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The impact of self-service technology on user satisfaction: a study of mobile banking apps

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Abstract: With the booming development of mobile internet and financial technology, the digital transformation of banks has been pushed forward to depth, and self-service technology (SST) has been popularised on a large scale. Researchers and practitioners are increasingly concerned about whether and how the service quality of self-service technologies improves user satisfaction. The causal chain of 'service quality-perceived value-user satisfaction', which is derived from the China user satisfaction index model, was used to investigate the influence mechanism and boundary of SST service quality on user satisfaction. By analysing 378 mobile banking app users through structural equation modelling, the results suggest that there was a partially mediating effect of perceived value on the relationship between SST service quality and user satisfaction and that bank image has a significant moderating role in the effect of SST service quality on perceived value. Our findings provide new perspectives and evidence for the study of the mechanism of the action of SST service quality in banks.

Keywords: self-service technology; SST; service quality; perceived value; user satisfaction; bank image.

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1 Introduction

Self-service technology (SST), also referred to as technology-based self-service (TBSS), was initially introduced by Dabholkar. Dabholkar and Bagozzi (2012) classified any activity or advantage offered by a service provider that relies on hardware, enabling users to independently accomplish a service, as SST. The introduction of self-service circumvents the limitations related to in-person engagements and enhances the accessibility and effectiveness of service provision. On the one hand, due to its convenience and low cost, there has been a significant increase in business investment in SST equipment and user enthusiasm for using SST. On the other hand, with the wide application of the internet in the financial market (Parasuraman and Grewal, 2000), the consumption behaviour of bank users is undergoing profound changes, making full use of their personal fragmented time or handling banking business anytime and anywhere through the use of more efficient and convenient self-service financial service technologies, such as mobile banking, WeChat applets, and online banking. As a result, the banking industry is paying increasing attention to the quality of SST services and making greater efforts to achieve a high level of SST service quality.

In today's competitive market environment, users and user satisfaction have become one of the most valuable assets of the banking industry (Siddiqi, 2011). Service quality is a precursor to user satisfaction and has become an important source of user loyalty (Lam, 2002; Gronroos, 1988). Mobile banking apps are currently the most important way to provide online banking services, so users put forward higher requirements for banks' mobile banking services. An increasing number of banks regard the services provided by mobile banking as one of the main products of online banking and make it the core competency of the bank. User satisfaction is largely affected by the quality of mobile banking app services, which in turn affects the bank's long-term benefits and future development. Therefore, how to further improve the service quality of mobile banking apps and then enhance user satisfaction has become an important issue for banks to solve. Drawing on the aforementioned details, this study aims to investigate the extent to which users' perceived value and satisfaction are influenced by the service quality of mobile banking applications, specifically focusing on the SST aspect.

The main theoretical and practical contributions we expect from this paper are as follows.

1 This study proves that the self-service technology quality (SSTQUAL) model can measure the service quality of mobile banking well, improves the theoretical method applicable to the study of self-service technical service quality.

2 This paper introduces bank image as a moderating variable to supplement the influence of bank image on the perceived value of users when they use SST.

3 In terms of practice, the SSTQUAL scale adopted in this paper is based on seven dimensions, and studies the overall quality of the service system in a targeted manner, so as to lay a foundation for mobile banking to provide higher quality services and then optimise consumer satisfaction.

At the same time, this paper selects the China Construction Bank APP as the empirical object of this paper, which has strong pertinence and practicality.

2 Literature review and hypothesis development

According to Khadka and Maharjan (2017), user satisfaction refers to the holistic evaluation of a product or service, encompassing the entire process of purchase and consumption over a specific time frame. Scientific investigations have endeavoured to establish a robust correlation between service quality and user contentment, with studies on the determinants influencing user satisfaction manifesting that service quality can exert an influence on user satisfaction. According to the theory of expectancy negation, user satisfaction is present in an e-service setting when the e-service encounter fulfils consumers' anticipated outcomes (Aslam et al., 2023). Banks try to satisfy their users by improving the perceived service quality, and in this regard, According to Parasuraman and Grewal (2000), the close correlation between user satisfaction and service quality is of utmost significance. This shows that service quality is the main factor that affects user satisfaction. The above reasoning leads to the following hypotheses:

Hypothesis 1 SST service quality has a positive impact on user satisfaction.

