Perception of Anthropomorphism, Intelligence and Adoption of AI: A case in mobile banking

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ABSTRACT

Purpose – Artificial intelligence (AI) has completely transformed the mobile banking industry, but little is known about how particular AI features influence consumer acceptance strategies and avoidance behaviours in the literature. To address this gap, the present study examines how users' intentions to embrace AI-based mobile banking are influenced by the pivotal characteristics of AI, perceived intelligence and anthropomorphism.

Design/methodology – A cross-sectional descriptive research design was used for this study. Further, a judgemental non-probability sampling was employed to identify the 100 respondents. The data was subsequently analysed using PLS-Structural Equation Modeling.

Findings – The results exhibit that both PI and PA positively and significantly impacted consumers' intention to adopt of AI-based mobile banking apps. It also offers theoretical underpinnings for the adoption of AI-based mobile banking apps. Furthermore, findings furnish practical guidance that can be instrumental for banks contemplating the implementation of AI to enhance user retention strategies.

Originality/value –This study adds valuable contribution to the field by shedding light on the nuanced aspects of AI and their substantial impact on users' intention to adopt mobile banking app services.

Introduction

Artificial Intelligence (AI) is an emerging technology that transforms various industries, ranging from manufacturing to retail sector. This transformative technology is also making significant waves in the banking sector, where AI plays a pivotal role in facilitating electronic banking services, reducing the need for direct interaction with bank personnel. As of 2023, the AI market within the banking industry is valued at around $9.00 billion, with projections indicating it will reach approximately $27.76 billion by 2027, thereby boasting a remarkable CAGR of 32.5% (GlobeNewswire, 2023). These statistics indicate that both the blooming of the banking sector and the adoption of AI are facilitating economic growth and enhancing how banks provide their services.

A review of literature underscores the substantial impact of the increasing adoption of technology in the banking sector. The integration of banking and technology is transforming how bank personnel and consumers engage within the sector. Notably, these institutions now offer AI-based mobile banking services that rely on algorithm-based service interactions. Major players such as SBI, Axis, HDFC, and ICICI have introduced AI-enabled chatbots to engage customers and facilitate regular transactions through conversational modeling, either in voice or text format. These transformative developments significantly affect the processes involved in building and maintaining customer relationships. Additionally, the application of AI in mobile banking goes beyond chatbots to include attributes such as payments of bill, account administration, customised investment advice, biometric authentication and real-time tracking. Therefore, incorporating of AI-based technology into banking apps and related services has made the industry more customer-centric and technologically relevant. In this landscape, the rise of AI-based mobile banking and the ongoing exploration of its adoption in the market hold paramount significance for users, researchers, and bank authorities.

Furthermore, bank authorities increasingly acknowledge the strategic importance of adopting AI technology. AI, with its analytical and cognitive capabilities, possesses the ability to engage with consumers in a human-like manner. It possesses the capability to recognize and express emotions like empathy and compassion in its communication. On the other side, intelligent algorithms of AI can also detect anomalies and fake information, providing consumers with highly personalised recommendations, tailored solutions, and seamless interactions. This high level of customization facilitated by AI enhances user satisfaction and fosters a deeper sense of trust and loyalty. These dual capabilities, including intelligent functionality and personalized interactions, define the two key perceptions of AI, i.e., intelligence and anthropomorphism (Moussawi et al., 2020). Notably, the intelligent aspect of AI demonstrates a system that functions effectively and autonomously and capable of assisting users in addressing financial activities. Anthropomorphism denotes a system that becomes replica to a real person in the execution of services or activities (Lin et al., 2021). Therefore, it becomes crucial to understand the role played by these AI features in mobile banking as they redefine and substantially augment the user experience.

