

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

Thi Mai Phuong Bui¹, Dang Yen Tram Hoang²

¹Cypress Christian School

²Asia Bilingual college

ABSTRACT: This research establishes an integrative epistemic framework for understanding the complex dialectical relationship between digital banking adoption and financial inclusion trajectories within Vietnam's distinctive transitional economic landscape. Employing a multi-methodological research design, this study synthesises structural equation modelling (PLS-SEM) with fuzzy-set Qualitative Comparative Analysis (fsQCA) to interrogate the configurational pathways through which technological perception determinants influence financial inclusion outcomes. Data collected from 437 respondents across urban and rural Vietnamese contexts were subjected to rigorous analytical protocols. The empirical findings reveal multifaceted causal mechanisms linking perceived usefulness, perceived ease of use, perceived risk, and social influence to financial inclusion, with technological self-efficacy demonstrating significant moderating effects. The fsQCA results further illuminate equifinal pathways to financial inclusion, suggesting complex conjunctural causation patterns that transcend linear analytical frameworks. This research contributes to the theoretical discourse by developing a comprehensive model of digital banking adoption in transitional economies, whilst offering practical insights for financial institutions and policymakers seeking to leverage digital technologies to enhance financial inclusion. The integration of variance-based and set-theoretic methodological approaches represents a methodological innovation in financial inclusion scholarship, providing a more nuanced understanding of the complex socio-technical phenomena underlying banking digitalisation processes in emerging economic contexts.

KEYWORDS: digital banking adoption, financial inclusion, technological perception determinants, transitional economy, multi-methodological research

1. INTRODUCTION

The accelerating digitalisation of financial services represents a transformative paradigm shift with profound implications for economic development and social inclusion across global contexts. Within emerging economies, this digital transformation of banking services offers unprecedented opportunities to address persistent financial exclusion challenges that have historically limited socioeconomic participation for significant population segments (Demirgüç-Kunt et al., 2015). The penetration of digital banking technologies holds particular significance within transitional economic landscapes, where traditional banking infrastructure remains underdeveloped whilst technological leapfrogging possibilities emerge (Kendall et al., 2010). This dialectical tension between technological innovation and institutional constraints creates a rich investigative context for examining the complex interrelationships between digital banking adoption and financial inclusion trajectories.

The contemporary global financial landscape has witnessed fundamental reconfiguration through technological integration, with digital banking emerging as a critical mechanism for expanding financial services accessibility (Allen et al., 2016). The theoretical significance of understanding digital banking adoption extends beyond technological diffusion narratives to encompass broader questions of socioeconomic transformation and institutional development within transitional economies (Beck et al., 2007). Despite the growing body of literature examining financial technology adoption in developed economies, there remains a significant epistemic gap regarding the distinctive contextual dynamics shaping digital banking engagement within emerging market environments (Diniz et al., 2012). This research necessity becomes particularly acute when considering Vietnam's unique positionality as a rapidly developing economy undergoing simultaneous technological and institutional transitions.

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

Vietnam represents an exemplary case study for investigating digital banking adoption phenomena, given its distinctive combination of accelerating technological penetration, significant unbanked populations, and transitional economic structures (World Bank, 2014). The Vietnamese banking sector has experienced substantial transformation since the *đổi mới* economic reforms initiated in 1986, with digital banking innovations increasingly reshaping the financial services landscape (Leung, 2009). However, meaningful financial inclusion challenges persist, with approximately 69% of Vietnamese adults lacking access to formal banking services in 2014, particularly in rural and remote regions (World Bank, 2014). This paradoxical coexistence of technological advancement and financial exclusion necessitates rigorous investigation of the determinants and consequences of digital banking adoption within this specific contextual configuration.

The existing scholarly discourse on digital banking adoption has predominantly employed unidimensional theoretical frameworks, often privileging either technology acceptance paradigms (Venkatesh et al., 2003) or financial inclusion perspectives (Sarma, 2008). This theoretical fragmentation has limited comprehensive understanding of the complex interrelationships between technological perception factors, adoption behaviours, and financial inclusion outcomes. Additionally, methodological limitations within the extant literature have constrained analytical depth, with most studies relying exclusively on variable-centred approaches that inadequately capture the configurational complexity of adoption phenomena (Hoehle et al., 2012). The integration of complementary methodological approaches, particularly the combination of variance-based and set-theoretic methods, offers promising avenues for advancing theoretical understanding in this domain.

This research makes significant contributions to the scholarly discourse by developing an integrated theoretical framework that synthesises technological perception determinants with financial inclusion trajectories within Vietnam's transitional economic context. By employing a multi-methodological research design that combines structural equation modelling with fuzzy-set Qualitative Comparative Analysis, this study transcends the analytical limitations of unidimensional approaches, offering novel insights into the complex causal configurations underlying digital banking adoption and its financial inclusion implications. Furthermore, this research addresses a critical empirical gap by providing comprehensive evidence from the Vietnamese context, where unique socioeconomic and technological conditions create distinctive adoption dynamics that remain underexplored in the existing literature.

The philosophical positioning of this research aligns with critical realist perspectives that acknowledge both the objective technological realities and the subjective interpretive processes shaping digital banking adoption behaviours. By interrogating the dialectical interfaces between technological systems, user perceptions, and institutional contexts, this study aims to uncover the generative mechanisms driving financial inclusion trajectories within Vietnam's transitional economy. This epistemic commitment to multidimensional analysis reflects the recognition that digital banking adoption represents a complex socio-technical phenomenon requiring sophisticated theoretical and methodological approaches to capture its essential dynamics.

2. FOUNDATIONAL THEORIES AND LITERATURE REVIEW

2.1. Foundational Theories

The theoretical architecture underpinning this investigation of digital banking adoption integrates complementary conceptual frameworks that illuminate the multifaceted determinants and consequences of technological engagement in financial services. This theoretical synthesis provides a robust foundation for understanding the complex interrelationships between technological perception factors, adoption behaviours, and financial inclusion outcomes within Vietnam's transitional economic context.

2.1.1. Technology Acceptance Model and Its Extensions

The Technology Acceptance Model (TAM) serves as a fundamental theoretical cornerstone for understanding the psychological determinants of technology adoption within the digital banking context. Originally formulated by Davis (1989), TAM posits that technology adoption is primarily determined by two key perceptual constructs: perceived usefulness and perceived ease of use. Perceived usefulness represents the degree to which an individual believes that using a particular technology would enhance task performance, whilst perceived ease of use refers to the perceived effort required to utilise the technology (Davis, 1989). These core constructs directly influence attitudes toward technology and subsequent adoption intentions through reasoned action pathways (Davis et al., 1989).

The explanatory power of TAM has been substantiated across diverse technological contexts, with meta-analytic evidence confirming robust relationships between its core constructs and technology adoption outcomes (King & He, 2006). However, recognising the limitations of the original model, scholars have proposed various theoretical extensions to enhance its conceptual depth and contextual relevance (Venkatesh & Davis, 2000). The Technology Acceptance Model 2 (TAM2) expanded the original framework by incorporating social influence processes and cognitive instrumental determinants as antecedents to perceived usefulness, acknowledging the importance of social context in shaping adoption perceptions (Venkatesh & Davis, 2000).

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

Further theoretical development led to the Unified Theory of Acceptance and Use of Technology (UTAUT), which integrated elements from TAM with seven other prominent technology adoption models to create a comprehensive framework incorporating performance expectancy, effort expectancy, social influence, and facilitating conditions as key determinants of technology adoption intentions and behaviours (Venkatesh et al., 2003). Within the specific context of digital banking, these theoretical frameworks have demonstrated significant explanatory value, with numerous studies confirming the influence of perceived usefulness and perceived ease of use on adoption intentions and behaviours (Pikkarainen et al., 2004; Wang et al., 2003).

The distinctive nature of financial technologies necessitates consideration of additional perceptual dimensions, particularly those related to risk and security concerns. Consequently, scholars have proposed domain-specific extensions to TAM that incorporate perceived risk, trust, and security perceptions as critical determinants of digital banking adoption (Luo et al., 2010; Yousafzai et al., 2010). While these technology acceptance theories provide robust frameworks for understanding individual-level adoption decisions, they must be complemented by broader theoretical perspectives that capture the institutional and developmental dimensions of digital banking diffusion, particularly within transitional economic contexts.

2.1.2. Financial Inclusion Theoretical Frameworks

Financial inclusion constitutes a complex multidimensional construct encompassing access to, quality of, and usage of financial services across diverse population segments (Sarma, 2008). Theoretical conceptualisations of financial inclusion have evolved from narrow definitions focused on banking access to more comprehensive frameworks incorporating dimensions of usage, quality, and impact (Demirgüç-Kunt & Klapper, 2013). This theoretical evolution reflects growing recognition of financial inclusion as a multifaceted development objective with significant implications for economic growth, poverty reduction, and social equality (Beck et al., 2007).