Perceived value is a quality judgment formed by the user's thoughts prior to purchasing a product or service compared to the actual feelings (ZeithamI, 1988), a core prior variable that determines user satisfaction and behavioural intentions and is considered a parameter of service quality on user satisfaction in various trading and service situations. Based on prior investigations, it has been established that the quality of mobile services exhibits a positive association with the subjective evaluation of their worth. Through the utilisation of the E-S-QUAL Scale, Turel et al. (2010) evaluated the service quality of prominent online platforms (namely Walmart and Amazon). The results were consistent with the previously mentioned conclusions. The service quality of SST studied in this paper is measured by Lin and Hsieh (2011) based on the users' comparison of the service quality of self-service technologies and based on the users' expected psychological comparison of the perceived quality when obtaining SST and further explored in accordance with the causality of the relevant variables in the Chinese Customer Satisfaction Index (CCSI) model. Turel et al. (2010) demonstrated through their research that user satisfaction is influenced in a positive manner by perceived value. Similarly, in the study conducted by Boon-itt (2015) regarding mobile banking, it was observed that e-service satisfaction is significantly impacted by the perceived value. Thus, it can be proposed that:

Hypothesis 2 Perceived value plays a mediating role in the effect of SST service quality on user satisfaction.

The bank image is the overall perception of a bank, which is formed by processing information from various sources over time. These sources include word-of-mouth, past experience and marketing communications. Bank image represents the stimulus value it provides to its users. Corporate image originates from subjective rather than objective cognitive process. In service industries such as banking, image evaluation is essential for designing effective marketing strategies. Bank image is the role of the bank itself in the formation of quality values. Service quality drives users' perceived value, but when the users' perception of the bank image is favourable or unfavourable, the relationship will correspondingly enhance or reduce the user's perception of value (Lam, 2002). Tarus and Bonuke (2012) identified that company image does play a crucial role. A favourable company image improves service quality, user satisfaction and user loyalty. Bank image plays an important role in retaining users. Similarly, Boohene, Agyapong and Siddiqi

have pointed out that a good company image leads to higher users' perceived value and hence higher user satisfaction (Parasuraman and Grewal, 2000; Rosemond and Agyapong, 2010). Therefore, the following is proposed:

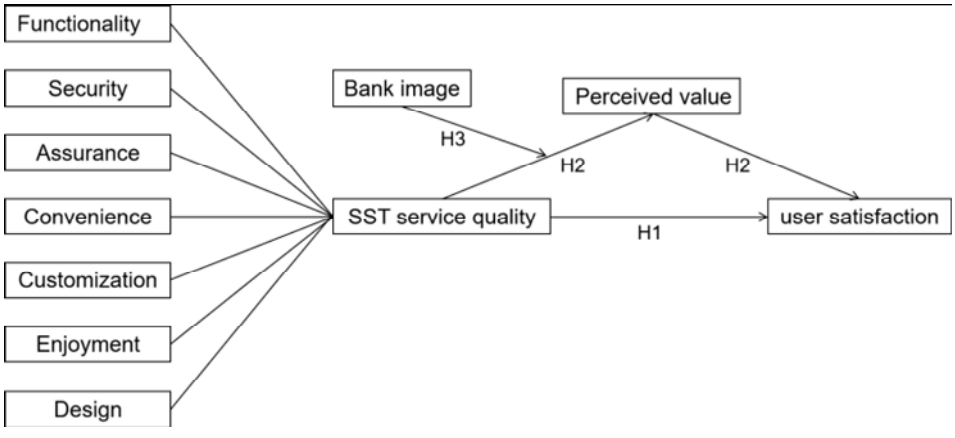
Hypothesis 3 Bank image plays a moderating role in the effect of SST service quality on users' perceived value.