However, the existing literature in this premise highlights a significant gap concerning how the distinct features of AI influence users' adoption intention, particularly in the context of mobile banking. Against this backdrop, the present study aims to bridge this gap by developing a conceptual model. This model integrates consumer adoption intention toward AI-based systems with the two key features of AI, namely, perceived intelligence and perceived anthropomorphism. This study attempts to understand how customers' adoption intentions in the context of mobile banking are influenced by these two different perceptions of AI. By shedding light on how perception of intelligence (PI) and perception of anthropomorphism (PA) influence adoption intentions (ADI), this study will contribute to more informed decisions when developing banking models in the new era. These decisions, in turn, are finely tuned to align with the actual adoption behaviours of users. The subsequent sections of this article are arranged as follows: Section 2 provides the related literature concerning mobile banking adoption and proposes the corresponding hypotheses. Section 3 outlines the methodology employed in this study. Section 4 analyses the model & presents the statistical findings. The results and conclusion of the study are encapsulated in Section 5. The article ends by summarizing the limitations of this study and offering recommendations for future research.

Literature Review and Hypotheses Development of the study

The current section reviews the literature defining the relationship between the different concepts of the present study in order to establish hypothetical linkages between them. This review is structured in two sub-sections i.e., adoption intention of AI and characteristics of AI, respectively.

Adoption Intention of AI

The acceptance of mobile banking by consumers is a crucial component of its effective implementation. According to Schiffman in 2013, it is a micro-level process that focuses on the stages by which an individual consumer passes when deciding whether to embrace or reject a new product (Schiffman et al., 2013). In the context of this study, consumer adoption pertains to the journey by which consumers determine their willingness to engage with technology-based banking services. The success of any technological innovation is significantly influenced by consumers' perceptions of its attributes and capabilities. In the modern age, where technology is evolving rapidly, understanding how consumers perceive and respond to these innovations is crucial for businesses as well as researchers.

A review of literature indicated that multiple theoretical models have been proposed by different researchers to establish a framework for understanding how individuals accept or adopt new technologies. Some of the prominent models include the TAM (Sharma, 2019; Priya et al., 2018), Unified Theory of Acceptance and use of technology (Jadil et al., 2021; Tamilmani et al., 2021), Diffusion of Innovations Theory (Chen, 2013), Theory of Reasoned Action (Chaouali & El Hedhli, 2019), and Task Technology Fit (Tam & Oliveira, 2016), etc. However, these models also have a limitation that they overlook the distinctive characteristics of technology (Cho et al., 2019) and how these technological features evoke a range of perceptions and reactions from consumers. Therefore, these different models have significantly contributed to the field, but there need to be more studies and a model that specifically investigates the effect of the fundamental characteristics of AI on the acceptance or adoption of technology.

Consequently, it has become imperative to address the evolving perceptions of AI and their effect on consumer adoption behaviour within the context of AI-powered mobile banking (Lu et al., 2020). Recognizing this gap, this study aims to understand consumers' adoption of AI-enabled mobile banking apps and emphasizes two key perceptions of AI technology, namely, perceived intelligence and perceived anthropomorphism, play a pivotal role in shaping consumers' internal states. These states, in turn, have a profound impact on individuals' approach and avoidance behaviours towards technological features.

Characteristics of AI

The term "Artificial Intelligence" was first introduced by John McCarthy in a workshop held at Dartmouth College in 1955. It has been defined as the creation of machines that can simulate the mental and emotional functions of the human mind (Russel & Norwig, 2016). In the present context, AI is perceived as a technology with the capacity to mimic or replicate human actions and perform tasks intelligently. The evaluation of AI features primarily focuses on consumers' perceptions, distinguishing it from other traditional systems due to its attributes of personalized, intelligent, and anthropomorphic behaviour (Huang & Rust, 2020; Grewal et al., 2021). Moussawi & Koufaris (2019) have systematically pinpointed perceived intelligence and anthropomorphism as pivotal attributes of AI-enabled systems. As a result, the present study aims to provide a nuanced understanding of these two fundamental characteristics of AI, i.e., PI and PA. These perceptions play a crucial role in consumers' decision-making processes regarding accepting or rejecting AI-enabled mobile banking apps. A detailed explanation of these two features is discussed as follows:

