EnS3	0.793	2.047			
	EnS4	0.772	2.019			
	EnS5	0.823	2.751			
	EnS6	0.831	2.955			
	EnS7	0.740	1.754			

EEx: Effort expectancy, PEx: performance expectancy, PSe: perceived security, Us: Usage, PrV: price value, EnS: environmental sustainability, *α*: Cronbach's Alpha, VIF: variance inflation factor, CR: composite reliability, AVE: average variance extracted.

Figure 2 Measurement model (see online version for colours)



EEx: effort expectancy, PEx: performance expectancy, PSe: perceived security, Us: m-banking apps usage, PrV: price value, EnS: environmental sustainability.

4.2 Structural models assessment

After assessing the measurement model, the next step for PLS-SEM evaluation is estimating the structural model. This current study includes the coefficient of determination (R^2), the effect size (f^2) and blindfolding-based cross-validated redundancy measure predictive power Q^2. The bootstrapping technique for the structural model with 5000 sampling iterations tests the hypothesis. According to Hair et al. (2017), the value of t-statistics equal to or higher than 1.96 is considered significant. Structural model coefficients relationships of the constructs estimate regression equations.

Table 3 Discriminant validity

Fornell-Lacker Ratio						
Constructs	*EEx*	*EnS*	*Us*	*PSe*	*PEx*	*PrV*
Effort Expectancy	**0.912**					
Environmental sustainability	0.471	**0.792**				
M-banking apps usage	0.642	0.377	**0.792**			
Perceived security	0.428	0.339	0.347	**0.853**		
Performance expectancy	0.606	0.419	0.534	0.235	**0.827**	
Price value	0.624	0.492	0.554	0.46	0.449	**0.879**

HTMT	*EnS*	*PSe*	*PEe*	*PrV*	*Us*
Environmental sustainability					
Perceived security	0.385				
Performance expectancy	0.456	0.255			
Price value	0.563	0.533	0.507		
M-banking apps usage	0.411	0.388	0.615	0.631	
Effort expectancy	0.509	0.477	0.678	0.704	0.698

EEx: Effort expectancy, PEx: performance expectancy, PSe: perceived security,
Us: m-banking apps usage, PrV: price value, EnS: environmental sustainability.

4.2.1 Path analysis

Our findings show that effort expectancy and performance expectancy directly impact m-banking apps usage, which is significant at 5%, H1 ($\beta = 0.348$, $p < 0.05$); H2 ($\beta = 0.226$, $p < 0.05$). The H3 ($\beta = 0.038$, $p > 0.05$) illustrates no relationship between perceived security and m-banking usage. The price value directly relates to m-banking app usage in our study, as shown in H4 ($\beta = 0.220$, $p > 0.05$). The m-banking apps' usage significantly influences the environmental sustainability H5 ($\beta = 0.378$, $p < 0.05$), as depicted in Table 4.

Table 4 Structural results

	Direct relations	*β*	*T Stats*	*P Values*	*LCI*	*UCI*	*Result*
H1	EEx → Usage	0.348	2.837	0.005	0.107	0.587	Supported
H2	PEx → Usage	0.226	2.049	0.041	0.004	0.436	Supported
H3	PSe → Usage	0.038	0.717	0.474	–0.074	0.136	Not supported
H4	PrV → Usage	0.220	2.923	0.003	0.079	0.373	Supported
H5	Usage → EnS	0.378	6.741	0.000	0.254	0.478	Supported

EEx: Effort expectancy, PEx: performance expectancy, PSe: perceived security,
Us: Usage, PrV: price value, EnS: environmental sustainability, β: path coefficient,
T stats: T statistics, LCI: lower-class interval, UCI: upper-class interval.

4.2.2 Mediation

Hayes' (2009) method was used to assess the mediation among the constructs. The H6 - H9 highlights mediations analysis. The indirect effect of effort expectancy through m-banking apps usage on environmental sustainability is statistically positive H6 ($\beta = 0.132$, $p < 0.05$; confidence interval value is zero). M-banking apps usage has no mediation effects between performance expectancy and environmental sustainability H7 ($\beta = 0.085$, $p > 0.05$; confidence interval value is not zero). The indirect impact of perceived security through m-banking apps usage on environmental sustainability failed to accept in this study, H7 ($\beta = 0.055$, $p > 0.015$, confidence interval value is not zero). There is an indirect effect of price value through m-banking apps on environmental sustainability H9 ($\beta = 0.083$, $p < 0.05$; confidence interval value is zero). The performance expectancy and perceived security do not influence environmental sustainability through the usage of m-banking apps among the Mao-Naga tribal adults in this study. The findings indicate that half of the hypotheses are positively significant at $p < 0.05$, $t > 1.96$ and support indirect relationships, as shown in Table 5.

Table 5 Mediation results

	Indirect relations	*β*	*T Stats*	*P Values*	*LCI*	*UCI*	*Result*
H6	EEx→Usage→EnS	0.132	2.493	0.013	0.040	0.246	Supported
H7	PEx→Usage →EnS	0.085	1.913	0.056	–0.000	0.176	Not supported
H8	PSe→Usage→EnS	0.015	0.691	0.489	–0.029	0.053	Not supported
H9	PrV→Usage→EnS	0.083	2.472	0.013	0.026	0.157	Supported

EEx: effort expectancy, PEx: performance expectancy, PSe: perceived security,
Us: Usage, PrV: price value, EnS: Environmental sustainability.