Lin and Hsieh (2011) proposed the SSTQUAL measure to assess service quality for SSTs, which encompasses seven dimensions: functionality, enjoyment, security, assurance, design, convenience, and customisation.

- *Functionality:* The functionality of SST service quality is defined as the ability of the user to address their own basic needs through the app after logging in to his/her personal account when using the mobile banking app, while the mobile banking app can provide more relevant additional functions (e.g., biological recognition technology, hiding personal balances).
- *Enjoyment:* The enjoyment of SST service quality is defined as the ability of a user's mobile banking app to perform operations to meet his or her needs smoothly and without system failures or errors when using the mobile banking app, enabling the user to resolve his or her individual demands smoothly.
- *Security:* The security of SST service quality is defined as the maximum avoidance of user information leakage when using mobile banking apps; users can share personal information with confidence, and account information will be protected.
- *Assurance:* Assurance of the quality of SST services is defined as the user's ability to accurately understand the functional buttons on the mobile banking app with the help of the knowledge they have, to easily understand how the services are reached and to be able to address the vast majority of their own needs through the app.
- *Convenience:* The convenience of SST service quality is defined as the app's ability to provide users with non-cash forms of service and assistance, accurately meet user demands, easily access account details, and provide convenience to users.
- *Customisation:* Customisation of SST service quality is defined as the mobile banking app providing heterogeneous, personalised and customised services for different user groups to better meet their needs.
- *Design:* The design of SST service quality is defined as the mobile banking app design of the interface layout, function buttons, and additional functions, which take into account the design aesthetics, have a unique style, and should be ergonomic, bringing users a good look and feel.

The selection of these seven dimensions is based on the SSTQUAL scale developed by Lin and Hsieh, which has passed four stages of qualitative and quantitative research, and has been popularised and applied in the service quality evaluation of SST scenarios such as e-banking, self-checkout, service robots, catering, and transportation services, and has a certain universality. With the continuous improvement of the breadth and depth of SST application, the dimensions of SST service quality should also be clearer (Leon, 2019). These seven dimensions can comprehensively measure the ease of use, reliability, efficiency, and hedonism of SST, and form a benign closed loop in user satisfaction evaluation. In summary, the research model of this paper is shown in Figure 1.

Figure 1 Conceptual model



3 Research methodology

3.1 Sampling and data collection

In this paper, the data were collected using a questionnaire method, and the scales used in the questionnaire were all mature scales. A total of 403 copies were recovered. In the process of data verification, attention was given to whether the sample had continuously repeatedly selected the same question items, too much missing data, important information was not filled in, whether the questionnaire was answered regularly, and the data that obviously existed for the above quality problems were eliminated. Finally, 378 valid questionnaires were obtained, with an effective recovery rate of 93.8%. In the sample set, females accounted for 56.9%; individuals aged 18 to 30 represented 63.2% of the overall participants; and undergraduate education and above accounted for 71.2%. It can be seen that the main users of mobile banking are the younger generation, with higher education levels, groups with fixed incomes, and female users.

3.2 Measures

For this investigation, both local and international established scales were employed as assessment instruments, all of which were grounded in a Likert Scale with five points. It ranged from utter dissatisfaction (rated as 1) to extreme contentment (rated as 5).

The measurement of SST service quality was conducted using the SSTQUAL scale created by Lin and Hsieh (2011). This comprehensive scale incorporates seven distinct dimensions, including functionality, enjoyment, security, assurance, design, convenience, and customisation, with a total of 20 entries. The reliability coefficients Cronbach's alpha for each dimension were 0.888, 0.905, 0.839, 0.878, 0.861, 0.865, and 0.859, respectively.

The examination of perceived value is in accordance with the study of Shamdasani et al. (2008) and Boon-itt (2015), using three entries: "In general, the value I obtain from utilising this mobile banking application is worthy of the time and effort I invest", "The

benefits received from the usage of the mobile banking app surpass the sacrifices I make", and "I highly appreciate the mobile banking application". The Cronbach's alpha value was 0.772.