Perceived Intelligence (PI)

Perceived intelligence can be broadly defined as individuals' assessment of a technology's cognitive intelligence, knowledge base, and purpose (Johnson et al., 2008). In terms of human-robot interaction, PI is reliant upon the robot's level of competence (Bartneck et al., 2009). It is commonly conducted by soliciting user ratings on various dimensions such as robot's

competency, smartness, authority, and, intelligence (Bartneck et al., 2007). Within the scope of the present study, it refers to a system endowed with efficient and autonomous functions that enable consumers to perform banking services or tasks seamlessly. It encompasses the system's ability to provide intelligent solutions to users' specific banking or financial needs without requiring human interaction. Notably, if a system can offer superior and tailored solutions based on the users' requirements, they are more inclined to use the new technology for their tasks.

Recent research by Lee and Chen in 2022 found that in AI-powered M-banking, intelligent attributes evoke feelings of care, respect, and affection among users. Similarly, Lin et al. (2021) confirmed the positive impact of PI on adoption in their research study. Additionally, Lin & Lee (2022) highlighted that PI enhances the autonomy and efficiency of mobile banking by offering assistance through expressions and dialogues, thereby enhancing users' sense of information and emotional support, which influences their intention to use the service.

However, as revealed by Pelau et al. in 2021, highly intelligent systems might make customers feel that AI threatens their identity. Furthermore, when AI provides excessive emotional support, consumers might perceive a threat, potentially decreasing their willingness to use mobile banking. Therefore, within the context of this study and based on the reviews mentioned above, it can be argued that PI influences affection and emotion among consumers, thereby affecting their intention to adopt. Thus, the hypothesis for the study is developed as follows:

H1: There is a significant influence of perceived intelligence on the adoption intention of AI-based mobile banking app.

Perceived Anthropomorphism (PA)

Anthropomorphism can be broadly described as the attribution of human-like feelings, internal states, and behavioural traits to the non-human identity like inanimate objects, animals, natural phenomena, and even supernatural entities (Epley et al., 2007). It depicts a distinct human-like interpretation of these physical characteristics or behaviours that goes beyond what

is promptly visible, rather than merely describing the features that already exist (Epley et al., 2008). Within the scope of the present study, PA characterizes a system's ability to mimic human-like behaviour when conducting banking services or tasks. This quality allows consumers to recognize and attribute human external characteristics (such as name, interface, expression) (Lin et al., 2021) to the system (mobile banking app), which potentially evoking feelings of care and love to users and making it like personal bank customer service (Moussawi et al., 2020).

A study conducted by Waytz et al. in 2014 has demonstrated that anthropomorphism fosters trust in technology systems so they intended to use technology-based services. Similarly, Moussawi et al., 2020 revealed that anthropomorphism enhanced consumers' perceived enjoyment during interactions with smart systems, subsequently increasing their intention to adoption such systems.

However, some studies have highlighted the negative impact of PA on individuals' willingness to adopt technology. A research study by Lu et al. in 2019 argued that attributing human-like qualities to technology can instill a threat to human recognition, thereby reducing people's inclination to accept such technology. Similarly, Gursoy et al., 2019 and Lin et al., 2019 have suggested that anthropomorphic feature has the potential to evoke negative emotions in users, leading to resistance against utilizing AI-based technology services. Therefore, within the context of the present study and based on the reviews mentioned above, it can be posited that PA influences the individuals' mental states, aligning them closely with human experiences, thereby affecting their adoption behaviour for systems. As a result, the hypothesis for the study is developed as follows:

H2: There is a significant influence of perceived anthropomorphism on the adoption intention of AI-based mobile banking app.