The structural result estimates R^2 values, reflecting the variance explained by the predictor constructs with values ranging from 0 to 1. As a rule of thumb, the R^2 values of 0.25, 0.50 and 0.75 are considered weak, moderate and substantial (Hair et al., 2011, 2019). M-banking app usage can explain around 47.8% of environmental sustainability. The current research has explanatory power, as indicated in Table 6. The effect size (f^2) metric assesses how removing a predictor construct affects an endogenous construct (Hair et al., 2019). The f^2 values greater than 0.02, 0.15 and 0.35 specifies small, medium and large effect sizes (Cohen, 1988). The f^2 score ranged from 0.02 to 0.15, showing that

this paper's constructs have small and medium effect sizes. The blindfolding-based cross-validated redundancy measures predictive power (Q^2) with an omission distance of 7 (Hair et al., 2019). The Q^2 should be greater than 0, 0.25 and 0.50, depicting small, medium and large predictive relevance (Hair et al., 2019). The present model has a medium predictive relevance, as in Table 6. Thus, verifying the predictive power of predictor and its significance for environmental sustainability.

Table 6 Results of f^2, R^2 and Q^2

Constructs	R^2	f^2	Q^2
Environmental sustainability	0.142		
M-banking apps usage	0.478		0.288
Effort Expectancy →M-banking apps usage		0.116	
M-banking apps usage →Environmental sustainability		0.166	
Perceived security →M-banking apps usage		0.003	
Performance expectancy →M-banking apps usage		0.051	
Price value → M-banking apps usage		0.049	

4.3 Importance-performance map analysis (IPMA)

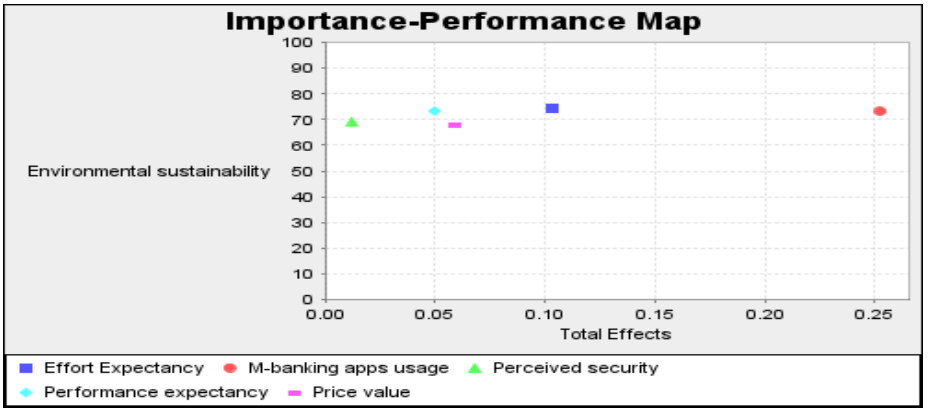
IPMA is the posthoc analysis of PLS-SEM, and the primary objective is to identify independent constructs with high importance with performance yield for executive actions. Our study modelled environmental sustainability as our target construct predicted by predictors. The

IPMA can detect the possible improvement aspect that necessitates attention from policymakers and researchers (Ringle and Sarstedt, 2016). As noted in Table 7 and Figure 3, in light of the environmental sustainability, m-banking apps usage emerged as the most important factor with a score of (0.253; 73.28) percent. The second-most crucial factor was effort expectancy, with a (0.103; 74.16) percent score. Perceived security, price value and performance expectancy have lower importance. Therefore, policymakers, banks and mobile service providers should encourage more usage of m-banking apps rather than visiting the branches for financial transactions, which can contribute to the environmental quality by curbing the pollution, carbon emissions and other environmental issues. The mobile service providers should concentrate on user-friendly aspects as effort expectancy determines the second most important factor of environmental sustainability. The IPMA advocates for the authorities to encourage digital finance for further managerial insights.

Table 7 IPMA results

Constructs	*Environmental*	*Performance*
Effort Expectancy	0.103	74.165
M-banking apps usage	0.253	73.281
Perceived security	0.012	69.143
Performance expectancy	0.050	73.352
Price value	0.059	67.618

Figure 3 IPMA (see online version for colours)



5 Discussion

This paper explores how digital finance through m-banking app usage promotes environmental sustainability. The effort expectancy significantly affects m-banking apps usage and indirectly environmental sustainability. When the individual customers perceive that the m-banking app is easy/pleasant to use to achieve the objective of their work, they adopt this technology. This observation is similar to the studies of Sinha and Singh (2019), Routray et al. (2019), Singh et al. (2020) and Abdul-Halim et al. (2021), which states that effort expectancy is a significant predictor of m- payment usage. The present research result is contradictory to the findings of Albashrawi et al. (2019), Shao and Yin (2019), Saprikis and Avlogiaris (2021), and Saprikis et al. (2022), where effort expectancy had no significant impact on m-banking apps payments.

Our findings align with the result where the performance expectancy is considered one of the essential antecedents for m-banking usage, which aligns with the findings of Farah et al. (2018), Baabdullah et al. (2019), Albashrawi et al. (2019), Saprikis and Avlogiaris, (2021) and Saprikis et al., (2022). On the other hand, in the mediation result, performance expectancy has no indirect relation to environmental sustainability. Tribals do not perceive it helpful to use m-banking apps for ecological benefit but use them to carry out their financial transactions. This is empirically in light of the view that the tribal customers still visit the bank branches.

In digital financial transactions, customers must be assured that their technology is secure and that their financial information is not exposed to risk (Kamdjoug et al., 2021). M-banking apps limit the risk of theft and middleman frauds. This present finding contradicts the existing literature on security as a critical factor in m-banking apps (Shankar et al., 2020a, 2022). Therefore, perceived security in the current research model fails to predict any variance in m-banking apps' usage. Tribals customers are least concerned regarding the security in using m-banking apps. Perceived security is not a determining factor that encourages them to adopt m-banking apps. Similar to Shao and Yin's (2019) findings, security had no significant influence on mobile payments. According to the respondents' characteristics of the tribal sample participants, most are younger, well-educated, and have adequate experience with the internet and technology.

