

# A Measurement Framework for e-CRM in Banking: Exploratory – Confirmatory Factor Analysis

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## ABSTRACT

The rapid digital transformation has increased rivalry in the banking industry, posing significant challenges in customer acquisition and retention. To flourish in a fiercely competitive environment, banks must maintain strong customer relationships and adapt to ever-changing demands while leveraging intelligent digital technologies. The primary aim of this study is to create and validate context-specific scales that assess electronic customer relationship management (e-CRM). The study used sequential exploratory mixed-methods techniques which began with conducting in-depth interviews of six (6) clients and six (6) bank personnel. Insights from these interviews guided the development of 82 item statements capturing the different attributes behind e-CRM. Next, Exploratory Factor Analysis was performed on an adequate sample size (n=410), showing the framework of six factors: Smart Service Accessibility, Dependable Banking Experience, User Access Assurance, Secure System Performance, Convenient Digital Engagement, and Easy-Access Account Management. Furthermore, the final model exhibits strong fit indices, based on Confirmatory Factor Analysis (n=300), indicating the robustness of two-factor structure and has good convergent validity. Overall, the results confirmed the made scale is psychometrically valid and successfully measures the effectiveness of e-CRM. The evaluated instrument is a useful resource for researchers, scholars, and educators who want to understand the features of e-CRM in banking institutions. Moreover, this research helps achieve the United Nations Sustainable Development Goal 9 (Industry, Innovation, and Infrastructure) by prioritizing digital revolution, efficient customer management, and innovation in financial services. Future studies scholars may expand the geographical scope beyond a single region to validate the framework's applicability across varied cultural and economic landscapes. There is also a critical need to investigate how these e-CRM dimensions influence long-term user loyalty and satisfaction, moving beyond structural validation toward examining behavioral outcomes.

**Keywords:** electronic customer relationship management, sequential exploratory mixed-method, exploratory factor analysis, confirmatory factor analysis, digital banking users

**SDG Indicator:** #9 (Industry, Innovation, and Infrastructure)

## INTRODUCTION

The rapid digital transformation has increased rivalry in the banking industry, posing significant challenges in customer acquisition and retention. To remain competitive, banks must make the most of artificial intelligence (AI), machine learning, and predictive analytics to enhance their e-CRM framework, offer personalized experiences, enable real-time decision-making, and provide customer insights that traditional systems cannot achieve (Acheampong et al., 2023). Consequently, the ability to respond to technological shifts has become essential for banks to upgrade their CRM strategies to evolving customer expectations (Tharian, 2025).

Globally, the market for CRM software has climbed sharply in recent years at a 17.8% compound annual growth rate, from \$15.4 billion in 2024 to \$18.07 billion in 2025. Increasing demand for cloud solutions, automated customer insights software, self-service banking, funding R&D projects, and a growing need for better customer

service can all contribute to the rise in previous experiences (Banking Customer Relationship Management Software Global Market Report, 2025). A survey conducted by Ernst & Young in July 2023 among 151 global retail and commercial banks showed a growing interest in Generative AI (GenAI) applications within e-CRM systems. Approximately 71% of banks have strategically allocated 20% of their funds to GenAI projects to boost customer satisfaction, maximize productivity, and cut costs. However this endeavour specifically designed to significantly increase client satisfaction while big data and artificial intelligence focus on transforming consumer experiences. Overall, these strategies encourage inclusivity, economic growth, and innovation, which all contribute to increased customer satisfaction and loyalty and support Sustainable Development Goals (SDGs 8 and 9) (Smith and Wallace, 2021).

In Southeast Asia, in the 2023 Digital Banking Survey cited that 68% of banks mentioned that improving client banking experiences as their primary goal for digitalization. It also increases operational efficiency (56%) and expands consumer reach (41%), which are other important drivers. Despite these intentions, over 80% of banks have not yet fully achieved their digitalization goals. In the Philippines, businesses are growing when it comes to pursuing a client-focused strategy, giving priority to client satisfaction, and unique services. In one study led via PricewaterhouseCoopers Philippines, 72% of Filipino consumers stated that they value tailored client experiences, and 68% of them are willing to pay more for goods and services from business that offer superior customer service. Banking and financial services go through an online transition while using CRM systems to improve customer interaction, expedite procedures, and provide customized financial products.