Research Methodology

The present study attempts to comprehend how the two distinct features of AI impact consumers' adoption intention towards the AI-based mobile banking apps by using a
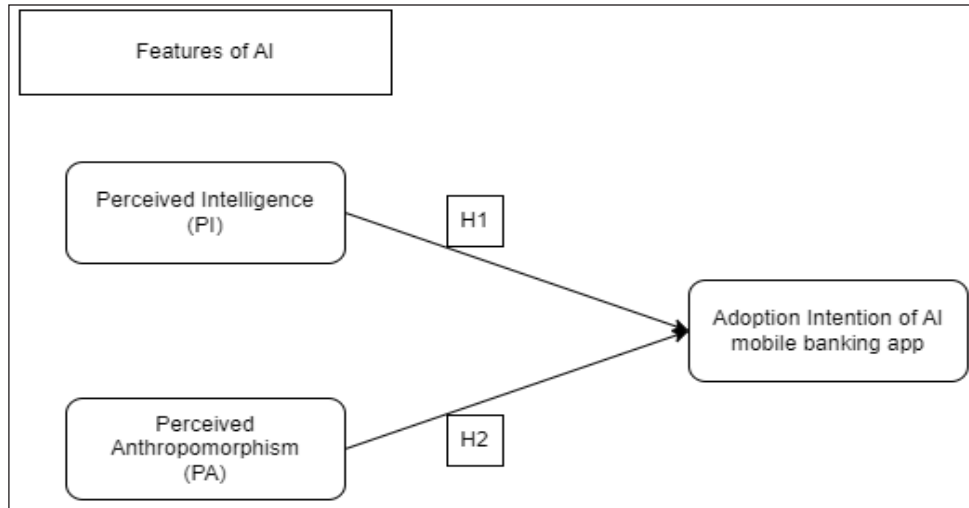
Fig. 1. Conceptual model

Source: Author's Representation

descriptive research design. The conceptual model of this study consist three latent variables, including adoption intention as one outcome variable, while intelligence and anthropomorphism are the two predictor variables.

Each of three variables were measured based on the standardized scales in the existing literature and were adopted in the context of AI-based mobile banking. Perceived intelligence a scale of five-item adapted from Moussawi et al., 2019) was assessed by asking respondents about the effectiveness and independence associated with using AI-based mobile banking apps. Perceived anthropomorphism (a seven-item scale adapted from Lu et al., 2019) was measured by requesting respondents to evaluate how closely AI-enabled mobile banking apps mimic human behaviour. Adoption intention was measured by a six-item scale adapted from Priya et al. (2018) to determine respondents' intention to adopt AI mobile banking apps in the future. Therefore, responses of these scales were evaluated by five-point Likert scale, ranging from 1 for "strongly disagree" to 5 for "strongly agree".

The present study employed a questionnaire survey method to investigate the proposed model for study, and for this, target samples were defined as the users of AI-based mobile banking apps in India. The past researches indicated that there was a sensitivity issue (Lin et al., 2021) in sampling procedure of technology adoption studies. Therefore, as recommended by the authors (Shankar & Datta, 2018; Deng et al., 2018), the study utilised a non- probability sampling approach to collect the data from 100 respondents.

To examine the conceptual model and hypotheses of the present study, structural equation modelling (SEM) was used. It was decided to utilise SmartPLS-3 software in order to run the SEM for present study. It (PLS) offers several advantages, including its ability to overcome multicollinearity issues, is distribution-free, and not affected by non-normality of the data or less sample size (Lee et al., 2018).

In order to profile the samples from whom the data was collected, the demographic profile of the samples was generated using SPSS (version-26). The overview of the demographic profile of the samples indicated (Table 1) that out of 100 respondents, 62% found as male and 38% as female. Data also indicated the age distribution of respondents in which 54% of participants were between the age group of 18 and 25, 31% fell between 25 and 35 years, 8% were aged between 35 and 45 years, 3% were in between 45 and 59 years and the rest were aged over 59 years. Furthermore, the sample's occupation figures reflected that approximately 45% of respondents identified as students, around 25% were professionals, and around 17% were engaged in various service occupations.