The measurement of user satisfaction draws on the American Customer Satisfaction Index (ACSI) developed by Fornell (1992) and consists of the following items: "I am content with the mobile banking application presented by this financial institution as a whole", "The mobile banking application offered by this bank surpassed my initial anticipations" and "This bank's mobile banking application closely aligns with my personal concept". The Cronbach's alpha value for user satisfaction is 0.806.

The measurement of bank image draws on the research of Nguyen and LeBlanc (2001) with three questions: "I have always had a good impression of this bank", "This bank has a good image in the minds of consumers", and "This bank's image is better than that of its competitors". The Cronbach's alpha value for bank image is 0.813.

3.3 Data analysis

SPSS17.0 and AMOS21.0 statistical software were utilised for data analysis. We examine the internal consistency of the questionnaire based on the Cronbach's alpha values of each variable. Subsequently, we selected structural equation modelling (SEM) to examine the hypothesised model.

3.4 Structural equation modelling

The discriminant validity of SST service quality, perceived value, user satisfaction and bank image was examined by confirmatory factor analysis (CFA). X2/df is 1.355, which meets the criteria for judgment, indicating that the model fits well. GFI is 0.908, and AGFI is 0.893, which indicates that this paper has a high degree of suitability; NFI is 0.913 > 0.9, which meets the standard; TLI is 0.973, which meets the general standard; CFI is 0.975, which is significantly higher than the standard; RMSEA is 0.031, which meets the standard. The above shows that the questionnaire designed in this paper has good discriminant validity and that the research data are suitable for further analysis.

Table 1 Model fitness indexes

	Index value	*Reference value*	*Compliance or not*
$\chi 2/df$	1.355	<3	Compliance
GFI	0.908	0.8	Compliance
AGFI	0.893	0.8	Compliance
NFI	0.913	0.9	Compliance
IFI	0.976	0.9	Compliance
TLI	0.973	0.9	Compliance
CFI	0.975	0.9	Compliance
RMSEA	0.031	<0.08	Compliance

4 Results

4.1 Descriptive statistics

Table 2 displays the standard deviations, means, and correlation coefficients for each variable.

Table 2 Mean, standard deviation and correlation coefficients

	Average value	*Standard deviation*	*Service quality*	*Perceived value*	*Bank image*	*Customer satisfaction*
SST service quality	3.64	0.658	1			
Perceived value	3.47	0.892	.267**	1		
Bank image	3.32	1.01	.032**	.266**	1	
Customer satisfaction	3.48	0.970	.323**	.441**	.27**	1

Note: **p < 0.01(two-tailed).

4.2 Hypothesis testing

As shown in Table 3, the value of direct effect of SST service quality on user satisfaction is 0.223, corresponding to 95% confidence interval [0.112, 0.334], not including 0, indicating that the user satisfaction is greatly influenced by the SST service quality, and we have confirmed hypothesis H1. The mediating effect of SST service quality → perceived value → user satisfaction is 0.158, corresponding to 95% confidence interval [0.095, 0.229], not including 0, indicating that perceived value plays a crucial role in mediating the relationship between SST service quality and user satisfaction. Hence, it can be inferred that perceived value partially mediates the impact of SST service quality on user satisfaction. So Hypothesis H2 is valid.

Table 3 Mediating effects of perceived value

Mediation path	*The value of effect*	*Lower*	*Upper*	*P*
Indirect effect				
SST service quality – perceived value – user satisfaction	0.158	0.095	0.229	0.000
Direct effect				
SST service quality – user satisfaction	0.223	0.112	0.334	0.000
Aggregate effect				
SST service quality – user satisfaction	0.381	0.269	0.489	0.000

As shown in Table 4, in Model 1, no significant effect was observed in any of the control variables on perceived value. As for Model 2, the independent variable of service quality exhibited a noticeably detrimental impact on perceived value ($\beta = 0.258$, $t = 5.322$); Model 3 exhibits a regression coefficient of 0.139 ($t = 2.914$) for the interaction term involving the independent variable and the moderator variable. This suggests a noteworthy impact of the interaction term on the perceived value. Furthermore, Model 3 surpasses Model 2 with regard to R^2 scores: Model 2 showcases a value of 0.148, whereas Model 3 demonstrates a significantly greater value of 0.167. It indicates that the