Many of today's banks lack of accurate understanding of customers habits or effectively support their services with current demands. Efficient CRM remains a headache for banks, particularly, when they need to persuade more customers who have different wants to achieve their targets (Tadayon et al., 2021; Zouari & Abdelhedi, 2021). The banking sector has been among the most severely impacted by the advancements in ICT. The quick technological change, client adaptation, and subsequent increases in internet prevalence and smartphone usage put banks under severe pressure in multiple aspects (Mathew et al., 2020). Hence, Building enduring, solid customer relationships can help understand clients' needs and provide them with the best services possible, which will help both attract new customers and keep existing ones (Khan et al., 2022).

While technology has shown banks with many options to boost customer fulfilment, it has also presented limitations that necessitated the adoption of innovative methods in the development and execution of their marketing plans and customer interactions (OECD, 2020; Kumar and Mokha, 2021). To flourish in a fiercely competitive environment, banks must maintain strong customer relationships and keep up with ever-changing demands. More than ever, a bank's performance is determined by client experiences and what defines their success (Osei et al., 2021). The study explores this demand by investigating and confirming the particular e-CRM frameworks used by banking organizations. Banks can enhance performance and gain a competitive edge by comprehending and refining these constructions, which will benefit client happiness and retention.

Existing research studies indicate that e-CRM combines conventional CRM across the market for online business solutions (Rami et al., 2024). One of the features involves employing different types of online electronic interfaces, such as emails, websites, and other platforms, to monitor and establish lasting connections with clients (Kumar, Mokha, and Pattnaik, 2021). Aside from that it consists of a sector combination, the primary approach to e-commerce, dedication of software, hardware, applications, along with oversight commitment (Koalathappilly and Kumar, 2024). E-CRM services made it easier for consumers to communicate with and serve their banks, which raised their degree of satisfaction and eventually resulted in ardent customers' base (Dehghanpouri, Soltani, and Rostamzadeh, 2020).

A business can improve processes and give sales, marketing, and customer support staff, more thorough customer information by deploying an E-CRM system. This system enables organizations to cut operating costs and forge more profitable client relationships as a result (Koalathappilly and Kumar, 2024). Electronic customer relationship management is now necessary for every business that intends to shift its trading operations online. Information technology, often known as E-CRM, is used to supply and administer customer relationship management solutions (Koalathappilly and Kumar, 2024). Thus, banks must improve their financial positions by looking at various methods to satisfy their clients and establishing enduring, solid ties with them by gaining

new clients and keeping hold of current ones, both of which can help the banks even more (Kumar et al., 2021; Koalathappilly and Kumar, 2024).

There are relevant studies on e-customer relationship management have discussed on possible characteristics and sources. Customization has an influence on the e-CRM bank's effectiveness. Banks need to stay informed of their clients' wants in order to provide their products and services that conform to their guidelines (Al-Hashem et al., 2022). Because of the breakthroughs in technology, digital banks may now offer services that are higher quality and more beneficial, giving their clients a better overall experience (Chauhan et al., 2022). It aims to satisfy each customer and concentrate on building a tight relationship and focus on developing a close relationship with their needs. Customers want individualized interactions and advice in today's economy (Ikegwu et al., 2024; Joel and Oguanobi, 2024c; Lopez, 2023).

The platform can likewise suggest items to customers with respect to their past buying and browsing habits. This level of customization not only improves the client experience but also increases retention and loyalty. Moreover, analyzing the information and processing makes better decisions by offering practical ideas that enable CRM approaches (Joel and Oguanobi, 2024a, 2024e). Such personalized campaigns for marketing are meaningful with customer choices, enhancing engagement and loyalty.

Another possible attributes that measure effective e-customer relation management is customer loyalty. Customer loyalty can be seen by varying behaviours, including how much of purchases are made, the average time spent on a website, and the number of views (Rabiul et al., 2023). Marketing experts have encouraged companies to establish enduring customer loyalty. Customer loyalty and e-CRM strategies have grown significantly due to increasing technological advancement, and maintaining long-term relationships with clients depends on efficient e-CRM. Given that the importance of customer loyalty has been defined in previous research, it remains one of the most real challenges facing the service sectors (Khan et al., 2022). Prior investigation documented a positive correlation between client loyalty and E-CRM (Shastri et al., 2020; Sasono et al., 2021).

System Quality this attributes takes into account that user pleasure is the key to the success of its functionality and gives attention to user demands, preferences, and experiences throughout the entire development process (Nuraeni, 2015). In mobile banking system quality is characterized by attributes like response time, system uptime, and overall user-friendliness (Junglas, & Watson, 2021). Likewise, it encompasses the system's stability, security, and interface design, which collectively enhance user confidence. Well-designed systems that meet these criteria improve user satisfaction and support broader adoption and engagement (Shaikh and Karjaluoto, 2022).