Table 1: Demographic profile for the study (n = 100)

Age* Gender and Occupation* Gender

Count		Gender		Total
		Male	Female	
Age	18 to less than 25 years	35	19	54
	25 to less than 35 years	16	15	31
	35 to less than 45 years	7	1	8
Occupation	Student	27	18	45
	Homemaker	0	1	1
	Self-employed	3	2	5
	Service	12	5	17
	Professional	14	11	25

Source: Authors' own findings

All of them were AI-mobile banking app users in the past six months, and therefore, they had an experience regarding AI-based technology. The demographics and screening question indicated that the sample was appropriate for the study and the analysis for that were carried out on the collected data in the following section.

Data Analysis

After ensuring sample adequacy, Partial Least Square-Structural Equation Model (PLS-SEM) technique was utilized to evaluate the conceptual model and hypotheses of the study. The SEM approach incorporates the combination of the measurement and the structural model. Confirmatory Factor Analysis (CFA) was employed to test the measurement model to validate the model fit, ensuring the chosen indicators accurately represent the underlying constructs. Subsequently, the structural model was employed to conduct path analysis, allowing for a detailed examination of the relationships between variables. The following sections explore these two models, providing a comprehensive analysis of their respective components.

Measurement model of the study

To check the adequacy of the measurement model in study, CFA was conducted. It is a statistical technique used to confirm that the observed variables (indicators) accurately measuring the latent constructs (variables) they are intended to represent. In the CFA analysis, an evaluation of convergent and discriminant validity (i.e., internal reliability and validity) was undertaken. To assess the internal reliability, both "Composite Reliability (CR) and Cronbach's Alpha (CA)" were computed for each variable. These reliability measures provide insights into the consistency and dependability of the measurement constructs.

Table 2: Measurement model results of the study

Constructs & Items	Standard Loadings	CA	CR	AVE
Perceived Anthropomor-phism (PA)		0.914	0.902	0.582
PA1	.934			
PA2	.941			
PA3	.885			
PA4	.567			
PA5	.392			
PA6	.620			
PA7	.821			
Perceived Intelli-gence (PI)		0.939	0.939	0.755
PI1	.854			
PI2	.886			
PI3	.821			
PI4	.864			
PI5	.916			
Adoption Inten-tion (ADI)		0.897	0.897	0.593
ADI1	.759			
ADI2	.751			
ADI3	.808			
ADI4	.845			
ADI5	.727			
ADI6	.722			

Source: Authors' own findings

The results of all CR and CA values for the selected variables surpassed the commonly accepted threshold of 0.7, ranging between 0.897 and 0.939 (Table 2), indicating that the variables have strong reliability of the measurement constructs as suggested by Hair et al. (2013). Moreover, to examine the "convergent validity", this study retrieved the average variance extracted

(AVE) values. AVE assesses the extent to which variables share common variance. All AVE values for each construct presented in Table 2 surpass the value of 0.5, thereby reflecting that they satisfied the criteria of convergent validity.

Further, to test the "discriminant validity" of the variables, the present study utilized the Heterotrait-Monotrait ratio approach. Their findings reveal that every HTMT value was under the established criteria of 0.85 (Table 3), highlighting that variables establish the discriminant validity, in line with (Henseler et al., 2016). In conclusion, the measurement analysis demonstrates that the model meets essential verification criteria, demonstrating internal reliability, convergent validity, and discriminant validity. Moreover, the research study evaluated the "variance inflation factor" in order to identify the potential multicollinearity issue among variables. The results highlighted that all the values of VIF for the constructs not exceeded the value of 5.0 in line with Liang & Shiau, (2018), which ranges between 1.652 and 4.604. This indicates that multicollinearity was not an issue in study.