Thus, they are more likely to override any problem regarding the level of security, complexity and difficulty of using m-banking apps.

The present findings establish that the price value, directly and indirectly, influences m-banking apps usage on environmental sustainability. It is in harmony with Baabdullah et al.'s (2019) findings where price value substantially impacts m-banking actual usage. Cost-effectiveness is one of digital finance's primary functions and advantages for providers and remote area dwellers (Elheddad et al., 2021). The cost-price trade-offs are crucial for the tribal customers as most participants do not have income. Customers are convinced that adopting m-banking apps will result in higher time efficiency and financial savings. Thus, users can directly access their financial issues at any time and place in India instead of wasting cost and time by travelling to banks' premises.

Overall, the present research on m-banking app usage positively relates to environmental sustainability. Most statements support the result and are similar to the findings of Ozcan and Apergis (2018) and Zou et al. (2021). Climate change and digital technology are interrelated megatrends (Shahbaz et al., 2020); the current research strengthens this stand that digital finance (m-banking apps usage) is statistically significant with environmental sustainability. Like Yan et al. (2018) and Zhou et al. (2010), our study complements that ICT components like m-banking apps can reduce energy consumption and CO^2 emissions through the substitution effect. The benefit of digital finance can enable the economy to function the financial system systematically without the physical infrastructure.

6 Limitations and future research implications

This study is not without flaws that may offer opportunities for further research. The study was conducted among the tribals in only one county (i.e., India). The research outcomes cannot be generalised to other economies where the level of ICT infrastructure and regulatory framework and customers' exposure and experience could be different. Similarly, this study was conducted in a banking context and its outcome. It would be interesting to replicate the research's model in other contexts where mobile technology can be applied. The cross-sectional survey with Likert scale items was employed, adding to the study's limitation. Therefore, the researchers are further encouraged to engage the longitudinal research in the future. According to the main profile characteristics of the current sample participants, most of them are students, younger, and have adequate familiarity with technology and mobile phone. Thus, younger generations are more likely to override problems regarding the usefulness of using mobile banking (Baabdullah et al., 2019).

7 Conclusion

The role of digital technology is undeniable as it has reshaped lives, work, and interactions. Currently, digital financial aspects and environmental sustainability are urgent issues receiving interest and research attention for environmental mitigation. M-banking apps are among the most convenient digital financial technologies developed in recent years and prove valuable benefits to various stakeholders. The development of smartphones' physical contactless chip-based payment instruments has become a

significant player in the financial services industry. Using the structural equation modelling, reviewed the factors determining environmental sustainability. The findings indicate that performance expectancy, effort expectancy and price value statistically and directly correlate with m-banking apps usage. The perceived security does not have a direct relationship with m-banking app usage. The performance expectancy and perceived security do not establish an indirect relationship with environmental sustainability. The reason could be that digital finance and its instruments are new among the tribals, and they could be ignorant of the risk issues and usefulness of the usage of the m-banking app. Therefore, customers should be protected for privacy and assured safety from scams and white-collar hackers and insist on its use. Overall, the study complies that digital finance usage positively impacts environmental sustainability. Thus, the policymakers, regulators, service providers and other stakeholders should encourage all sections to adopt digital finance to promote climate change. Our findings can significantly guide financial institutions, policymakers, and mobile service providers to enhance participation in the global digital banking system where formal banking utilisation is low. We believe that the findings of this research can increase m-banking apps adoption rates and simultaneously contribute toward achieving the overarching goal of sustainable development among the indigent populace. On the other hand, the customers should be aware of their private information and protect themselves from scams and hackers. To this end, policymakers, financial experts, and researchers must consistently monitor the success and progress of digital financial inclusion programs on other sustainability dimensions.

Declaration

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References

Abdul-Halim, N.A., Vafaei-Zadeh, A., Hanifah, H., Teoh, A.P. and Nawaser, K. (2021) 'Understanding the determinants of e-wallet continuance usage intention in Malaysia', *Quality and Quantity*, pp.1–27, https://doi.org/10.1007/s11135-021-01276-7

Alalwan, A.A., Dwivedi, Y.K. and Rana, N.P. (2017) 'Factors influencing adoption of mobile banking by Jordanian bank customers: extending UTAUT2 with trust', *International Journal of Information Management*, Vol. 37, No. 3, pp.99–110, https://doi.org/10.1016/j.ijinfomgt.2017.01.002

Alalwan, A., Dwivedi, Y. and Williams, M. (2014) 'Examining factors affecting customer intention and adoption of internet banking in Jordan', *UK Academy for Information Systems Conference*, Oxford, pp.1–25.

Alavi, S. and Ahuja, V. (2016) 'An empirical segmentation of users of mobile banking apps', *Journal of Internet Commerce*, Vol. 15, No. 4, pp.390–407, https://doi.org/10.1080/15332861.2016.1252653

Albashrawi, M., Kartal, H., Oztekin, A. and Motiwalla, L. (2019) 'Self-reported and computer-recorded experience in mobile banking: a multi-phase path analytic approach', *Information Systems Frontiers*, Vol. 21, No. 4, pp.773–790, https://doi.org/10.1007/s10796-018-9892-1

Ali, M.H., Zailani, S., Iranmanesh, M. and Foroughi, B. (2019) 'Impacts of environmental factors on waste, energy, and resource management and sustainable performance', *Sustainability*, Vol. 11, No. 8, pp.1–16, https://doi.org/10.3390/su11082443