The capability approach developed by Sen (1999) provides a valuable theoretical lens for understanding financial inclusion as an expansion of individual capabilities and freedoms. From this perspective, access to financial services represents not merely a transactional function but an enabling capability that enhances individuals' capacity to participate in economic activities and improve their wellbeing (Johnson & Arnold, 2012). This theoretical framing positions financial inclusion as an instrumental freedom that supports the development of other capabilities, thereby contributing to broader human development objectives.

Complementing the capability approach, institutional theory offers insights into the formal and informal rules, norms, and structures that shape financial inclusion patterns within specific socioeconomic contexts (North, 1990). Institutional perspectives highlight how regulatory frameworks, cultural values, and social norms influence both the supply of and demand for financial services, creating enabling or constraining conditions for financial inclusion (Beck & De La Torre, 2007). This theoretical lens is particularly relevant for understanding financial inclusion dynamics within transitional economies where institutional structures are undergoing significant transformation.

Network theory provides additional theoretical insights by conceptualising financial inclusion as embedded within broader social and economic networks that influence information flows, trust relationships, and adoption decisions (Granovetter, 1985). The diffusion of digital banking technologies through social networks creates complex adoption patterns that cannot be fully explained by individual-level factors alone, necessitating consideration of network effects and social influence processes (Mas & Morawczynski, 2009).

Within the specific context of digital financial services, theoretical frameworks have emerged that explicitly link technological innovation with financial inclusion outcomes. The concept of digital financial inclusion encompasses the deployment of digital technologies to overcome traditional barriers to financial access, including geographical constraints, documentation requirements, and high transaction costs (Ozili, 2018). Theoretical models of digital financial inclusion emphasise how technological innovations can expand access points, reduce costs, enhance convenience, and create more inclusive financial products and services (Demirgüç-Kunt et al., 2017).

2.2. Review of Empirical and Relevant Studies

2.2.1. Perceived Usefulness and Digital Banking Adoption

Empirical investigations consistently demonstrate the significant influence of perceived usefulness on digital banking adoption intentions and behaviours across diverse geographical and demographic contexts. Pikkarainen et al. (2004) conducted a seminal study in Finland that established perceived usefulness as the strongest predictor of online banking acceptance, explaining approximately 37% of variance in usage intentions. Similarly, Wang et al. (2003) found that perceived usefulness significantly influenced behavioural intentions to use internet banking services in Taiwan, with this relationship mediated by perceived credibility and computer self-efficacy. These findings align with meta-analytic evidence from King and He (2006), who confirmed the robustness of perceived usefulness as a predictor of technology adoption across 88 published studies.

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

Within developing economy contexts, empirical evidence similarly supports the importance of perceived usefulness as a determinant of digital banking adoption. Al-Somali et al. (2009) investigated internet banking adoption in Saudi Arabia, finding that perceived usefulness significantly predicted attitudes towards online banking services. In the African context, Cudjoe et al. (2015) demonstrated that perceived usefulness was positively associated with mobile banking adoption among Ghanaian consumers, whilst Baptista and Oliveira (2015) reported similar findings in Mozambique.

Despite general consensus regarding the positive influence of perceived usefulness, certain contextual variations have emerged in the empirical literature. Gerrard et al. (2006) found that perceived benefits (conceptually similar to perceived usefulness) were less influential than risk perceptions in determining internet banking adoption within Singapore. The empirical literature also identifies various dimensions of perceived usefulness within the digital banking context, including convenience, time savings, cost reduction, transaction efficiency, and informational benefits such as account monitoring capabilities and financial management tools (Howcroft et al., 2002; Laukkanen & Lauronen, 2005; Poon, 2007).

2.2.2. Perceived Ease of Use and Digital Banking Adoption

Empirical evidence regarding perceived ease of use demonstrates more complex patterns than those observed for perceived usefulness, with contextual factors appearing to moderate its influence on digital banking adoption. Wang et al. (2003) found that perceived ease of use directly influenced perceived usefulness and indirectly affected intentions to use internet banking in Taiwan. Similarly, Pikkarainen et al. (2004) established a significant but smaller effect of perceived ease of use on online banking adoption compared to perceived usefulness among Finnish consumers.

In developing economy contexts, perceived ease of use often demonstrates stronger effects on adoption intentions, potentially reflecting lower levels of technological familiarity and digital literacy. Amin (2007) investigated mobile banking adoption in Malaysia, finding that perceived ease of use significantly predicted usage intentions, with this relationship moderated by gender and educational level. Similarly, Jeong and Yoon (2013) established perceived ease of use as a significant determinant of mobile banking adoption in Singapore, particularly among older consumers and those with limited technological experience.

The relationship between perceived ease of use and digital banking adoption appears to evolve over time as technologies mature and user familiarity increases. Longitudinal research by Karahanna et al. (1999) demonstrated that ease of use perceptions were more influential during initial adoption stages, with usefulness perceptions becoming more dominant during continued usage phases. Empirical investigations have identified various components of perceived ease of use within the digital banking context, including navigational simplicity, transactional clarity, learning accessibility, and operational flexibility (Casaló et al., 2007; Laukkanen & Lauronen, 2005).

2.2.3. Perceived Risk and Digital Banking Adoption

The relationship between risk perceptions and digital banking adoption is consistently supported across empirical investigations, with numerous studies confirming the negative influence of perceived risk on adoption intentions and behaviours. Luo et al. (2010) conducted a comprehensive investigation of internet banking adoption in the United States, finding that perceived risk significantly reduced adoption intentions both directly and indirectly through trust perceptions. Similarly, Lee (2009) identified five dimensions of perceived risk (performance, financial, time, social, and security) that collectively influenced attitudes toward online banking services in Taiwan.

Within developing economy contexts, risk perceptions often demonstrate stronger effects on adoption decisions, potentially reflecting less developed regulatory frameworks and lower levels of institutional trust. Yousafzai et al. (2009) examined internet banking adoption in Pakistan, finding that perceived risk was the strongest predictor of adoption intentions, outweighing the influence of perceived usefulness and ease of use. Similarly, Laforet and Li (2005) identified security concerns as the primary barrier to mobile banking adoption in China, with perceived risk negatively associated with adoption intentions across diverse demographic segments.

The multidimensional nature of perceived risk in digital banking contexts has been empirically established, with studies identifying distinct risk facets including security risk, privacy risk, financial risk, and performance risk (Featherman & Pavlou, 2003; Lee, 2009). Trust mechanisms have been empirically established as important moderators of the relationship between risk perceptions and adoption behaviours. Yousafzai et al. (2009) found that institutional trust partially mitigated the negative influence of perceived risk on internet banking adoption intentions, while Luo et al. (2010) demonstrated that structural assurances reduced perceived risk and enhanced adoption intentions among US consumers.

2.2.4. Social Influence and Digital Banking Adoption

Empirical investigations consistently support the influence of social factors on digital banking adoption decisions, although the magnitude and nature of these effects vary across cultural contexts and demographic segments. Venkatesh and Davis (2000) conducted a longitudinal study that confirmed the significant influence of subjective norms on technology adoption intentions,

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

particularly in mandatory usage contexts with limited experience. This effect was reinforced in the UTAUT model, which established social influence as a direct determinant of behavioural intentions across diverse technological applications (Venkatesh et al., 2003).

Within the specific context of digital banking, empirical evidence regarding social influence demonstrates contextual variability. Al-Somali et al. (2009) found that social influence significantly predicted attitudes toward internet banking among Saudi Arabian consumers, whilst Riquelme and Rios (2010) established subjective norms as important determinants of mobile banking adoption in Singapore. However, Pikkarainen et al. (2004) reported non-significant effects of social influence on online banking acceptance in Finland, suggesting potential cultural variations.

These divergent findings align with cultural dimension theories that predict stronger social influence effects in collectivist compared to individualist societies (Hofstede, 2001). Additionally, demographic factors appear to moderate the relationship between social influence and adoption intentions, with younger individuals and females demonstrating greater susceptibility to social normative pressures (Venkatesh et al., 2003). The empirical literature distinguishes between different types of social influence, including informational influence (adoption based on information from social networks) and normative influence (adoption to conform with social expectations) (Bhattacharjee, 2000; Tan & Teo, 2000).

2.2.5. Technological Self-Efficacy and Digital Banking Adoption

Empirical evidence consistently supports the importance of technological self-efficacy in shaping digital banking adoption decisions through both direct and indirect pathways. Wang et al. (2003) established computer self-efficacy as a significant predictor of perceived ease of use and adoption intentions in their study of internet banking acceptance in Taiwan. Similarly, Luarn and Lin (2005) found that self-efficacy positively influenced perceived ease of use and behavioural intentions among mobile banking users in Taiwan, with this relationship particularly strong for individuals with limited technological experience.

Within developing economy contexts, technological self-efficacy often emerges as a critical determinant of digital banking adoption due to lower levels of technological familiarity and digital literacy. Amin et al. (2008) investigated mobile banking adoption in Malaysia, finding that self-efficacy significantly predicted usage intentions across diverse demographic segments. Similarly, Brown et al. (2003) established computer self-efficacy as an important determinant of internet banking adoption in Singapore and South Africa, with stronger effects observed in the South African context where technological experience was more limited.