Table 3: Heterotrait Monotrait analysis results

	ADI	PA	PI
ADI			
PA	0.4		
PI	0.744	0.294	

Source: Authors' own findings

Structural model analysis

After satisfying the criteria of the measurement model against the predefined values, the subsequent stage in the SEM analysis involved testing the hypotheses using the collected dataset within the structural model. This section delves into an empirical study focused on the adoption intention of AI-enabled mobile banking services. The analysis was performed using SmartPLS 3.0, yielding, Standardized path coefficients (β), corresponding t-values and R^2 value. The path coefficient and t-value serve as crucial measures, reflecting the degree of strength and direction of variables in the relationship. It indicates the extent to which changes in one variable influence another. The R^2 value, known as the coefficient of determination, provides insights into the how much proportion of variance in the outcome variable that is predictable from the predictor variables. It reflects the explanatory capacity of the structure, signifying how well the independent variable explains the variability observed in the dependent variable (Hair et al., 2013).

To determine the significance levels, established criteria from existing literature were followed. The specific threshold values are, if t > 1.96, the coefficient was considered as significant at the $p < 0.05$ confidence level; if t > 2.58, significance was established at the $p < 0.01$ confidence level, and if t > 3.1, significance was established at the $p < 0.001$ confidence level. The hypotheses results, as depicted in Figure 2, revealed that both PA ($\beta = 0.204$, t = 2.532, $p < 0.05$) and PI ($\beta = 0.683$, t = 8.248, $p < 0.001$) exhibited a positive and significant impact on ADI. Importantly, the t-values for both variables surpassed the threshold of 1.96, in accordance with the prescribed t-value criteria (Davis, 1986), thus, hypotheses H1 and H2 were supported (Table 4).

Therefore, the present study established a significant relationship of PA and PI with the oucome variable, i.e., adoption intention (ADI) of AI-based mobile banking apps. These quantitative results highlight the crucial importance of variables, intelligence and anthropomorphism, in shaping the intention of users toward AI technology. Essentially, these characteristics enhance the user experience in mobile banking, aligning their perceptions with expectations and foster confidence in the practical utility of these apps. The intelligent feature of the apps empowers users to accomplish transactions and provide personalized banking services. On the other hand, anthropomorphic features create a sense of comfort and familiarity, akin to interacting with a human, and enhance users' experiential anticipation while using these apps. These results are consistent with prior literature in the field of adoption of AI (Moussawi et al., 2020; Troshani et al., 2020; Lee & Chen, 2022), affirming the relevance and applicability of these findings within the existing literature landscape.
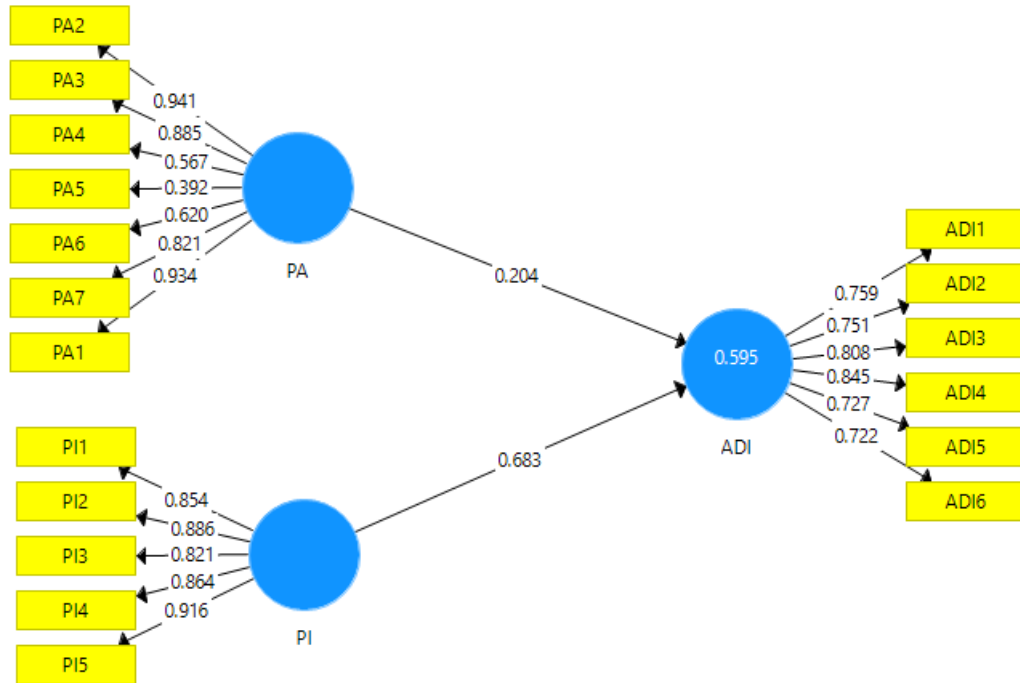
Fig. 2: Results of the structural model