Allen, C., Metternicht, G. and Wiedmann, T. (2019) 'Prioritising SDG targets: assessing baselines, gaps and interlinkages', *Sustainability Science*, Vol. 14, pp.421–438, https://doi.org/10.1007/s11625-018-0596-8

Al-Sabaawi, M.Y.M., Alshaher, A.A. and Alsalem, M.A. (2021) 'User trends of electronic payment systems adoption in developing countries: an empirical analysis', *Journal of Science and Technology Policy Management,* pp.1–25, https://doi.org/10.1108/JSTPM-11-2020-0162

Alvarez-Risco, A., Quipuzco-Chicata, L. and Escudero-Cipriani, C. (2021) 'Determinants of online repurchase intention in COVID-19 times: evidence from an emerging economy', *Lecturas de Economía*, Vol. 96, pp.101–143, https://doi.org/10.17533/udea.le.n96a342638

Baabdullah, A.M., Alalwan, A.A., Rana, N.P., Kizgin, H. and Patil, P. (2019) 'Consumer use of mobile banking (M-banking) 'in Saudi Arabia: towards an integrated model', *International Journal of Information Management*, Vol. 44, pp.38–52, https://doi.org/10.1016/j.ijinfomgt.2018.09.002

Bansal, P. (2005) 'Evolving sustainably: a longitudinal study of corporate sustainable development', *Strategic Management Journal*, Vol. 26, No. 3, pp.197–218, https://doi.org/10.1002/smj.441

Beckers, S.F.M., Van Doorn, J. and Verhoef, P.C. (2018) 'Good, better, engaged? The effect of company-initiated customer engagement behavior on shareholder value', *Journal of the Academy of Marketing Science*, Vol. 46, No. 3, pp.366–383, https://doi.org/10.1007/s11747-017-0539-4

Belanche-Gracia, D., Casaló-Ariño, L.V. and Pérez-Rueda, A. (2015) 'Determinants of multi-service smartcard success for smart cities development: a study based on citizens' privacy and security perceptions', *Government Information Quarterly*, Vol. 32, No. 2, pp.154–163, https://doi.org/10.1016/j.giq.2014.12.004

Bhatiasevi, V. (2016) 'An extended UTAUT model to explain the adoption of mobile banking', *Information Development*, Vol. 32, No. 4, pp.799–814, https://doi.org/10.1177/0266666915570764

Bommer, W.H., Rana, S. and Milevoj, E. (2022) 'A meta-analysis of eWallet adoption using the UTAUT model', *International Journal of Bank Marketing,* pp.1–29, https://doi.org/10.1108/IJBM-06-2021-0258

Brundtland G.H. (1987) 'World commission on environment and development: our common future', *United Nations*, https://doi.org/10.1007/978-1-4020-9160-5_1126

Cancino, C.A., La Paz, A.I., Ramaprasad, A. and Syn, T. (2018) 'Technological innovation for sustainable growth: an ontological perspective', *Journal of Cleaner Production*, Vol. 179, No. 1, pp.31–41, https://doi.org/10.1016/j.jclepro.2018.01.059

Chand, K., Tiwari, R. and Sapna (2022) 'Effect of perception and satisfaction on preference for mobile wallet', *FIIB Business Review*, pp.1–13, https://doi.org/10.1177/23197145221077365

Chaouali, W. and El Hedhli, K. (2019) 'Toward a contagion-based model of mobile banking adoption', *International Journal of Bank Marketing*, Vol. 37, No. 1, pp.69–96, https://doi.org/10.1108/IJBM-05-2017-0096

Chatterjee, A. (2020) 'Financial inclusion, information and communication technology diffusion, and economic growth: a panel data analysis', *Information Technology for Development*, Vol. 26, No. 3, pp.607–635, https://doi.org/10.1080/02681102.2020.1734770

Chawla, D. and Joshi, H. (2019) 'Consumer attitude and intention to adopt mobile wallet in India – an empirical study', *International Journal of Bank Marketing*, Vol. 37, No. 7, pp.1590–1618, https://doi.org/10.1108/IJBM-09-2018-0256

Che Nawi, N., Al Mamun, A., Hayat, N. and Seduram, L. (2022) 'Promoting sustainable financial services through the adoption of eWallet among Malaysian working adults', *SAGE Open*, Vol. 12, No. 1, pp.1–15, https://doi.org/10.1177/21582440211071107

Cheng, C-Y., Chien, M-S. and Lee, C-C. (2021) 'ICT diffusion, financial development, and economic growth: an international cross-country analysis', *Economic Modelling*, Vol. 94, pp.662–671, https://doi.org/10.1016/j.econmod.2020.02.008

Chin, W., Cheah, J.H., Liu, Y., Ting, H., Lim, X.J. and Cham, T.H. (2020) 'Demystifying the role of causal-predictive modeling using partial least squares structural equation modeling in information systems research', *Industrial Management and Data Systems*, Vol. 120, No. 12, pp.2161–2209, https://doi.org/10.1108/IMDS-10-2019-0529

Cohen, J. (1988) *Statistical Power Analysis for the Behavioral Sciences*, 2nd ed., Lawrence Erlbaum.