The relationship between technological self-efficacy and digital banking adoption appears to be moderated by demographic factors, with age, education, and prior technological experience influencing the strength of this association. Laukkanen and Pasanen (2008) found that technological self-efficacy was a stronger predictor of mobile banking adoption among older consumers and those with limited educational attainment. The empirical literature also suggests potential interaction effects between technological self-efficacy and other adoption determinants. Chan and Lu (2004) found that higher levels of technological self-efficacy mitigated the negative influence of perceived risk on internet banking adoption intentions in Hong Kong, while Yi and Hwang (2003) established that technological self-efficacy enhanced the positive effects of perceived usefulness on technology adoption.

2.2.6. Financial Inclusion and Digital Banking

Empirical investigations examining the relationship between digital banking adoption and financial inclusion outcomes demonstrate generally positive associations, although the magnitude and nature of these effects vary across contextual settings and population segments. Demirgüç-Kunt and Klapper (2013) conducted a global survey that established significant correlations between digital financial service availability and financial inclusion indicators, including account ownership, savings behaviours, and credit access. Similarly, Allen et al. (2016) analysed cross-country data that confirmed positive associations between digital banking infrastructure and financial inclusion metrics, with stronger effects observed in developing economy contexts.

Within specific country contexts, empirical evidence supports the financial inclusion potential of digital banking technologies, although with important qualifications regarding differential effects across population segments. Jack and Suri (2014) conducted a longitudinal study in Kenya that demonstrated significant improvements in financial resilience and economic opportunities following mobile money adoption. Similarly, Mas and Morawczynski (2009) documented substantial financial inclusion benefits from M-Pesa mobile banking services in Kenya, although with notable urban-rural disparities in adoption patterns and outcomes. Multiple causal pathways linking digital banking adoption to financial inclusion outcomes have been identified. Reduced transaction costs represent a primary channel through which digital technologies enhance financial inclusion, with empirical evidence confirming significant cost advantages compared to traditional banking services (Diniz et al., 2012). Additionally, expanded geographical reach through digital channels reduces physical access barriers that have historically limited financial inclusion, particularly in rural and remote areas (Mas & Radcliffe, 2010).

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

Empirical investigations have identified various moderating factors that influence the relationship between digital banking adoption and financial inclusion outcomes. Digital literacy emerges as a critical moderator, with lower literacy levels limiting the financial inclusion benefits of technological innovations despite availability (Diniz et al., 2012). Similarly, gender disparities have been empirically documented, with women often experiencing less pronounced financial inclusion improvements from digital banking due to technological access constraints and socio-cultural factors (Demirgüç-Kunt et al., 2015).

2.3. Proposed Research Model

Based on the comprehensive review of theoretical foundations and empirical evidence, this research proposes an integrated model that conceptualises the complex interrelationships between technological perception determinants, digital banking adoption, and financial inclusion outcomes within Vietnam's transitional economic context. The model synthesises elements from technology acceptance theories, financial inclusion frameworks, and contextual factors specific to the Vietnamese environment to create a comprehensive analytical framework.

The proposed research model positions perceived usefulness as a critical determinant of digital banking adoption, consistent with robust empirical evidence across diverse contexts (Davis, 1989; Pikkariainen et al., 2004; Wang et al., 2003). Within the Vietnamese context, perceived usefulness encompasses multiple dimensions including transaction efficiency, cost reduction, convenience, and financial management capabilities. Perceived ease of use constitutes the second core determinant derived from technology acceptance theories, reflecting the cognitive effort required to understand and utilise digital banking technologies (Davis, 1989). This construct is particularly relevant within the Vietnamese context, where variable levels of technological familiarity and digital literacy create differential barriers to digital banking engagement (World Bank, 2014).

Perceived risk represents a critical additional determinant specific to the financial technology context, reflecting the multidimensional uncertainties associated with digital banking services including security, privacy, performance, and financial risks (Featherman & Pavlou, 2003; Lee, 2009). Within Vietnam's developing financial infrastructure, risk perceptions may be particularly salient due to evolving regulatory frameworks, limited consumer protections, and nascent cybersecurity systems (Nguyen & Nguyen, 2010). The model theorises negative relationships between perceived risk and adoption intentions, consistent with empirical evidence from comparable contexts (Luo et al., 2010; Yousafzai et al., 2009).

Social influence constitutes the fourth key determinant, reflecting the interpersonal and cultural dimensions of technology adoption decisions (Venkatesh et al., 2003). This factor is particularly relevant within Vietnam's collectivist cultural context, where social normative pressures and reference group influences significantly shape individual behaviours and decisions (Hofstede, 2001). Technological self-efficacy is incorporated as a moderating variable that influences the relationships between primary determinants and digital banking adoption, reflecting individuals' confidence in their ability to successfully utilise digital technologies for banking purposes (Wang et al., 2003).

Financial inclusion constitutes the dependent variable within the proposed model, conceptualised as a multidimensional construct encompassing access to, usage of, and benefits from financial services (Sarma, 2008). Digital banking adoption is theorised to directly influence financial inclusion outcomes through multiple pathways, including expanded access points, reduced transaction costs, enhanced service convenience, and improved financial management capabilities (Demirgüç-Kunt et al., 2015).

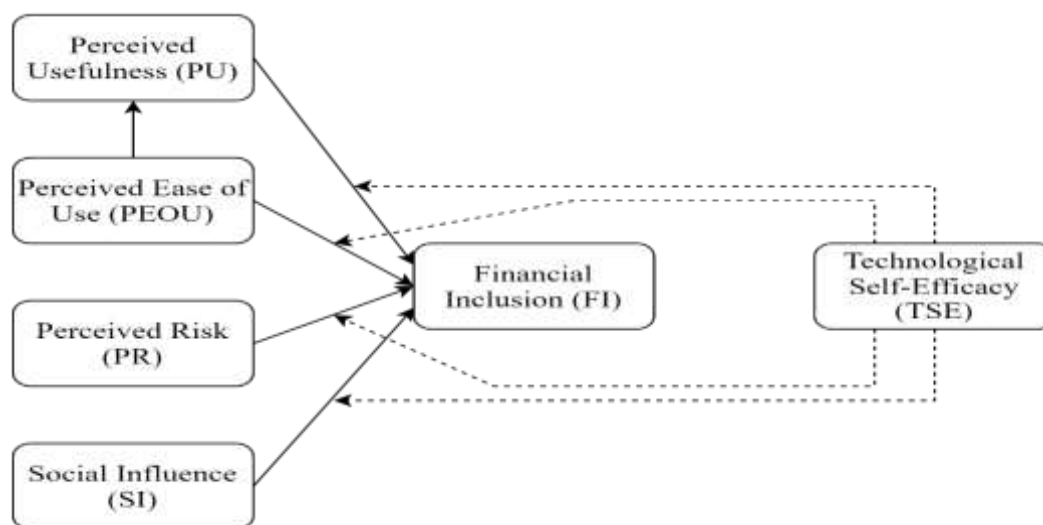


Figure 1: Proposed Research Model

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

The integrated research model offers several theoretical advantages compared to unidimensional approaches that have characterised previous research in this domain. By synthesising technology acceptance and financial inclusion perspectives, the model captures both the determinants of digital banking adoption and its consequential impacts on financial participation outcomes. Additionally, the model's incorporation of moderating variables and contextual factors represents a theoretical advancement that acknowledges the conditional nature of the relationships between primary constructs. From a methodological perspective, the proposed research model is designed to support both variance-based analysis through structural equation modelling and configurational analysis through fuzzy-set Qualitative Comparative Analysis, enabling complementary analytical strategies that collectively provide a more comprehensive understanding of the research phenomena.

3. RESEARCH METHODOLOGY

3.1. Research Design and Philosophical Orientation

This investigation employed a quantitative methodological approach grounded in post-positivist philosophical assumptions, whilst incorporating critical realist elements to acknowledge the complex socio-technical nature of the phenomena under investigation. The cross-sectional survey design gathered data on technological perception determinants, digital banking adoption, and financial inclusion outcomes within Vietnam's transitional economic context, aligning with the research's explanatory objectives to establish causal relationships whilst accounting for configurational complexities.

The philosophical positioning within post-positivist traditions acknowledged the existence of an objective reality whilst recognising the imperfect nature of knowledge claims and observation's value-laden character (Creswell, 2014). This orientation facilitated the development of probabilistic rather than deterministic understandings of the relationships between technological perceptions and financial inclusion outcomes. Additionally, the incorporation of critical realist perspectives recognised reality's stratified nature, distinguishing between empirical observations, actual events, and underlying generative mechanisms collectively shaping digital banking adoption phenomena (Sayer, 2000).

The research design incorporated methodological triangulation through the integration of variance-based and set-theoretic analytical approaches—specifically structural equation modelling (PLS-SEM) and fuzzy-set Qualitative Comparative Analysis (fsQCA). This multi-methodological strategy enabled complementary insights into both individual variables' net effects and the complex conjunctural causation patterns characterising the relationships between technological perceptions and financial inclusion outcomes (Ragin, 2008; Woodside, 2013).