Reliability was the ability to do the given task precisely and correctly (Umer, Haji, & Zafar, 2020). This means service providers have the know-how to deliver reliable and highly accurate services, regularly completing them correctly (Ramirez, and Montecillo, 2022). Reliability with client satisfaction, and they came across that there was a positive association between the two, and that high customer satisfaction can result from performance that provides more accurate and trustworthy information (Umer et al. 2020).

One of the components of the E-recS-QUAL was responsiveness, which has been shown by staff members' willingness and desire to provide prompt customer service (Tien et al., 2021). Responsiveness influenced by how fast and quality the business's output depending on the choices of its clients. It assessed the level of communication and customer service offered. Mobile banking may simplify contact between each client and the management of their bank accounts, for example, by allowing private online conversations directly linked to their personal information. Effective communication and fast resolution of customer facing issues would have significant implications on customer satisfaction, based on their performance result (Reddy and Megharaja, 2021).

On the other hand, responsiveness can keep clients' attention, and prompt responses increase customer loyalty and happiness (Sirait & Purnama, 2022). In the customer service industry, live data analysis can eventually improve responsiveness. Using current data, chatbots, and digital assistants can provide clients with immediate

help by answering their queries and concerns (Rane, 2023; Rane, Achari, and Choudhary, 2023). These procedures could assist financial companies in creating various user-responsive solutions (Malaquias and Hwang, 2019). Overall such attributes was vital for increasing product's bottom line simply because it is quick and makes customers feel happy (Top and Ali, 2021).

Security and privacy are necessary to building electronic trust so that consumers' worries about misuse of sensitive information can be put to rest. For example, people may have a negative view of their security and privacy (Foroughi, Iranmanesh, and Hyun, 2019). Security lapses were seen to be a major deterrent to customers divulging classified data online (Merhi, Hone, and Tarhini, 2019). Security concerns continue to be the crucial question to the adoption of m-banking services amid the potential for data theft or leaking by hackers, for a particular case (Merhi et al., 2019). This is a kind of protection that mobile applications must have against viruses, hacking, and other illegal activity (Owuamanam, 2021).

Privacy and security were among the issues raised by the e-banking customer. When utilizing e-banking, they were worried about the security of financial activities and the protection of their privacy (Das and Ravi, 2021). Besides, since consumer happiness has been greatly impacted by privacy and security, the researchers advised managers to enhance the system to forbid exchanging data with third parties for customers' protection (Top and Ali, 2021). Therefore, a superior protection and confidentiality solution offered by e-CRM banking can boost client satisfaction. Additionally, clients would be motivated and inspired to keep using the online platform due to its confidential and secure features.

Data Management and Analytics it supported the idea about how data mining methods may improve CRM procedures (Raja et al., 2020). Big Data Analytics need to look at vast and different collections of data to find undiscovered relationships, obscure trends, and other useful data. Digital platform data sheds light on consumer patterns, interests, and sentiments. CRM is built on customer data, which includes demographics, past purchases, and behavioral information (Chatterjee, Chaudhuri, and Vrontis, 2022). This approach helps businesses predict trends, make informed decisions, and discover customers' preferences and habits in great depth (Adenekan, Solomon, Simpa, and Obasi, 2024; Naim, 2022; Razzak, Imran, and Xu, 2020). Big Data Analytics deals with this type of problem by enabling real-time assessment and scrutiny of huge collections of organized and unorganized data generated by businesses. This feature improves client retention and engagement through deeper client segmentation, tailored promotions, and maintenance forecasting (Atadoga et al., 2024; Naeem et al., 2022). There are numerous advantages to incorporating big data analytics into CRM. Getting more in-depth knowledge about customers is one of the most benefits. Businesses might find previously unknown behaviors and trends by analysing data from many sources.

Businesses can make use of the knowledge to develop focused advertising campaigns, better pricing plans, while improving customer support. Predictive analytics, for example, can help companies anticipate clients who are likely to leave and put efficient means of retention plans (Putra, Rivera, and Pramukti, 2023). By knowing what causes customer attrition, companies may improve their client retention trends by addressing problems before they become more serious (Nembe, Atadoga, Adelakun, Odeyemi, 2024; Oguanobi, and Joel, 2024; Reddy, 2021).