Daly, H.E. (1990) 'Toward some operational principles of sustainable development', *Ecological Economics*, Vol. 2, No. 1, pp.1–6, https://doi.org/10.1016/0921-8009(90)90010-R

Danso, A., Adomako, S., Amankwah-Amoah, J., Owusu-Agyei, S. and Konadu, R. (2019) 'Environmental sustainability orientation, competitive strategy and financial performance', *Business Strategy and the Environment*, Vol. 28, No. 5, pp.885–895, https://doi.org/10.1002/bse.2291

DeLone, W.H. and McLean, E.R. (2003) 'The DeLone and McLean model of information systems success: a ten-year update', *Journal of Management Information Systems*, Vol. 19, No. 4, pp.9–30, https://doi.org/10.1080/07421222.2003.11045748

Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S. and Hess, J. (2020) 'The global findex database 2017: measuring financial inclusion and opportunities to expand access to and use of financial services', *World Bank Economic Review*, Vol. 34, No. 2018, pp.S2–S8, https://doi.org/10.1093/wber/lhz013

Dhahri, S., Slimani, S. and Omri, A. (2021) 'Behavioral entrepreneurship for achieving the sustainable development goals', *Technological Forecasting and Social Change*, Vol. 165, pp.1–11, https://doi.org/10.1016/j.techfore.2020.120561

Elheddad, M., Benjasak, C., Deljavan, R., Alharthi, M. and Almabrok, J.M. (2021) 'The effect of the fourth industrial revolution on the environment: the relationship between electronic finance and pollution in OECD countries', *Technological Forecasting and Social Change*, Vol. 163, April, pp.1–10, https://doi.org/10.1016/j.techfore.2020.120485

Farah, M.F., Hasni, M.J.S. and Abbas, A.K. (2018) 'Mobile-banking adoption: empirical evidence from the banking sector in Pakistan', *International Journal of Bank Marketing*, Vol. 36, No. 7, pp.1386–1413, https://doi.org/10.1108/IJBM-10-2017-0215

Ferreira, J.J.M., Fernandes, C.I. and Ferreira, F.A.F. (2020) 'Technology transfer, climate change mitigation, and environmental patent impact on sustainability and economic growth: a comparison of European countries', *Technological Forecasting and Social Change*, Vol. 150, October 2019, pp.1–8, https://doi.org/10.1016/j.techfore.2019.119770

Foroughi, B., Iranmanesh, M. and Hyun, S.S. (2019a) 'Understanding the determinants of mobile banking continuance usage intention', *Journal of Enterprise Information Management*, Vol. 32, No. 6, pp.1015–1033, https://doi.org/10.1108/JEIM-10-2018-0237

Foroughi, B., Mohammad Shah, K.A., Ramayah, T. and Iranmanesh, M. (2019b) 'The effects of peripheral service quality on spectators' emotions and behavioural intentions', *International Journal of Sports Marketing and Sponsorship*, Vol. 20, No. 3, pp.495–515, https://doi.org/10.1108/IJSMS-08-2018-0082

Gansser, O.A. and Reich, C.S. (2021) 'A new acceptance model for artificial intelligence with extensions to UTAUT 2: an empirical study in three segments of application', *Technology in Society*, Vol. 65, pp.1–15, https://doi.org/10.1016/j.techsoc.2021.101535

Gomber, P., Koch, J.A. and Siering, M. (2017) 'Digital finance and finTech: Current research and future research directions', *Journal of Business Economics*, Vol. 87, No. 5, pp.537–580, https://doi.org/10.1007/s11573-017-0852-x

Hair, J.E., Hult, G.T.M., Ringle, C.M. and Sarstedt, M. (2014) *A Primer on Partial Least Squares Structural Equation Modelling (PLS-SEM)*, Sage, Washington DC.

Hair, J.F. and Sarstedt, M. (2019) 'Factors vs. composites: guidelines for choosing the right structural equation modeling method', *Project Management Journal*, Vol. 50, No. 6, pp.619–624, https://doi.org/10.1177/8756972819882132

Hair, J.F., Hult, G.T.M., Ringle, C.M. and Sarstedt, M. (2017) *A Primer on Partial Least Squares Structural Equation Modelling (PLS)*, 2nd ed., Sage, Washington DC.

Hair, J.F., Ringle, C.M. and Sarstedt, M. (2011) 'PLS-SEM: indeed a silver bullet', *Journal of Marketing Theory and Practice*, Vol. 19, No. 2, pp.139–151, https://doi.org/10.2753/MTP.1069-6679190202

Hair, J.F., Risher, J.J., Sarstedt, M. and Ringle, C.M. (2019) 'When to use and how to report the results of PLS-SEM', *European Business Review*, Vol. 31, No. 1, pp.2–24, https://doi.org/10.1108/EBR-11-2018-0203

Hair, J.F., Sarstedt, M., Ringle, C.M. and Mena, J.A. (2012) 'An assessment of the use of partial least squares structural equation modeling in marketing research', *Journal of the Academy of Marketing Science*, Vol. 40, No. 3, pp.414–433, https://doi.org/10.1007/s11747-011-0261-6

Hayes, A.F. (2009) 'Beyond baron and kenny: statistical mediation analysis in the new millennium', *Communication Monographs*, Vol. 76, No. 4, pp.408–420, https://doi.org/10.1080/03637750903310360

Henseler, J., Ringle, C.M. and Sarstedt, M. (2015) 'A new criterion for assessing discriminant validity in variance-based structural equation modeling', *Journal of the Academy of Marketing Science*, Vol. 43, No. 1, pp.115–135, https://doi.org/10.1007/s11747-014-0403-8

Hervani, A.A., Sarkis, J. and Helms, M.M. (2017) 'Environmental goods valuations for social sustainability: a conceptual framework', *Technological Forecasting and Social Change*, Vol. 125, pp.137–153, July, https://doi.org/10.1016/j.techfore.2017.07.015

Hidayat-ur-Rehman, I., Alzahrani, S., Rehman, M.Z. and Akhter, F. (2022) 'Determining the factors of m-wallets adoption. A twofold SEM-aNN approach', *Plos One*, Vol. 17, No. 1, pp.1–24, https://doi.org/10.1371/journal.pone.0262954