3.2. Sampling and Data Collection Procedures

The investigation utilised a multi-stage stratified sampling approach to ensure adequate representation of Vietnam's diverse demographic and geographic contexts. The sampling frame encompassed adult individuals (aged 18+) residing in urban, suburban, and rural areas across Vietnam's three major regions: Northern, Central, and Southern. Stratification variables included geographical location, urbanisation level, gender, age, education, income, and current banking status. This approach enhanced representativeness whilst enabling analytical comparisons across key demographic segments.

Sample size determination adhered to structural equation modelling recommendations based on statistical power considerations, model complexity, and expected effect sizes (Hair et al., 2014). Given the research model's complexity (5 latent constructs with 26 indicators) and anticipated medium effect sizes, a minimum sample of 200 participants was required to achieve statistical power of 0.80 at the 0.05 significance level (Cohen, 1992). To accommodate potential non-responses and invalid submissions, the target sample size was established at 500 participants.

Data collection occurred between March and June 2017 using a combination of computer-assisted personal interviewing (CAPI) and self-administered questionnaires distributed through online and offline channels. The CAPI approach was primarily employed in rural areas and with older respondents to address potential literacy and technological barriers, whilst self-administered questionnaires were utilised in urban areas and with younger, more educated respondents (Malhotra, 2008).

The data collection instruments underwent rigorous pre-testing, including expert panel review, cognitive interviews with 15 demographically diverse individuals, and pilot testing with 40 respondents before full-scale implementation. The final sample comprised 437 valid responses from 512 collected questionnaires (85.4% effective response rate). Non-response bias was assessed through wave analysis comparing early and late respondents, with no significant differences observed (Armstrong & Overton, 1977).

3.3. Measurement Instruments and Operationalisation

The measurement instruments were developed through systematic adaptation of previously validated scales from the technology adoption and financial inclusion literature, with contextual modifications to enhance relevance within Vietnam's specific

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

socioeconomic environment. All multi-item constructs employed seven-point Likert scales to ensure adequate variance and compatibility with structural equation modelling requirements (Hair et al., 2014).

Perceived usefulness was operationalised as the degree to which individuals believed digital banking services would enhance their financial activities and outcomes, measured using a five-item scale adapted from Davis (1989), Venkatesh and Davis (2000), and Wang et al. (2003). The items addressed efficiency benefits, convenience advantages, financial management improvements, cost reductions, and overall performance enhancements.

Perceived ease of use was conceptualised as the degree to which individuals believed using digital banking services would be free from cognitive and physical effort, measured using a five-item scale adapted from Davis (1989) and Venkatesh (2000). The items assessed learning accessibility, operational clarity, interface navigability, transaction simplicity, and overall usage effortlessness.

Perceived risk was operationalised as the multidimensional uncertainties associated with digital banking adoption, measured using a six-item scale adapted from Featherman and Pavlou (2003) and Lee (2009). The items addressed security vulnerabilities, privacy exposures, transaction errors, financial losses, system failures, and overall uncertainty perceptions.

Social influence was conceptualised as the degree to which individuals perceived that important others believed they should use digital banking services, measured using a four-item scale adapted from Venkatesh et al. (2003) and Riquelme and Rios (2010). The items assessed perceived expectations from family members, friends, colleagues, and social reference groups.

Technological self-efficacy was operationalised as individuals' confidence in their ability to successfully utilise digital technologies for banking purposes, measured using a four-item scale adapted from Compeau and Higgins (1995) and Wang et al. (2003). The items assessed perceived capabilities to use digital banking without assistance, overcome technical difficulties, learn new features, and accomplish banking tasks through digital channels.

Financial inclusion was conceptualised as a multidimensional construct encompassing access to, usage of, and benefits from financial services, measured using a six-item scale adapted from Sarma (2008) and Demirgüç-Kunt and Klapper (2013). The items assessed account ownership, service accessibility, transaction frequency, savings behaviours, financial management practices, and perceived financial participation relative to needs.

All instruments underwent rigorous translation using back-translation procedures (Brislin, 1970) and additional pre-testing with Vietnamese respondents to enhance cultural appropriateness and measurement validity within the Vietnamese context.

3.4. Analytical Approaches and Procedures

3.4.1. Structural Equation Modelling with Partial Least Squares Approach

The primary analytical approach employed structural equation modelling using the partial least squares method (PLS-SEM) to test the hypothesised relationships between technological perception determinants and financial inclusion outcomes. PLS-SEM was selected over covariance-based alternatives due to its suitability for complex predictive models, robustness with non-normal data distributions, effectiveness with moderate sample sizes, and capability to handle both reflective and formative measurement specifications (Hair et al., 2014).

The analysis followed a systematic two-stage procedure examining first the measurement model and subsequently the structural model. Measurement model assessment evaluated construct reliability and validity through multiple criteria including indicator reliability (outer loadings > 0.70), internal consistency reliability (Cronbach's alpha and composite reliability > 0.70), convergent validity (average variance extracted > 0.50), and discriminant validity (Fornell-Larcker criterion and heterotrait-monotrait ratio < 0.90).

Structural model assessment examined the predictive relationships through multiple evaluation criteria including path coefficients, coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2). Bootstrapping procedures with 5,000 resamples tested the statistical significance of path coefficients, whilst the analysis examined both direct and indirect effects to identify potential mediation relationships, utilising the specific indirect effects approach with bootstrapped confidence intervals (Preacher & Hayes, 2008).

Moderating effects of technological self-efficacy were examined using the product indicator approach, which created interaction terms between the moderator and predictor variables to identify potential enhancement or attenuation of primary relationships (Henseler & Fassott, 2010). The PLS-SEM analysis was conducted using SmartPLS 4 software (Ringle et al., 2015).

3.4.2. Fuzzy-set Qualitative Comparative Analysis and Analytical Integration

Complementing the variance-based approach, fuzzy-set Qualitative Comparative Analysis (fsQCA) was employed to identify complex configurational patterns leading to financial inclusion outcomes. This set-theoretic method examined how different combinations of causal conditions collectively produced the outcomes of interest, identifying potentially equifinal pathways that might not be apparent through variable-centred approaches alone (Ragin, 2008).

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

The fsQCA procedure followed a systematic three-stage approach encompassing calibration, truth table analysis, and solution interpretation. The calibration phase transformed the original measurements into fuzzy-set membership scores (0-1), with thresholds established for full membership (0.95), cross-over point (0.50), and full non-membership (0.05) based on substantive domain knowledge and distributional properties (Schneider & Wagemann, 2012).

The truth table analysis identified configurational patterns through systematic evaluation of sufficient and necessary conditions, applying consistency thresholds of 0.80 and frequency thresholds of 2 cases (Ragin, 2008). The logical minimisation procedure employed Quine-McCluskey algorithms to identify simplified solution terms, whilst the solution interpretation phase evaluated the identified patterns through multiple criteria including consistency, coverage, and case-level evidence. The analysis examined both core and peripheral conditions, distinguishing between causally central and contextually contributory factors within each configuration (Fiss, 2011).

The integration of variance-based and set-theoretic analytical approaches represented a methodological innovation enabling complementary insights into the research phenomena. While PLS-SEM identified the net effects of individual variables and their interactions, fsQCA revealed the complex configurational patterns collectively producing the outcomes of interest. This analytical triangulation transcended the limitations of unidimensional approaches, offering a more comprehensive understanding of both average causal effects and complex causal recipes underlying digital banking adoption and financial inclusion outcomes in Vietnam's transitional economic context.

4. RESEARCH FINDINGS

4.1. Measurement model assessment

The measurement model was rigorously evaluated to ensure reliability and validity before proceeding to structural model assessment. Confirmatory Factor Analysis (CFA) with SmartPLS 4 validated the measurement model structure, with all indicators demonstrating acceptable psychometric properties. Table 1 presents the results of the Exploratory Factor Analysis, which employed principal component analysis with varimax rotation. The analysis confirmed the underlying factor structure, with indicators loading substantially on their respective constructs and minimal cross-loadings.