Proactive service and support to customers' needs through predictive support and recommendations (e.g. personal assistance through chatbots and virtual assistants) anticipating potential issues and offering solutions proactively. The ability of contemporary customer-oriented management philosophy to analyze, develop, and provide marketing strategies and services helps the business establish and preserve lasting relationship (Guerola-Navarro, et al., 2021). This makes it possible for companies to support particular client segments with customized marketing messaging, boosting operational efficacy (Nembe et al., 2024).

Irrefutably, consumer interests and habits can shift quickly, their actual data analysis skills are extremely essential. Companies may improve how satisfied customers are by responding to consumer complaints, feedback, and questions more quickly and efficiently (Keith, 2023). Research revealed that proactive service and support for various clients can lead increase consumer approval since it provides several advantages, such as improved allocation of resources and a greater awareness of customer needs (Osei et al., 2021).

Communication and engagement has become a crucial factor of success in the modern corporate environment. Businesses aim to establish closer ties with their clients in order to promote loyalty and spur expansion. Enabling personalized experiences, using advanced analytics to foresee consumer demands, setting up real-time conversations, and examining customer sentiment and review are all ways to engage customers. Businesses can use these skills to develop more responsive and meaningful engagement strategies, which raises levels of client satisfaction in general (Ijomah, Idemudia, Eyo-Udo, and Anjorin, 2024).

The businesses may adopt action and offer customized retention incentives, like special services or discounts, to keep these clients interested by recognizing the early signs of customer attrition, such as decreased usage or negative reviews (Simpa, Solomon, Adenekan, and Obasi, 2024a; Uzougbo, Ikegwu, and Adewusi, 2024b). Moreover, relevant and suitable advertising promotions can be sent using data that is fresh. Customers who are close to retail location, for instance, can receive push notifications on their cellphones about flash deals or other special offers. In order to increase customer flow and encourage in-person transactions, this kind of real-time interaction makes use of location-based data. Financial organizations can utilize live analytics to manage transactions and identify fraudulent activity as it occurs, and real-time interaction is essential in the banking industry. By promptly warning clients and taking action, these organizations can improve security and trust, two essential elements of customer management (Singla and Jangir, 2020; Uzougbo, et al., 2024e).

Customer Feedback and Sentiment Analysis through understanding what customers think and suggestions is crucial to following their experiences and ways to improve engagement activities (Rane, 2023; Rane et al., 2023). Data-driven findings enable enterprises to sort on tons of numbers of comments and suggestions from all kinds of sources, including online evaluations, posts on social networks, and polls to collect information about the opinions of customers and sentiments. Moreover, feedback analysis might stimulate a creation of new goods and services. Using data-driven decision-making, businesses may change their services by learning what customers like and dislike (Valdez Mendia & Flores-Cuautle, 2022). Businesses can keep track of brand mentions and conversations on social media sites like Facebook, Instagram, and Twitter to determine public sentiment and respond appropriately (Macarthy, 2021).

For instance, client feelings about a business or product can be found through sentiment analysis of social networking sites, thereby offering valuable recommendations for raising satisfaction among consumers. Similarly, assessing what consumers like and forecasting future spend patterns can be achieved by examining previous purchasing history (Anitha and Patil, 2022; Raji et al., 2024). Therefore, a crucial component of feedback systems to assess and adjust the direction of the e-banking service is the accurate and timely consideration of consumer complaints (Shams et al., 2020). They also argued that banks can use unfavourable customer reviews and comments to identify service flaws and appropriately handle customer complaints, which will improve their ability to keep current customers and attract new ones (Thomson, 2020). Customer satisfaction and retention are essential to a firm since keeping current clients is frequently less expensive than finding potential clients.

In banking sector they used AI driven analytics to enhance customer retention through the use of accurate consumer profiling and targeting, mix prediction and prevention, loyalty program optimization, and satisfied clients measurement and improvement. These skills enable companies to create customized plans that maintain clients' interest and loyalty (Rane, 2023; Rane et al., 2023). Hence, in order for companies to sustain their clientele, they must constantly assess and improve customer satisfaction, which is a crucial predictor of loyalty and future retention (Rane et al., 2023).

Complaint is a sign from unhappy consumers who wish to offer the business another chance to retain them as a customer (Jeanpert et al., 2021). To continue to be competitive, banks must properly address concerns and find quick, flexible, and focused solutions (Shams et al., 2020). Apparently, negative customer feedback and suggestions can help banks identify their service delivery flaws and appropriately handle customer complaints, which will improve the banks' ability to draw in new business and keep hold of existing clients (Rane et al., 2023).