Ho, J.C., Wu, C.G., Lee, C.S. and Pham, T.T.T. (2020) 'Factors affecting the behavioral intention to adopt mobile banking: an international comparison', *Technology in Society*, Vol. 63, pp.1–9, https://doi.org/10.1016/j.techsoc.2020.101360

Kamdjoug, J.R.K., Wamba-Taguimdje, S.L., Wamba, S.F. and Kake, I.B.e. (2021) 'Determining factors and impacts of the intention to adopt mobile banking app in Cameroon: case of SARA by afriland first bank', *Journal of Retailing and Consumer Services*, Vol. 61, pp.1–20, https://doi.org/10.1016/j.jretconser.2021.102509

Karjaluoto, H., Shaikh, A.A., Leppäniemi, M. and Luomala, R. (2020) 'Examining consumers' usage intention of contactless payment systems', *International Journal of Bank Marketing*, Vol. 38, No. 2, pp.332–351, https://doi.org/10.1108/IJBM-04-2019-0155

Katini, K. and Amalanathan, S. (2022) 'Exploring relationships between financial literacy and environmental sustainability among the tribals through structural equation modelling', *Journal of Positive School Psychology*, Vol. 6, No. 8, pp.5940–5959.

Kazancoglu, Y., Sezer, M.D., Ozkan-Ozen, Y.D., Mangla, S.K. and Kumar, A. (2021) 'Industry 4.0 impacts on responsible environmental and societal management in the family business', *Technological Forecasting and Social Change*, Vol. 173, pp.1–11, https://doi.org/10.1016/j.techfore.2021.121108

Klapper, L., El-Zoghbi, M. and Hess, J. (2016) 'Achieving the sustainable development goals: the role of financial inclusion', *UNSGSA* (Issue April), https://doi.org/10.18520/cs/v110/i2/127-128

Lawson-Body, A., Willoughby, L., Lawson-Body, L. and Tamandja, E.M. (2020) 'Students' acceptance of E-Books: an application of UTAUT', *Journal of Computer Information Systems*, Vol. 60, No. 3, pp.256–267, https://doi.org/10.1080/08874417.2018.1463577

Loh, X.M., Lee, V.H., Hew, T.S. and Lin, B. (2022) 'The cognitive-affective nexus on mobile payment continuance intention during the COVID-19 pandemic', *International Journal of Bank Marketing,* pp.1–21, https://doi.org/10.1108/IJBM-06-2021-0257

Luo, X., Li, H., Zhang, J. and Shim, J.P. (2010) 'Examining multi-dimensional trust and multi-faceted risk in initial acceptance of emerging technologies□: an empirical study of mobile banking services', *Decision Support Systems*, Vol. 49, No. 2, pp.222–234, https://doi.org/10.1016/j.dss.2010.02.008

Malaquias, R.F. and Hwang, Y. (2016) 'An empirical study on trust in mobile banking: a developing country perspective', *Computers in Human Behavior*, Vol. 54, pp.453–461, https://doi.org/10.1016/j.chb.2015.08.039

Merhi, M., Hone, K. and Tarhini, A. (2019) 'A cross-cultural study of the intention to use mobile banking between lebanese and British consumers: extending UTAUT2 with security, privacy and trust', *Technology in Society*, Vol. 59, pp.1–12, https://doi.org/10.1016/j.techsoc.2019.101151

Merhi, M., Hone, K., Tarhini, A. and Ameen, N. (2021) 'An empirical examination of the moderating role of age and gender in consumer mobile banking use: a cross-national, quantitative study', *Journal of Enterprise Information Management*, Vol. 34, No. 4, pp.1144–1168, https://doi.org/10.1108/JEIM-03-2020-0092

Morelli, J. (2011) 'Environmental sustainability: a definition for environmental professionals', *Journal of Environmental Sustainability*, Vol. 1, No. 1, pp.1–10, https://doi.org/10.14448/jes.01.0002

Mullan, J., Bradley, L. and Loane, S. (2017) 'Bank adoption of mobile banking: stakeholder perspective', *International Journal of Bank Marketing*, Vol. 35, No. 7, pp.1152–1172, https://doi.org/10.1108/IJBM-09-2015-0145

Oláh, J., Aburumman, N., Popp, J., Khan, M.A., Haddad, H. and Kitukutha, N. (2020) 'Impact of industry 4.0 on environmental sustainability', *Sustainability*, Vol. 12, No. 11, pp.1–21, https://doi.org/10.3390/su12114674

Oliveira, T., Thomas, M., Baptista, G. and Campos, F. (2016) 'Mobile payment: understanding the determinants of customer adoption and intention to recommend the technology', *Computers in Human Behavior*, Vol. 61, pp.404–414, https://doi.org/10.1016/j.chb.2016.03.030

Ozcan, B. and Apergis, N. (2018) 'The impact of internet use on air pollution: evidence from emerging countries', *Environmental Science and Pollution Research*, Vol. 25, No. 5, pp.4174–4189, https://doi.org/10.1007/s11356-017-0825-1

Ozili, P.K. (2020) 'Contesting digital finance for the poor', *Digital Policy, Regulation and Governance*, Vol. 22, No. 2, pp.135–151, https://doi.org/10.1108/DPRG-12-2019-0104

Pece, A.M., Simona, O.E.O. and Salisteanu, F. (2015) 'Innovation and economic growth: an empirical analysis for CEE countries', *Procedia Economics and Finance*, Vol. 26, No. 15, pp.461–467, https://doi.org/10.1016/s2212-5671(15)00874-6