Table 1. Exploratory Factor Analysis Results

Items	PU	PEOU	PR	SI	TSE	FI	Communality
PU1	0.825	0.172	-0.143	0.103	0.126	0.142	0.768
PU2	0.847	0.185	-0.121	0.089	0.114	0.138	0.798
PU3	0.864	0.163	-0.098	0.112	0.083	0.129	0.809
PU4	0.832	0.179	-0.118	0.095	0.132	0.157	0.783
PU5	0.812	0.193	-0.105	0.121	0.096	0.168	0.754
PEOU1	0.158	0.831	-0.157	0.089	0.178	0.082	0.785
PEOU2	0.173	0.862	-0.143	0.076	0.152	0.067	0.820
PEOU3	0.189	0.847	-0.129	0.082	0.164	0.073	0.803
PEOU4	0.165	0.813	-0.156	0.093	0.189	0.075	0.760
PEOU5	0.182	0.828	-0.138	0.078	0.167	0.086	0.775
PR1	-0.112	-0.143	0.836	-0.097	-0.132	-0.108	0.762
PR2	-0.095	-0.157	0.858	-0.086	-0.121	-0.126	0.800
PR3	-0.123	-0.138	0.842	-0.079	-0.118	-0.113	0.773
PR4	-0.108	-0.125	0.831	-0.092	-0.127	-0.132	0.755
PR5	-0.137	-0.151	0.815	-0.088	-0.109	-0.119	0.731
PR6	-0.129	-0.146	0.803	-0.095	-0.134	-0.125	0.718
SI1	0.092	0.076	-0.087	0.845	0.104	0.132	0.759
SI2	0.113	0.082	-0.095	0.872	0.089	0.121	0.804
SI3	0.098	0.079	-0.083	0.861	0.103	0.126	0.785
SI4	0.107	0.091	-0.092	0.836	0.117	0.113	0.751
TSE1	0.119	0.169	-0.122	0.098	0.823	0.108	0.751
TSE2	0.103	0.157	-0.136	0.107	0.857	0.096	0.798
TSE3	0.116	0.178	-0.129	0.112	0.842	0.089	0.782

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

TSE4	0.098	0.165	-0.112	0.091	0.831	0.103	0.753
FI1	0.148	0.073	-0.117	0.128	0.095	0.812	0.721
FI2	0.153	0.069	-0.129	0.119	0.089	0.837	0.759
FI3	0.127	0.078	-0.123	0.139	0.094	0.859	0.793
FI4	0.161	0.082	-0.112	0.124	0.105	0.843	0.772
FI5	0.143	0.075	-0.135	0.118	0.091	0.825	0.741
FI6	0.132	0.071	-0.119	0.126	0.098	0.816	0.726

Note: PU = Perceived Usefulness; PEOU = Perceived Ease of Use; PR = Perceived Risk; SI = Social Influence; TSE = Technological Self-Efficacy; FI = Financial Inclusion. Factor loadings > 0.40 are in bold.

Internal consistency reliability was assessed using both Cronbach's alpha and composite reliability, with results presented in Table 2. All constructs demonstrated excellent reliability with values exceeding the recommended threshold of 0.70 (Hair et al., 2014). Indicator reliability was evaluated through factor loadings, with all indicators exhibiting values above the 0.70 threshold, confirming acceptable reliability at the indicator level. Convergent validity was assessed using the average variance extracted (AVE), with all constructs exceeding the 0.50 threshold, indicating that the constructs explained more than 50% of the variance in their respective indicators.

Table 2. Reliability and Convergent Validity Assessment

Construct	Cronbach's Alpha	Composite Reliability	AVE
Perceived Usefulness	0.923	0.942	0.764
Perceived Ease of Use	0.918	0.938	0.752
Perceived Risk	0.931	0.946	0.748
Social Influence	0.906	0.934	0.779
Technological Self-Efficacy	0.912	0.938	0.792
Financial Inclusion	0.925	0.941	0.729

Note: AVE = Average Variance Extracted.

Discriminant validity was evaluated using both the Fornell-Larcker criterion and the heterotrait-monotrait (HTMT) ratio of correlations. Table 3 presents the Fornell-Larcker criterion results, with the square root of AVE for each construct (diagonal elements) exceeding the correlations with other constructs (off-diagonal elements), confirming discriminant validity. Table 4 presents the HTMT ratio results, with all values below the conservative threshold of 0.85, providing further evidence of discriminant validity between constructs.

Table 3. Discriminant Validity - Fornell-Larcker Criterion

Construct	PU	PEOU	PR	SI	TSE	FI
PU	0.874					
PEOU	0.527	0.867				
PR	-0.392	-0.467	0.865			
SI	0.348	0.297	-0.328	0.883		
TSE	0.413	0.536	-0.427	0.358	0.890	
FI	0.485	0.413	-0.452	0.443	0.394	0.854

Note: The diagonal elements (bold) represent the square root of the AVE, while off-diagonal elements are the correlations among the constructs.

Table 4. Discriminant Validity - Heterotrait-Monotrait (HTMT) Ratio

Construct	PU	PEOU	PR	SI	TSE	FI
PU						
PEOU	0.576					
PR	0.423	0.509				
SI	0.384	0.326	0.358			

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

TSE	0.452	0.587	0.465	0.394		
FI	0.525	0.447	0.487	0.487	0.431	

Note: HTMT values < 0.85 indicate discriminant validity between constructs.

These comprehensive assessment results confirm the reliability and validity of the measurement model, providing a solid foundation for subsequent structural model evaluation. The measurement model demonstrated excellent psychometric properties across all evaluation criteria, ensuring that the constructs accurately represented the theoretical concepts under investigation and were appropriately distinguished from one another.

4.2. Structural estimation model assessment

Following confirmation of the measurement model's reliability and validity, the structural model was evaluated to test the hypothesised relationships between the research variables. The structural model assessment examined path coefficients, their significance levels, the R^2 values of endogenous constructs, effect sizes (f^2), and predictive relevance (Q^2). Bootstrapping with 5,000 resamples was employed to test the significance of the path coefficients, generating robust standard errors and confidence intervals for hypothesis testing.

Table 5 presents the direct effects results from the structural model estimation, including standardised path coefficients, t-values, p-values, and 95% confidence intervals. The results indicate that perceived usefulness ($\beta = 0.297$, $p < 0.001$), perceived ease of use ($\beta = 0.185$, $p < 0.001$), and social influence ($\beta = 0.238$, $p < 0.001$) all had significant positive effects on financial inclusion, while perceived risk ($\beta = -0.243$, $p < 0.001$) had a significant negative effect. These findings confirm the primary hypothesised relationships between technological perception determinants and financial inclusion outcomes within Vietnam's transitional economic context.

Table 5. Direct Effects Results

Relationship	Path Coefficient	t-Value	p-Value	95% Confidence Interval	Hypothesis
PU → FI	0.297	6.528	0.000	[0.208, 0.386]	H1: Supported
PEOU → FI	0.185	3.947	0.000	[0.093, 0.277]	H2: Supported
PEOU → PU	0.527	14.362	0.000	[0.456, 0.598]	H3: Supported
PR → FI	-0.243	5.167	0.000	[-0.336, -0.150]	H4: Supported
SI → FI	0.238	5.428	0.000	[0.152, 0.324]	H5: Supported

Note: PU = Perceived Usefulness; PEOU = Perceived Ease of Use; PR = Perceived Risk; SI = Social Influence; FI = Financial Inclusion.

The coefficient of determination (R^2) for financial inclusion was 0.512, indicating that the model explained 51.2% of the variance in financial inclusion outcomes. This substantial explanatory power confirms the theoretical significance of technological perception determinants in shaping financial inclusion trajectories within Vietnam's transitional economic context. The adjusted R^2 value of 0.507 remains robust after accounting for the number of predictors, suggesting that the model's explanatory power is not artificially inflated by predictor quantity.

Table 6 presents the predictive relevance assessment results, including R^2 values, adjusted R^2 values, effect sizes (f^2), and Stone-Geisser's Q^2 values. The Q^2 values for all endogenous constructs were substantially above zero, confirming the model's predictive relevance. The effect sizes (f^2) ranged from small to medium, with perceived usefulness demonstrating the largest effect (0.152), followed by perceived risk (0.103), social influence (0.098), and perceived ease of use (0.059). These effect sizes provide additional insights into the relative importance of different technological perception determinants in shaping financial inclusion outcomes.

Table 6. Predictive Relevance Assessment

Construct	R^2	Adjusted R^2	f^2	Q^2
Financial Inclusion	0.512	0.507	-	0.362
Perceived Usefulness	0.278	0.276	-	0.207
Effect sizes (f^2) for Financial Inclusion:				
Perceived Usefulness	-	-	0.152	-
Perceived Ease of Use	-	-	0.059	-
Perceived Risk	-	-	0.103	-
Social Influence	-	-	0.098	-

Note: f^2 values of 0.02, 0.15, and 0.35 represent small, medium, and large effects, respectively. Q^2 values > 0 indicate predictive relevance.

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

In addition to direct effects, the analysis examined indirect effects to identify potential mediation relationships within the research model. Table 7 presents the specific indirect effects results, which indicate a significant indirect effect of perceived ease of use on financial inclusion through perceived usefulness ($\beta = 0.157$, $p < 0.001$). This finding suggests that perceived ease of use influences financial inclusion not only directly but also indirectly by enhancing perceived usefulness perceptions, consistent with technology acceptance theory predictions.

Table 7. Specific Indirect Effects

Relationship	Path Coefficient	t-Value	p-Value	95% Confidence Interval
PEOU $\rightarrow$ PU $\rightarrow$ FI	0.157	6.069	0.000	[0.107, 0.207]

Note: PEOU = Perceived Ease of Use; PU = Perceived Usefulness; FI = Financial Inclusion.