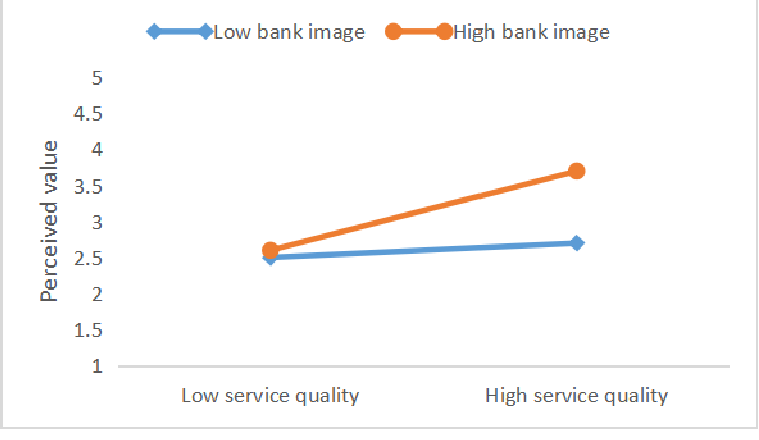
interpretability of the model is enhanced. According to Figure2, the relationship between SST service quality and perceived value demonstrates a positive correlation. However, it is worth noting that the slope is significantly greater at higher levels and significantly smaller at lower levels. It also indicates that the magnitude of the effect of service quality on perceived value increases as bank image improves. This proves hypothesis H3: The image of the bank greatly moderates the impact of SST service quality on the perception of value.

Table 4 Moderating effect of bank image

Model		*Perceived value*		
		Model 1	*Model 2*	*Model 3*
Control variable	Gender	0.052	0.039	0.043
	Age group	0.075	0.040	0.047
	Educational level	0.047	0.060	0.068
	Monthly income	0.064	0.079	0.089
Independent variable	SST service quality		0.258***	0.265***
Moderator variable	Bank image		0.259***	0.253***
Interaction term	SST service quality × bank image			0.139**
R^2		0.012	0.148	0.167
Adjusted R^2		0.001	0.134	0.152
F		1.112	10.758***	10.621***

Notes: *p < 0.05; **p < 0.01; ***p < 0.001

Figure 2 Diagram of moderating effects (see online version for colours)



5 Discussion

The findings of the SEM demonstrate that there exists a strong and positive association between the quality of service provided by SST and the perceived value of mobile

banking applications. Put simply, higher quality service in mobile banking leads to an enhanced perception of value. The banking industry pays increasing attention to the service quality of SST and makes more efforts to achieve a higher level of SST service quality to satisfy users. However, in terms of the overall status of mobile banking development, the banking industry's customer acquisition and customer activation are gradually increasing their reliance on mobile terminals. On the other hand, the level of service quality demonstrates a positive relationship with the perceived value. Turel et al. (2010) measured the service quality of websites (Walmart and Amazon) through the E-S-QUAL scale. The research findings have reached the determination that these dimensions invariably exhibit a robust positive association with perceived value. This suggests that improving the service quality of China Construction Bank's mobile banking app can increase the perceived value of users; at present, users have formed the habit of online entertainment, interaction and consumption, and there are increasingly more choices in app products. Overall, users' expectations are increasing, and competition in the mobile app industry is expanding. Rank the degree of impact of seven metrics that measure the quality of SST services: assurance (0.77); design (0.77); functionality (0.76); convenience (0.71); customisation (0.70); security (0.70); and enjoyment (0.65). It can be seen that the quality of mobile banking app services can be improved more effectively in terms of assurance, design, functionality, convenience, customisation, and security to attract users to use the app and at the same time better enhance the perceived value of users.