In indeed, knowing what the consumer wants and needs is just the very first step in meeting their preferred market's needs, since banking services can either meet or fall short of the customer's expectations. Customers

can access the digital banking system to see how susceptible they are to complaints (Shams et al., 2020). Hence, finding solutions to grievances from clients in a prompt and courteous way can show a company's dedication to customer satisfaction and enable greater loyalty. This is why handling customer complaints correctly and promptly is an essential component of feedback systems used to assess and improve the use of online banking service (Zhou et al., 2019; Shams et al., 2020). These studies support the identification and elucidation of the specific e-CRM components that are still necessary for the effective implementation and use of e-CRM strategies, particularly in the banking industry.

However, this research study is guided by a theoretical framework. The foundation of this study is grounded to Relationship Marketing Theory (1994) this theory brings the attention of the critical role of building long-term partnership rather than focusing solely on transactional communications. Long-term partnership was opposed to just transactional exchanges. Banks that proactively handle complaints can promote stronger relationships with their customers. Additionally, personalized follow-ups after complaint resolution can enhance trust and loyalty, further solidifying the customer-bank relationship.

In the digital sphere, CRM is a complete procedure of creating and preserving lucrative client connections with the aim of enhancing business relations with clients by providing exceptional customer service and fulfilment (Magatef, Al-Okaily, Ashour, and Abuhussein, 2023). Even if relationship management has been a business practice for decades, establishing strong client ties is now more crucial than ever for a company's survival.

Today, e-CRM is becoming more and more popular since it uses advanced technologies to improve and broaden communication among customers. By using this method, companies may increase productivity and maximize every customer interaction (Angeloska-Dichovska and Angeleski, 2020). Another theory wherein this study is girted, Expectancy-Disconfirmation Theory (1980) posits that client pleasure depends on the gap between expectations and actual experiences. In banking institution specifically in handling complaint if the resolution exceeds expectation, expected that the customer satisfaction increases. On the other hand, failure to meet expectation results in dissatisfaction and possible customer confusion.

The effect of E-CRM on customer satisfaction was overlooked in favor of evaluating customer experience, a weakness that was evidently noted in prior investigations (Zaim et al., 2020). Customers expect to have anticipation in interacting with their banks in a way that is quick, individualized, and effective through time-built experiences (Ramirez and Montecillo, 2022), offer their clients with invaluable assistance when they face bank-related issues. Positive client experiences are the result of such communication and assistance (Kumar, Mokha, and Pattnaik, 2022). Upadhyaya, (2020) cited that relationship and satisfaction-related investments would help improve experience and contentment. Therefore, the firms' E-CRM services have made it possible for customers to communicate and engage with them, which raise their sense of fulfilment (Upadhyaya , 2020).

Aside from Relationship Management Theory (1994) and Expectancy-Disconfirmation Theory (1980), this study is also anchored on the Service Recovery Paradox (McCullough & Bharadwaj, 1992), conveying that, a well-handled complaint can result in higher customer satisfaction than if no issue had happened. Quick and effective resolution of complaints (e.g., fraud issues, transaction errors) can improve customer trust. A proactive recovery strategy (e.g., compensation, apologies) strengthens loyalty. In the context of banking, quick and effective resolution of complaints (e.g., fraud issues, transaction errors) can improve customer trust. While a proactive recovery strategy (e.g., compensation, apologies) strengthens loyalty, it also requires careful implementation to be effective.

Service failure based on research still one of the most important marketing concerns of our time. Companies cannot promise perfect service delivery, but they should make sure that any issues are fixed quickly to meet customer expectations (Bagherzadeh et al., 2020). Customer satisfaction is strongly and significantly influenced by politeness, remuneration, and the speed at which service correction is completed; perceived honesty and reputation for the brand have a moderating influence (Lin et al., 2021). Managers can try to increase brand credibility by minimizing service failure. Furthermore, due to its effect on client loyalty and satisfaction, Tran (2024) advises managers to put their shoes to their clients, value and assist them, and go beyond their expectations. Notably, businesses aim to put the principle of transparency into practice and are searching for methods to win back customers' trust in their goods and services (Thomson, 2020).