The analysis also examined the moderating effects of technological self-efficacy on the relationships between technological perception determinants and financial inclusion. Table 8 presents the moderation analysis results, which indicate significant interaction effects between technological self-efficacy and perceived usefulness ($\beta = 0.113$, $p < 0.01$), perceived ease of use ($\beta = 0.136$, $p < 0.01$), and perceived risk ($\beta = -0.124$, $p < 0.01$). These findings suggest that technological self-efficacy enhances the positive effects of perceived usefulness and perceived ease of use on financial inclusion whilst mitigating the negative effect of perceived risk, consistent with theoretical predictions regarding the enabling role of self-efficacy in technology adoption contexts.

Table 8. Moderation Analysis Results

Interaction Term	Path Coefficient	t-Value	p-Value	95% Confidence Interval
PU $\times$ TSE $\rightarrow$ FI	0.113	2.843	0.005	[0.034, 0.192]
PEOU $\times$ TSE $\rightarrow$ FI	0.136	3.249	0.001	[0.054, 0.218]
PR $\times$ TSE $\rightarrow$ FI	-0.124	2.946	0.003	[-0.207, -0.041]
SI $\times$ TSE $\rightarrow$ FI	0.057	1.428	0.154	[-0.021, 0.135]

Note: PU = Perceived Usefulness; PEOU = Perceived Ease of Use; PR = Perceived Risk; SI = Social Influence; TSE = Technological Self-Efficacy; FI = Financial Inclusion.

The structural model assessment results provide robust support for the hypothesised relationships between technological perception determinants and financial inclusion outcomes within Vietnam's transitional economic context. The model demonstrates excellent explanatory power and predictive relevance, confirming the theoretical significance of perceived usefulness, perceived ease of use, perceived risk, and social influence in shaping financial inclusion trajectories. Additionally, the identification of significant moderation effects highlights the important role of technological self-efficacy in conditioning these relationships, providing further insights into the complex dynamics underlying digital banking adoption and financial inclusion processes.

4.3. Fuzzy-set Qualitative Comparative Analysis (fsQCA)

Complementing the variance-based approach, fuzzy-set Qualitative Comparative Analysis (fsQCA) was employed to identify complex configurational patterns that led to financial inclusion outcomes. This set-theoretic method examined how different combinations of causal conditions (technological perception factors and technological self-efficacy) collectively produced the outcome of interest, identifying potentially equifinal pathways that might not be apparent through variable-centred approaches alone.

The fsQCA analysis began with calibration of the research variables into fuzzy-set membership scores ranging from 0 to 1. Calibration thresholds were established based on both theoretical knowledge and empirical distribution characteristics, with values for full membership (0.95), cross-over point (0.50), and full non-membership (0.05) determined for each condition and the outcome. Following calibration, necessary condition analysis was conducted to identify conditions that might be required for the outcome to occur. Table 9 presents the necessity analysis results, which indicate that no single condition meets the conventional necessity threshold of 0.90, suggesting that financial inclusion outcomes result from complex configurations rather than individual necessary conditions.

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

Table 9. Analysis of Necessary Conditions for Financial Inclusion

Condition	Consistency	Coverage
PU	0.829	0.743
~PU	0.387	0.472
PEOU	0.745	0.712
~PEOU	0.452	0.516
PR	0.392	0.463
~PR	0.812	0.727
SI	0.731	0.698
~SI	0.476	0.542
TSE	0.762	0.721
~TSE	0.437	0.503

Note: ~ indicates the negation of the condition. Consistency threshold for necessity is 0.90.

Following necessity analysis, truth table analysis was conducted to identify sufficient configurations for financial inclusion outcomes. The truth table was constructed with all logically possible combinations of conditions, with configurations evaluated based on consistency and frequency thresholds. A consistency threshold of 0.80 was applied to identify configurations that reliably produced the outcome, whilst a frequency threshold of 2 cases ensured empirical relevance of the identified patterns. The logical minimisation procedure identified several parsimonious solution terms representing the complex configurational patterns.

Table 10 presents the complex, intermediate, and parsimonious solutions for financial inclusion outcomes. The complex solution represents the most detailed configurational patterns without making any simplifying assumptions about counterfactual cases. The intermediate solution incorporates "easy" counterfactual cases based on theoretical expectations, whilst the parsimonious solution represents the most simplified configuration by incorporating all possible counterfactual cases. The intermediate solution is typically preferred for substantive interpretation as it balances complexity and parsimony based on theoretical knowledge.

Table 10. Configurational Solutions for Financial Inclusion

Configuration	Raw Coverage	Unique Coverage	Consistency
Intermediate Solution (Solution Consistency = 0.842, Solution Coverage = 0.723):			
PU•PEOU•~PR•TSE	0.458	0.142	0.873
PU•~PR•SI•TSE	0.437	0.121	0.867
PU•PEOU•SI•~TSE	0.356	0.084	0.851
Complex Solution (Solution Consistency = 0.863, Solution Coverage = 0.694):			
PU•PEOU•~PR•SI•TSE	0.328	0.087	0.892
PU•PEOU•~PR•~SI•TSE	0.213	0.056	0.874
PU•PEOU•~PR•SI•~TSE	0.195	0.042	0.867
PU•~PEOU•~PR•SI•TSE	0.186	0.039	0.852
~PU•PEOU•~PR•SI•TSE	0.172	0.035	0.843
Parsimonious Solution (Solution Consistency = 0.803, Solution Coverage = 0.768):			
PU•~PR	0.631	0.256	0.814
PEOU•~PR	0.587	0.192	0.821
SI•TSE	0.493	0.118	0.838

Note: • indicates the logical AND operator; ~ indicates the negation of the condition. PU = Perceived Usefulness; PEOU = Perceived Ease of Use; PR = Perceived Risk; SI = Social Influence; TSE = Technological Self-Efficacy.

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

The intermediate solution identified three configurational pathways to financial inclusion outcomes, each with high consistency levels exceeding the 0.80 threshold. The first configuration (PU•PEOU•~PR•TSE) combines high perceived usefulness, high perceived ease of use, low perceived risk, and high technological self-efficacy, representing a technology-optimistic pathway characterised by positive perceptions and technological confidence. The second configuration (PU•~PR•SI•TSE) combines high perceived usefulness, low perceived risk, high social influence, and high technological self-efficacy, representing a socially-influenced pathway where adoption is driven by both utility perceptions and social normative pressures. The third configuration (PU•PEOU•SI•~TSE) combines high perceived usefulness, high perceived ease of use, high social influence, and low technological self-efficacy, representing a support-dependent pathway where positive perceptions and social encouragement compensate for limited technological confidence.

These configurational findings complement the variance-based results by highlighting the complex combinatorial patterns that lead to financial inclusion outcomes. While the PLS-SEM analysis identified the net effects of individual variables, fsQCA revealed how these factors combine in different configurations to produce the outcome of interest. The identification of three distinct pathways to financial inclusion suggests equifinality in the causal processes, with different combinations of technological perception factors and technological self-efficacy leading to similar inclusion outcomes.

The configurational analysis also revealed interesting asymmetric effects that were not apparent in the variance-based results. For instance, while technological self-efficacy was present in two configurational pathways, its absence characterised the third pathway, suggesting that its influence on financial inclusion depends on the specific combination of other conditions present. Similarly, while perceived ease of use was absent in one configurational pathway, its presence was critical in the other two pathways, highlighting the contextual nature of its influence. These asymmetric patterns underscore the complex, conjunctural nature of the relationships between technological perception determinants and financial inclusion outcomes.

The fsQCA results provide valuable complementary insights to the variance-based findings, offering a more nuanced understanding of the complex causal configurations underlying financial inclusion in Vietnam's transitional economic context. The identification of multiple equifinal pathways suggests that different population segments may follow distinct routes to financial inclusion based on their specific perception configurations and technological capabilities. These insights have important implications for both theoretical understanding and practical interventions aimed at enhancing financial inclusion through digital banking technologies.

5. DISCUSSION OF RESEARCH RESULTS AND CONCLUSIONS

This research has examined the complex interrelationships between technological perception determinants, digital banking adoption, and financial inclusion within Vietnam's transitional economic context. Through a multi-methodological approach combining structural equation modelling with fuzzy-set Qualitative Comparative Analysis, this investigation has generated comprehensive insights into both individual variables' net effects and the complex configurational patterns underlying financial inclusion processes. This discussion synthesises these findings with existing theoretical and empirical literature to draw substantive conclusions and identify broader implications.

The empirical findings confirm the significant influence of perceived usefulness on financial inclusion outcomes ($\beta = 0.297$, $p < 0.001$), consistent with technology acceptance theory predictions (Davis, 1989; Pikkarainen et al., 2004). This substantial direct effect suggests that utility perceptions represent critical drivers of digital banking adoption and subsequent financial inclusion within Vietnam's transitional economic context, extending previous research in developing economies (Al-Somali et al., 2009; Cudjoe et al., 2015) by explicitly linking usefulness perceptions with financial inclusion outcomes.