Second, the findings show that SST service quality has a positive impact on user satisfaction. McLean (2018) concluded that perceived service quality in mobile applications has a significant and positive impact on user satisfaction. The survey outcomes additionally validate that user satisfaction in mobile banking applications is positively and significantly influenced by the quality of SST service. This discovery resembles the conclusions drawn in preceding research. Banks try to satisfy their users by improving the perceived service quality (Nguyen and Leblanc, 2001). In relation to this matter, Parasuraman and Grewal (2000) emphasised the significance of the intimate connection between service quality and user contentment. It becomes evident that service quality plays a pivotal role in influencing user satisfaction. This validates the affirmative association between service quality and user satisfaction. Drawing upon DeLone and McLean Information System (D&MIS) success model, the interrelationship between service quality and user satisfaction gains further support. It can be deduced that the satisfaction of users might be influenced by the quality of service provided. This suggests that improving the service quality of China Construction Bank's mobile banking app can improve user satisfaction; at present, users have formed the habit of online entertainment, interaction and consumption, and there are increasingly more choices in app-using products. Overall, users' expectations are increasing, and competition in the mobile app industry is expanding. The resulting 7 dimensions of SST service quality in terms of security, design, functionality, convenience, customisation, and safety can be more effective in improving the quality of mobile banking app services to attract users to use them and to better improve user satisfaction. Since mobile apps for entertainment tend to bring more enjoyment to users, when using mobile banking apps, users will inevitably compare the user experience of mobile banking apps with that of apps provided by mature technology companies. In fact, users do not have a high demand for enjoyment when they use mobile banking apps, and their requirements for mobile banking apps are more inclined to satisfy basic needs and convenient and friendly operation experiences.

Once more, the findings illustrated in this study demonstrate that user satisfaction is influenced positively by user perceived value. This aligns with the outcomes reported in numerous prior investigations, including Turel et al.'s (2010) study indicating a positive relationship between perceived value and user satisfaction. Furthermore, a study conducted by Boon-itt (2015) in the domain of mobile banking revealed a significant impact of perceived value on user satisfaction. However, Leon's (2019) study on mobile banking service quality in the Philippines showed that perceived value did not have a significant effect on user satisfaction in mobile banking applications, and differences in geographical and national conditions may be the reason for the contradiction in the conclusions of the study. This suggests that user satisfaction can be improved by enhancing users' perceived value and simplifying the steps of mobile banking operations to meet the daily operating habits of users. To bring convenience to users and ensure their operational experience, users' perceived value is enhanced, which ultimately affects user satisfaction.

Finally, this paper concludes that bank image plays a moderating role between SST service quality and users' perceived value, complementing the effect of bank image on perceived value when users use SST and providing new perspectives and evidence for understanding the mechanism of SST service quality. In addition, a strong corporate image improves service quality with user satisfaction and user loyalty. Satisfaction and Loyalty in China, a study on the effect of user relationship management on users, confirms that corporate image does play a crucial role. The image of the bank plays an important role in retaining the users. Similarly, Rosemond and Agyapong (2010) and as well as Siddiqi (2011) have claimed that a good corporate image leads to high user perceived value and thus increases user satisfaction. In recent years, incidents such as 'Hongxing Erke', 'Xinjiang Cotton', and 'Huiyuan' have demonstrated that our nationals have more than once shown their great support to conscientious enterprises, which have demonstrated their social responsibility in times of social crisis and danger. According to this investigation, the image of banks was found to have a favourable influence on the quality of SST services, as well as on users' perceived value. Enhancing the corporate image by assuming social responsibility not only demonstrates corporate responsibility but also gains more attention.

6 Conclusions

The SST service quality has become a growing priority for the banking industry, which is striving to enhance the quality of SST services and make significant advancements in this area. In terms of the overall development status of mobile banking, the banking industry is gradually increasing its reliance on mobile terminals for customer acquisition and customer activation. In this research, we present the notion of SST and investigate the mechanism through which the quality of SST services affects user satisfaction in mobile banking applications. By referring to existing relevant literature and analysing the data from questionnaires, hypothesis testing can be performed. Finally, we found that:

1 There was a positive correlation between service quality and user satisfaction. This shows that improving the service quality of China Construction Bank's mobile banking app can improve user satisfaction.