Rahi, S., Abd, G.M., Alnaser, F.M.I. and Ngah, A.H. (2018) 'Investigating the role of unified theory of acceptance and use of technology (UTAUT) in internet banking adoption context', *Management Science Letters*, Vol. 8, No. 3, pp.173–186, https://doi.org/10.5267/j.msl.2018.1.001

Ringle, C.M. and Sarstedt, M. (2016) 'Gain more insight from your PLS-SEM results the importance-performance map analysis', *Industrial Management and Data Systems*, Vol. 116, No. 9, pp.1865–1886, https://doi.org/10.1108/IMDS-10-2015-0449

Routray, S., Khurana, R., Payal, R. and Gupta, R. (2019) 'A move towards cashless economy: a case of continuous usage of mobile wallets in India', *Theoretical Economics Letters*, Vol. 9, No. 4, pp.1152–1166, https://doi.org/10.4236/tel.2019.94074

Roxas, B., Ashill, N. and Chadee, D. (2017) 'Effects of entrepreneurial and environmental sustainability orientations on firm performance: a study of small businesses in the Philippines', *Journal of Small Business Management*, Vol. 55, pp.163–178, https://doi.org/10.1111/jsbm.12259

Sankaran, R. and Chakraborty, S. (2022) 'Factors impacting mobile banking in India: empirical approach extending UTAUT2 with perceived value and trust', *IIM Kozhikode Society and Management Review*, Vol. 11, No. 1, pp.7–24, https://doi.org/10.1177/2277975220975219

Saprikis, V. and Avlogiaris, G. (2021) 'Factors that determine the adoption intention of direct mobile purchases through social media apps', *Information*, Vol. 12, No. 11, pp.1–21, https://doi.org/10.3390/info12110449

Saprikis, V., Avlogiaris, G. and Katarachia, A. (2022) 'A comparative study of users vs. non-users' Behavioral Intention towards M-Banking Apps' Adoption. *Information*, Vol. 13, No. 1, pp.1–23, https://doi.org/10.3390/info13010030

Schmitz, A., Díaz-Martín, A.M. and Yagüe Guillén, M.J. (2022) 'Modifying UTAUT2 for a cross-country comparison of telemedicine adoption', *Computers in Human Behavior*, Vol. 130, pp.1–11, https://doi.org/10.1016/j.chb.2022.107183

Semerikova, E. (2020) 'What hinders the usage of smartphone payments in Russia? Perception of technological and security barriers', *Technological Forecasting and Social Change*, Vol. 161, September, p.120312, https://doi.org/10.1016/j.techfore.2020.120312

Shahbaz, M., Nasir, M.A., Hille, E. and Mahalik, M.K. (2020) 'U.K'*s Net-Zero Carbon Emissions Target: Investigating the Potential Role of Economic Growth*, financial development, and R & D expenditures based on historical data *Technological Forecasting and Social Change*, Vol. 161, pp.1–15, https://doi.org/10.1016/j.techfore.2020.120255, 1870-2017

Shang, D. and Wu, W. (2017) 'Understanding mobile shopping consumers' continuance intention. *Industrial Management and Data Systems*, Vol. 117, No. 1, pp.213–227, https://doi.org/10.1108/IMDS-02-2016-0052

Shankar, A. and Jain, S. (2021) 'Factors affecting luxury consumers', 'webrooming intention□: a moderated-mediation approach', *Journal of Retailing and Consumer Services*, Vol. 58, pp.1–12.

Shankar, A., Datta, B. and Jebarajakirthy, C. (2019) 'Are the generic scales enough to measure service quality of mobile banking? A comparative analysis of generic service quality measurement scales to mobile banking context', *Services Marketing Quarterly*, Vol. 40, No. 3, pp.224–244, https://doi.org/10.1080/15332969.2019.1630176

Shankar, A., Datta, B., Jebarajakirthy, C. and Mukherjee, S. (2020a) 'Exploring mobile banking service quality: a qualitative approach', *Services Marketing Quarterly*, Vol. 41, No. 2, pp.182–204, https://doi.org/10.1080/15332969.2020.1742982

Shankar, A., Jebarajakirthy, C. and Ashaduzzaman, M. (2020b) 'How do electronic word of mouth practices contribute to mobile banking adoption?', *Journal of Retailing and Consumer Services*, Vol. 52, pp.1–14, https://doi.org/10.1016/j.jretconser.2019.101920

Shankar, A., Tiwari, A.K. and Gupta, M. (2022) 'Sustainable mobile banking application: a text mining approach to explore critical success factors', *Journal of Enterprise Information Management*, Vol. 35, No. 2, pp.414–428, https://doi.org/10.1108/JEIM-10-2020-0426

Shao, Z. and Yin, H. (2019) 'Building customers' trust in the ridesharing platform with institutional mechanisms: An empirical study in China', *Internet Research*, Vol. 29, No. 5, pp.1040–1063, https://doi.org/10.1108/INTR-02-2018-0086

Shin, D.H. (2009) 'Towards an understanding of the consumer acceptance of mobile wallet', *Computers in Human Behavior*, Vol. 25, No. 6, pp.1343–1354, https://doi.org/10.1016/j.chb.2009.06.001

Shin, S. and Lee, W.J. (2021) 'Factors affecting user acceptance for NFC mobile wallets in the US and korea', *Innovation and Management Review*, Vol. 18, No. 4, pp.417–433, https://doi.org/10.1108/INMR-02-2020-0018

Shobande, O.A. and Ogbeifun, L. (2022) 'Has information and communication technology improved environmental quality in the OECD? –a dynamic panel analysis', *International Journal of Sustainable Development and World Ecology*, Vol. 29, No. 1, pp.39–49, https://doi.org/10.1080/13504509.2021.1909172