The significant direct effect of perceived ease of use on financial inclusion ($\beta = 0.185$, $p < 0.001$), coupled with its indirect effect through perceived usefulness ($\beta = 0.157$, $p < 0.001$), confirms the dual influence pathways theorised in technology acceptance models (Davis et al., 1989). These findings demonstrate that usability perceptions affect financial inclusion both directly by facilitating technological engagement and indirectly by enhancing utility perceptions, underscoring the interdependence between ease of use and usefulness evaluations (Venkatesh & Davis, 2000). Within Vietnam's context, characterised by variable technological familiarity, these findings highlight the critical importance of interface simplicity in promoting financial inclusion through digital channels.

The strong negative relationship between perceived risk and financial inclusion ($\beta = -0.243$, $p < 0.001$) reinforces previous evidence regarding risk perceptions' inhibiting effect on digital banking adoption (Luo et al., 2010; Yousafzai et al., 2009). This finding extends earlier research by explicitly linking risk perceptions to financial inclusion outcomes rather than merely adoption intentions, suggesting that perceived uncertainties constrain financial participation through digital channels. Within Vietnam's

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

developing financial infrastructure, these risk perceptions represent significant barriers requiring intervention through both technological enhancements and institutional assurances.

The significant positive influence of social influence on financial inclusion ($\beta = 0.238$, $p < 0.001$) aligns with previous research demonstrating interpersonal and cultural factors' importance in technology adoption decisions (Venkatesh et al., 2003; Riquelme & Rios, 2010). This finding is particularly relevant within Vietnam's collectivist cultural context, where social normative pressures significantly shape individual behaviours (Hofstede, 2001). The substantial effect size suggests that social influence mechanisms represent important leverage points for enhancing financial inclusion.

The identification of significant moderating effects of technological self-efficacy on the relationships between technological perceptions and financial inclusion represents a novel contribution. The enhancing effect of self-efficacy on the relationships between perceived usefulness, perceived ease of use, and financial inclusion, coupled with its mitigating effect on the relationship between perceived risk and financial inclusion, suggests that technological confidence serves as an important enabler that amplifies positive influences whilst buffering negative impacts. These findings align with previous research establishing self-efficacy as a critical psychological resource in technology adoption contexts (Compeau & Higgins, 1995; Wang et al., 2003).

The configurational analysis through fsQCA provides complementary insights that enrich understanding of the complex causal patterns underlying financial inclusion. The identification of three distinct pathways—technology-optimistic ($PU \bullet PEOU \bullet \sim PR \bullet TSE$), socially-influenced ($PU \bullet \sim PR \bullet SI \bullet TSE$), and support-dependent ($PU \bullet PEOU \bullet SI \bullet \sim TSE$)—suggests equifinality in the causal processes. These configurational patterns reveal complex conjunctural causation that transcends variable-centred approaches' additive logic, highlighting how specific combinations of conditions collectively produce financial inclusion outcomes.

Integrating variance-based and configurational findings provides a more comprehensive understanding of the complex interrelationships between technological perceptions and financial inclusion. While the structural model identifies individual variables' average effects across the entire sample, the configurational analysis reveals distinct causal recipes applicable to specific population subgroups. This complementary insight suggests the need for differentiated strategies addressing specific perception configurations and adoption pathways, rather than universal approaches assuming homogeneous causal dynamics.

These empirical findings have important theoretical implications. The research extends technology acceptance theories by integrating them with financial inclusion frameworks, creating a more comprehensive theoretical architecture capturing both technological engagement determinants and their consequential impacts on financial participation outcomes (Demirgüç-Kunt et al., 2015; Venkatesh et al., 2003). The identified moderating effects contribute to theoretical understanding by specifying the conditional nature of relationships between technological perceptions and financial inclusion outcomes (Venkatesh & Bala, 2008). Similarly, the configurational patterns advance theoretical understanding by identifying complex causal recipes that suggest the need for more sophisticated theoretical models acknowledging conjunctural causation and equifinality (Ragin, 2008).

The research findings have substantial practical implications for financial institutions, technology providers, and policymakers. For financial institutions, the strong influence of perceived usefulness suggests the importance of developing clear value propositions emphasising digital banking services' functional benefits (Pikkarainen et al., 2004). The significant influence of perceived ease of use highlights user-centred design principles' critical importance (Venkatesh, 2000). The substantial negative effect of perceived risk underscores robust security measures, transparent privacy policies, and effective risk communication strategies' importance (Luo et al., 2010). The significant influence of social influence suggests potential for peer-based promotion strategies leveraging interpersonal networks (Riquelme & Rios, 2010).

For policymakers, the findings suggest the need for comprehensive digital financial inclusion strategies addressing multiple adoption barriers simultaneously. Regulatory frameworks should balance innovation enablement with consumer protection, while educational initiatives should promote both digital literacy and financial capability. The configurational findings highlighting multiple pathways to financial inclusion emphasise differentiated strategies' importance for addressing specific perception configurations characterising different population segments.

This research has several limitations suggesting future investigation avenues. The cross-sectional design limits causal inference, suggesting the need for longitudinal research examining these relationships over time (Venkatesh & Davis, 2000). Additionally, while this research examined technological perception determinants comprehensively, other potentially relevant factors were not explicitly included. Future studies could expand the theoretical framework to incorporate additional factors (Luo et al., 2010; Yousafzai et al., 2009) and adopt comparative designs examining multiple countries to identify both universal patterns and context-specific dynamics (Demirgüç-Kunt et al., 2015).

In conclusion, this research has provided comprehensive insights into the complex interrelationships between technological perception determinants, digital banking adoption, and financial inclusion within Vietnam's transitional economic context. These

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

findings contribute to theoretical understanding whilst offering practical insights for financial institutions and policymakers seeking to enhance financial inclusion through digital banking technologies.

ACKNOWLEDGMENTS

I would like to express my sincere gratitude to Dr. Hoang Vu Hiep for his invaluable guidance and inspiration throughout this research. His expertise, insights, and unwavering support have been instrumental in shaping the direction and quality of this study. I am deeply appreciative of his generosity in sharing his time, knowledge, and network, which have greatly contributed to the success of this research. His mentorship and commitment to academic excellence have not only enriched the quality of this work but have also had a profound impact on my personal and professional growth.

REFERENCES

- 1) Aldás-Manzano, J., Lassala-Navarré, C., Ruiz-Mafé, C., & Sanz-Blas, S. (2009). The role of consumer innovativeness and perceived risk in online banking usage. *International Journal of Bank Marketing*, 27(1), 53-75.
- 2) Allen, F., Demirgüç-Kunt, A., Klapper, L., & Peria, M. S. M. (2016). The foundations of financial inclusion: Understanding ownership and use of formal accounts. *Journal of Financial Intermediation*, 27, 1-30.
- 3) Al-Somali, S. A., Gholami, R., & Clegg, B. (2009). An investigation into the acceptance of online banking in Saudi Arabia. *Technovation*, 29(2), 130-141.
- 4) Amin, H. (2007). Internet banking adoption among young intellectuals. *Journal of Internet Banking and Commerce*, 12(3), 1-13.
- 5) Amin, H., Hamid, M. R. A., Lada, S., & Anis, Z. (2008). The adoption of mobile banking in Malaysia: The case of Bank Islam Malaysia Berhad (BIMB). *International Journal of Business and Society*, 9(2), 43-53.
- 6) Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, 14(3), 396-402.
- 7) Baptista, G., & Oliveira, T. (2015). Understanding mobile banking: The unified theory of acceptance and use of technology combined with cultural moderators. *Computers in Human Behavior*, 50, 418-430.
- 8) Beck, T., & De La Torre, A. (2007). The basic analytics of access to financial services. *Financial Markets, Institutions & Instruments*, 16(2), 79-117.
- 9) Beck, T., Demirgüç-Kunt, A., & Levine, R. (2007). Finance, inequality and the poor. *Journal of Economic Growth*, 12(1), 27-49.
- 10) Bhattacharjee, A. (2000). Acceptance of e-commerce services: The case of electronic brokerages. *IEEE Transactions on Systems, Man, and Cybernetics - Part A: Systems and Humans*, 30(4), 411-420.
- 11) Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology*, 1(3), 185-216.
- 12) Brown, I., Cajee, Z., Davies, D., & Stroebel, S. (2003). Cell phone banking: Predictors of adoption in South Africa - an exploratory study. *International Journal of Information Management*, 23(5), 381-394.
- 13) Casaló, L. V., Flavián, C., & Guinalú, M. (2007). The role of security, privacy, usability and reputation in the development of online banking. *Online Information Review*, 31(5), 583-603.
- 14) Chan, S. C., & Lu, M. T. (2004). Understanding internet banking adoption and use behavior: A Hong Kong perspective. *Journal of Global Information Management*, 12(3), 21-43.
- 15) Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112(1), 155-159.
- 16) Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, 19(2), 189-211.
- 17) Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Sage Publications.
- 18) Cudjoe, A. G., Anim, P. A., & Nyanyofio, J. G. N. T. (2015). Determinants of mobile banking adoption in the Ghanaian banking industry: A case of Access Bank Ghana Limited. *Journal of Computer and Communications*, 3(2), 1-19.
- 19) Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340.
- 20) Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982-1003.
- 21) Demirgüç-Kunt, A., & Klapper, L. (2013). Measuring financial inclusion: Explaining variation in use of financial services across and within countries. *Brookings Papers on Economic Activity*, 2013(1), 279-340.
- 22) Demirgüç-Kunt, A., Klapper, L., & Singer, D. (2017). Financial inclusion and inclusive growth: A review of recent empirical evidence. *World Bank Policy Research Working Paper*, No. 8040.