2 User perceived value has a positive impact on user satisfaction. This shows that by simplifying the operation steps of mobile banking, it provides convenience to users, improves users' perceived value, and ultimately affects user satisfaction.

3 The image of the bank has a positive impact on the quality of SST and the perceived value of users. It shows that banks can enhance their corporate image by assuming social responsibility to gain more attention.

6.1 Theoretical implications

From the perspective of SST, this study aims to assess the influence of SST service quality dimensions on perceived value and user satisfaction in mobile banking applications. Our research contributes to enhancing the understanding of how service quality in mobile banking apps impacts user satisfaction, specifically focusing on SST.

In contrast to prior research, this article incorporates the second-order factors of SST into the model of perceived value and user satisfaction, including seven different dimensions, aiming to investigate the influence of service quality on user satisfaction. This novel approach introduces fresh perspectives to the field of research on satisfaction.

In addition, the novelty of this study is the introduction of bank image as a moderating variable to supplement and verify the impact of bank image on perceived value when users use SST. There are very few articles on SST and service quality that use enterprise or bank image as a moderating variable; they usually use bank image as one of the dimensions of service quality to directly study its impact on user satisfaction. We introduce bank image as a moderating variable, providing a new perspective and evidence for studying the mechanism of SST service quality.

6.2 Practical implications

Firstly, based on the perspective of SST service quality, our study explores the influence mechanism of mobile banking, a relatively mature financial service method, on bank user satisfaction, and puts forward specific solutions.

Secondly, based on the CCSI model and the relevant mature scales, we designs, distributes and collects the bank APP satisfaction questionnaire, and obtains the main factors affecting bank user satisfaction through a reasonable analysis of the questionnaire data, so as to provide data support for the optimisation of bank SST service quality and help banks formulate corresponding strategies.

Finally, the research results of this paper can provide some new ideas and perspectives for the development of the banking industry, and help it clarify that mobile banking is an important means for banks to lay out the digital blueprint, and how to realise the ecology of mobile banking business is the ultimate goal of the bank's digital blueprint.

6.3 Limitations and future directions

First, in terms of the limitations of the study sample, in this paper, the number of valid questionnaires finally recovered by simple sampling is 378, and with a limited sample size, it is inevitable that the sample will deviate from the overall sample. In general, the standard sample size should be at least 10-15 times the number of items, and the scale

items used in this paper totalled 33. While the minimum standard for the sample size has been met, enhancing the research findings' scientific validity and representativeness necessitates gathering additional research data. In forthcoming investigations, it is crucial to ensure both the sample size's adequacy and representativeness, as well as an improved scientific approach for surveying methods. The results will then be more convincing and valuable for promotion.

Second, in terms of the limitations of the research object, this article only conducts a questionnaire survey on China Construction Bank's mobile banking. According to the nature of the bank, China Construction Bank belongs to the state-owned banks, and people are more likely to trust state-owned enterprises. The research sample in this paper has its own attributes, the conclusions drawn lack universality, and the development ideas of private banks may be different from the research object studied in this paper. In addition, in terms of the scope of SST, which includes mobile banking but is not limited to this, the WeChat mini program is an emerging technology. In future research, scholars can consider the nature of the sample itself and the scope of the sample research, and the results and conclusions may be more convincing.

Finally, there are shortcomings in the research methodology. This paper adopts a cross-sectional study, which is more convenient in data collection, and the time of the questionnaire collection process is concentrated in approximately three months. Compared with the longitudinal study, the results of the data analysis and the conclusions obtained are more likely to reflect the present. For SST service quality, further in-depth research is needed to better understand the public's reaction to the application of similar intelligent technology services, to explain the deeper causal relationship between SST service quality and user satisfaction, and even to further explore its impact on user loyalty. Scholars can conduct further research by systematically employing the longitudinal method to examine the quality of SST services. Alternatively, they can delve into the intricate relationship between the quality of SST services, user satisfaction, and user loyalty.

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