Silvestre, B.S. and Țîrcă, D.M. (2019) 'Innovations for sustainable development: moving toward a sustainable future', *Journal of Cleaner Production*, Vol. 208, January, pp.325–332, https://doi.org/10.1016/j.jclepro.2018.09.244

Singh, N., Sinha, N. and Liébana-Cabanillas, F.J. (2020) 'Determining factors in the adoption and recommendation of mobile wallet services in India: analysis of the effect of innovativeness, stress to use and social influence', *International Journal of Information Management*, Vol. 50, pp.191–205, https://doi.org/10.1016/j.ijinfomgt.2019.05.022

Singh, N., Srivastava, S. and Sinha, N. (2017) 'Consumer preference and satisfaction of M-wallets: a study on north Indian consumers', *International Journal of Bank Marketing*, Vol. 35, No. 6, pp.944–965, https://doi.org/10.1108/IJBM-06-2016-0086

Sinha, N. and Singh, N. (2019) 'Understanding technology readiness and user's perceived satisfaction with mobile wallets services in India. *Nmims Management Review*, Vol. 37, No. 3, pp.10–33.

Svensson, G. and Wagner, B. (2015) 'Implementing and managing economic, social and environmental efforts of business sustainability propositions for measurement and structural models', *Management of Environmental Quality: An International Journal*, Vol. 26, No. 2, pp.195–213, https://doi.org/10.1108/MEQ-09-2013-0099

Thusi, P. and Maduku, D.K. (2020) 'South African millennials' acceptance and use of retail mobile banking apps: An integrated perspective', *Computers in Human Behavior*, Vol. 111, pp.1–10, https://doi.org/10.1016/j.chb.2020.106405

UNFCCC (2015) 'The paris agreement', *UNFCCC*, https://doi.org/10.4324/9789276082569-2

Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003) 'User acceptance of information technology: toward a unified view', *MIS Quarterly: Management Information Systems*, Vol. 27, No. 3, pp.425–478, https://doi.org/10.2307/30036540

Venkatesh, V., Thong, J.Y.L. and Xu, X. (2012) 'Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology', *MIS Quarterly*, Vol. 36, No. 1, pp.157–178.

Wang, K., Zhu, R. and Cheng, Y. (2022) 'Does the development of digital finance contribute to haze', *Energies*, Vol. 15, No. 7, pp.1–21.

Yang, M., Al Mamun, A., Mohiuddin, M., Nawi, N.C. and Zainol, N.R. (2021) 'Cashless transactions: a study on intention and adoption of e-wallets', *Sustainability*, Vol. 13, No. 2, pp.1–18, https://doi.org/10.3390/su13020831

Zhang, H., Lu, Y., Gupta, S. and Gao, P. (2015) 'Understanding group-buying websites continuance: an extension of expectation confirmation model', *Internet Research*, Vol. 25, No. 5, pp.767–793, https://doi.org/10.1108/IntR-05-2014-0127

Zhou, T., Lu, Y. and Wang, B. (2010) 'Integrating TTF and UTAUT to explain mobile banking user adoption', *Computers in Human Behavior*, Vol. 26, pp.760–767, https://doi.org/10.1016/j.chb.2010.01.013

Ziolo, M., Fidanoski, F., Simeonovski, K., Filipovski, V. and Jovanovska, K. (2017) 'Sustainable finance role in creating conditions for sustainable economic growth and development', in Filho, W.L., Pociovalisteanu, D-M. and Al-Amin, A.Q. (Eds.): *Sustainable Economic Development: Green Economy and Green Growth*, Springer Cham, pp.187–211, https://doi.org/10.1007/978-3-319-45081-0_11

Zou, F., Li, T. and Zhou, F. (2021) 'Does the level of financial cognition affect the income of rural households? Based on the moderating effect of the digital financial inclusion index', *Agronomy*, Vol. 11, No. 9, pp.1–20, https://doi.org/10.3390/agronomy11091813

Appendix 1

M-banking apps usage	
I regularly use m-banking apps to check my bank balance	DeLone and McLean (2003)
I regularly use m-banking apps to make purchases whenever there are chances	Baabdullah et al. (2019)
I regularly use m-banking apps to transfer and remit money	
I regularly use m-banking apps to make payments	
I regularly use m-banking apps to pay utility bills (electricity/gas/phone recharge etc.)	
I regularly use m-banking apps to receive money	
I regularly use m-banking apps to save money	
Price value	
M-banking apps are reasonably priced	Venkatesh et al. (2012)
M-banking apps give good value for the money	
In the current situation, m-banking apps provide good value	
Performance expectancy	
I feel that the m-banking apps are useful in my daily life	Venkatesh et al. (2012)
M-banking apps increase my chances of achieving that are important to me	
M-banking apps improve my payment convenience	
M-banking apps help me accomplish things more quickly	

Effort expectancy	
Learning to use m-banking apps is easy for me	Venkatesh et al. (2012)
I find m-banking apps easy to use for daily financial operations	
It is easy for me to become skilful at using m-banking apps	
My interaction with m-banking apps is clear and understandable	
Perceived security	
I believe m-banking apps have the potential to be safer than the traditional option of cash	Shin (2009)
I believe the technology used in m-banking apps is very safe	Chawla and Joshi (2019)
I believe that transactions conducted through m-banking apps are safe	
I believe the chances of losing money stored in m-banking apps are low	
Environment sustainability	Katini and Amalanathan (2022)
I am able to keep the surroundings clean with less pollution	
I am able to protect the environment and nature	
I am able to contribute to climate change promotion	
I always use water consciously	
My family uses more natural resources that do not threaten the health and well-being of people in the future	
I am able to change my lifestyle and reduce waste (throwing less food or not wasting materials)	
I am able to reuse things as much as I can	