Table 4: Hypotheses test results of the study

Hypotheses	Path coefficient	T-values	P-Values	Results
H1: PA→ADI	.204	2.532	.004*	SUPPORTED
H2: PI→ADI	.683	8.248	.000**	SUPPORTED
R Square	.595			

Source: Authors' own findings; Note: $p < 0.05^*$ and $p < 0.001^{**}$

Conclusion

The primary aim of this study is to enhance our understanding in context of AI-based mobile banking apps with respect to the key AI characteristics. This study represents an initial attempt to identify intelligence and anthropomorphism as crucial triggers that affect the users' internal states and perceptions of using AI technology. These two key characteristics create distinction between AI systems and traditional information systems, especially in terms of user perception. Consequently, this study offers valuable contribution for subsequent studies exploring AI technology in the realm of mobile banking as well as other kinds of mobile apps and devices with AI.

Additionally, the empirical results demonstrate the substantial impact of both intelligence and anthropomorphism on adoption intention of users toward AI-based mobile banking apps (H1 and H2). Essentially, these characteristics contribute to an enhanced user experience when using mobile banking apps, aligning users' perception with their expectations and foster confidence in the practical utility of these apps. In other words, the intelligent attribute of mobile apps enables users to accomplish transactions and provide customised banking services. Anthropomorphism feature of apps, on the other hand, create a sense of comfort and familiarity akin to interacting with a human, and provide the better experience to user. These results align with existing literature on AI adoption (Moussawi et al., 2020; Lee & Chen, 2022).

The present study also holds significant practical implications for banks seeking to develop AI-based mobile banking services and boost adoption rates of their mobile banking apps. While providing mobile banking services, Research & Development team should appraise the incorporation of AI-based technology. It helps in to cater the users' demand and motives, reducing errors, and improve overall reliability. For instance, the integration of intelligent customer service or chatbots can efficiently resolve common issues, reducing the need for users to wait for manual assistance. This can accelerate the acceptance and utilization of mobile banking technology.

Furthermore, there is a growing need for personalized services as society becomes more diverse. In terms of intelligence, mobile banking apps should possess the capability to resolve the specific issues faced by users in a pre-defined manner so that it matches with interactions that one would have with a living human being. In order to achieve this, banks should consider incorporating anthropomorphic effects like human voice and real faces into their development process of mobile banking app, enhancing the provision of customized services for valuable clients. Additionally, they should strive for more stringent deep learning feedback mechanisms, pushing for continuous advancements in AI technology.

Therefore, this concerted effort will lead users to perceive AI as a highly effective problem-solving tool akin to interacting with a living being. Notably, when any user will experience daily issues in mobile banking, banks ought to proactively assist and encourage them to seek assistance from new technology. This approach serves to modify users' internal factors, alleviating their anxiety, and fostering a comfortable service experience. By maximizing the benefits of new technology in the realm of banking, this strategy can enhance overall user satisfaction and engagement.

Limitations and Future Directions of the study

The present study has some limitations: This study followed the cross-sectional research design but future studies may consider the longitudinal research approach in order to enhance comprehension of the cause-effect and interrelationships between variables. The present study exclusively examines the users of AI-based mobile banking services; future researchers are required to extend their investigations to include non-users as well. This approach will enable a comparative analysis of diverse perceptions and contribute to enhancing the generalizability of findings.

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