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

- 23) Demirgüç-Kunt, A., Klapper, L., Singer, D., & Van Oudheusden, P. (2015). The Global Findex Database 2014: Measuring financial inclusion around the world. World Bank Policy Research Working Paper, No. 7255.
- 24) Diniz, E., Birochi, R., & Pozzebon, M. (2012). Triggers and barriers to financial inclusion: The use of ICT-based branchless banking in an Amazon county. *Electronic Commerce Research and Applications*, 11(5), 484-494.
- 25) Featherman, M. S., & Pavlou, P. A. (2003). Predicting e-services adoption: A perceived risk facets perspective. *International Journal of Human-Computer Studies*, 59(4), 451-474.
- 26) Fiss, P. C. (2011). Building better causal theories: A fuzzy set approach to typologies in organization research. *Academy of Management Journal*, 54(2), 393-420.
- 27) Gerrard, P., Cunningham, J. B., & Devlin, J. F. (2006). Why consumers are not using internet banking: A qualitative study. *Journal of Services Marketing*, 20(3), 160-168.
- 28) Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American Journal of Sociology*, 91(3), 481-510.
- 29) Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2014). A primer on partial least squares structural equation modeling (PLS-SEM). Sage Publications.
- 30) Henseler, J., & Fassott, G. (2010). Testing moderating effects in PLS path models: An illustration of available procedures. In V. Esposito Vinzi, W. W. Chin, J. Henseler, & H. Wang (Eds.), *Handbook of partial least squares: Concepts, methods and applications* (pp. 713-735). Springer.
- 31) Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43(1), 115-135.
- 32) Hoehle, H., Scornavacca, E., & Huff, S. (2012). Three decades of research on consumer adoption and utilization of electronic banking channels: A literature analysis. *Decision Support Systems*, 54(1), 122-132.
- 33) Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations* (2nd ed.). Sage Publications.
- 34) Howcroft, B., Hamilton, R., & Hewer, P. (2002). Consumer attitude and the usage and adoption of home-based banking in the United Kingdom. *International Journal of Bank Marketing*, 20(3), 111-121.
- 35) Im, I., Hong, S., & Kang, M. S. (2011). An international comparison of technology adoption: Testing the UTAUT model. *Information & Management*, 48(1), 1-8.
- 36) Jack, W., & Suri, T. (2014). Risk sharing and transactions costs: Evidence from Kenya's mobile money revolution. *American Economic Review*, 104(1), 183-223.
- 37) Jeong, B. K., & Yoon, T. E. (2013). An empirical investigation on consumer acceptance of mobile banking services. *Business and Management Research*, 2(1), 31-40.
- 38) Johnson, S., & Arnold, S. (2012). Inclusive financial markets: Is transformation under way in Kenya? *Development Policy Review*, 30(6), 719-748.
- 39) Karahanna, E., Straub, D. W., & Chervany, N. L. (1999). Information technology adoption across time: A cross-sectional comparison of pre-adoption and post-adoption beliefs. *MIS Quarterly*, 23(2), 183-213.
- 40) Kendall, J., Mylenko, N., & Ponce, A. (2010). Measuring financial access around the world. World Bank Policy Research Working Paper, No. 5253.
- 41) King, W. R., & He, J. (2006). A meta-analysis of the technology acceptance model. *Information & Management*, 43(6), 740-755.
- 42) Laforet, S., & Li, X. (2005). Consumers' attitudes towards online and mobile banking in China. *International Journal of Bank Marketing*, 23(5), 362-380.
- 43) Laukkanen, T., & Lauronen, J. (2005). Consumer value creation in mobile banking services. *International Journal of Mobile Communications*, 3(4), 325-338.
- 44) Laukkanen, T., & Pasanen, M. (2008). Mobile banking innovators and early adopters: How they differ from other online users? *Journal of Financial Services Marketing*, 13(2), 86-94.
- 45) Lee, M. C. (2009). Factors influencing the adoption of internet banking: An integration of TAM and TPB with perceived risk and perceived benefit. *Electronic Commerce Research and Applications*, 8(3), 130-141.
- 46) Leung, S. (2009). Banking and financial sector reforms in Vietnam. *ASEAN Economic Bulletin*, 26(1), 44-57.
- 47) Luarn, P., & Lin, H. H. (2005). Toward an understanding of the behavioral intention to use mobile banking. *Computers in Human Behavior*, 21(6), 873-891.

Dialectical Interfaces of Digital Banking Adoption: A Multi-Methodological Investigation of Technological Perception Determinants and Financial Inclusion Trajectories in Vietnam's Transitional Economy

- 48) Luo, X., Li, H., Zhang, J., & 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*, 49(2), 222-234.
- 49) Malhotra, N. K. (2008). *Marketing research: An applied orientation* (5th ed.). Pearson Education.
- 50) Mas, I., & Morawczynski, O. (2009). Designing mobile money services: Lessons from M-PESA. *Innovations: Technology, Governance, Globalization*, 4(2), 77-91.
- 51) Mas, I., & Radcliffe, D. (2010). Mobile payments go viral: M-PESA in Kenya. *World Bank Policy Research Working Paper*, No. 5353.
- 52) Nguyen, N. T., & Nguyen, D. T. (2010). Vietnam's financial system. In *Southeast Asian Economic Outlook 2010* (pp. 26-34). OECD Publishing.
- 53) North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge University Press.
- 54) Ozili, P. K. (2018). Impact of digital finance on financial inclusion and stability. *Borsa Istanbul Review*, 18(4), 329-340.
- 55) Pikkarainen, T., Pikkarainen, K., Karjaluoto, H., & Pahnla, S. (2004). Consumer acceptance of online banking: An extension of the technology acceptance model. *Internet Research*, 14(3), 224-235.
- 56) Poon, W. C. (2007). Users' adoption of e-banking services: The Malaysian perspective. *Journal of Business & Industrial Marketing*, 23(1), 59-69.
- 57) Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879-891.
- 58) Ragin, C. C. (2008). *Redesigning social inquiry: Fuzzy sets and beyond*. University of Chicago Press.
- 59) Ragin, C. C., & Davey, S. (2016). *Fuzzy-set/qualitative comparative analysis 3.0*. Department of Sociology, University of California, Irvine.
- 60) Ringle, C. M., Wende, S., & Becker, J. M. (2015). *SmartPLS 3*. SmartPLS GmbH, Boenningstedt.
- 61) Riquelme, H. E., & Rios, R. E. (2010). The moderating effect of gender in the adoption of mobile banking. *International Journal of Bank Marketing*, 28(5), 328-341.
- 62) Sarma, M. (2008). Index of financial inclusion. *ICRIER Working Paper*, No. 215.
- 63) Sayer, A. (2000). *Realism and social science*. Sage Publications.
- 64) Schneider, C. Q., & Wagemann, C. (2012). *Set-theoretic methods for the social sciences: A guide to qualitative comparative analysis*. Cambridge University Press.
- 65) Sen, A. (1999). *Development as freedom*. Oxford University Press.
- 66) Tan, M., & Teo, T. S. (2000). Factors influencing the adoption of internet banking. *Journal of the Association for Information Systems*, 1(1), 1-42.
- 67) Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research*, 11(4), 342-365.
- 68) Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences*, 39(2), 273-315.
- 69) Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186-204.
- 70) Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425-478.
- 71) Wang, Y. S., Wang, Y. M., Lin, H. H., & Tang, T. I. (2003). Determinants of user acceptance of internet banking: An empirical study. *International Journal of Service Industry Management*, 14(5), 501-519.
- 72) Woodside, A. G. (2013). Moving beyond multiple regression analysis to algorithms: Calling for adoption of a paradigm shift from symmetric to asymmetric thinking in data analysis and crafting theory. *Journal of Business Research*, 66(4), 463-472.
- 73) World Bank. (2014). *Global financial development report 2014: Financial inclusion*. World Bank Publications.
- 74) Yi, M. Y., & Hwang, Y. (2003). Predicting the use of web-based information systems: Self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International Journal of Human-Computer Studies*, 59(4), 431-449.
- 75) Yousafzai, S. Y., Foxall, G. R., & Pallister, J. G. (2010). Explaining internet banking behavior: Theory of reasoned action, theory of planned behavior, or technology acceptance model? *Journal of Applied Social Psychology*, 40(5), 1172-1202.
- 76) Yousafzai, S. Y., Pallister, J. G., & Foxall, G. R. (2009). Multi-dimensional role of trust in internet banking adoption. *The Service Industries Journal*, 29(5), 591-605.