This study presented a schematic model of various components of e-customer relationship management characteristics in banking institutions. This model illustrates several elements or characteristics that contribute to successful e-customer relationship management in the particular study location. Furthermore, the elements known as Factor 1... n are what determine the underlying constructs. The primary factor is in the middle, where it is surrounded by assumed determinants. The findings would be relevant to an interesting scale that assesses on how effectively e-CRM performs in their banking sector in valued clienteles in Region X. Figure 1 is a diagram presenting the index used to determine the attributes that contribute to the effective e-CRM in banking industry.

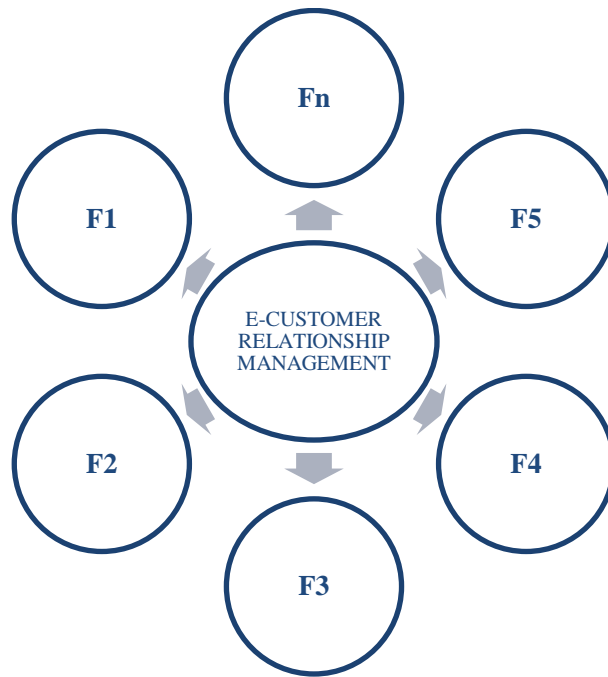


Figure 1. Conceptual Framework of the Study

The result followed the utilization of exploratory research methodology and a sequential mixed-methods research process, which began with a quantitative phase after an in-depth interview. By clustering particular dimensions that establishes the quantity of hidden structure of e-customer relationship management in banking sectors, the objective was to find phenomena based on the statements made by the respondents. In order to ascertain the dimensionality of the items, this study used a multivariate technique. Confirmatory factor analysis will be utilized to propose the most e-CRM model in banking.

This study explores the best-fit model for e-CRM presentation. In particular, the goal of this research project is to determine the best fit model for effective e-CRM in the banking industry, as well as to build a framework on the dimensions. This exploration advances to profound insights of the different attributes of effective e-CRM specifically within the banking entity. It provides banking institutions, particularly the head of customer relationship management, with insights to evaluate and know the function of the e-CRM in achieving performance goals for both individuals and the organization while enhancing customer retention.

Similarly, initial safeguard for a customer relations officer while on their growth period may be to find operational efficiency and CRM protocols for its customer service managers. This will help the officer continually deliver high-quality service, raise customer loyalty ratings, and obtain favourable, whether financial or non-financial outcomes. Present study could be reviewed by human resources offices in different financial service businesses to improve their policies and modify their current performance management system.

Further, this research will also enable stakeholders to better understand and appreciate the demanding roles of customer service representatives and CRM marketing managers. Their efforts are vital in consistently meeting customer wants and delivering exceptional service quality in an increasingly competitive banking environment. Lastly, the results can serve as a baseline of data and references for related study in other industries which offer goods and services.

Finally, the findings of this study will give future researchers the foundational information they need to carry out a more thorough investigation into e-CRM performance, digital banking, and both exploratory and confirmatory factor analysis. This study will be served as their resource for empirical reviews and theoretical citations that will contribute to their individual research for both academic and non-academic purposes in the field of mobile banking and digital service quality.

## METHODOLOGY

The study aims to establish and validate scales tailored to the specific context for evaluating electronic customer relationship management (e-CRM).

### Study Participants

The qualitative phase of this study began with in-depth, one-on-one interviews with (6) bank employees and (6) valued clients who were experiencing digital banking services in Region X, selected through purposive sampling. The researcher divides the participants into four groups: two held managerial positions, two were at the supervisory level, and the remaining two were in the rank and file employees, and six clients of banks. The ideal range of participants for data saturation is six (6) to twelve (12) according to Creswell (2021). These individuals could offer insights into the features of e-CRM in the banking sector.

The quantitative phase of the study consisted of two surveys administered to banking customers in Region X; proportionate stratified sampling across clienteles of several banks; and an exploratory factor analysis. The questionnaire had 82 items, to determine the sample population. The number of samples cited by Bryant & Yarnold (1995) should be five times the number of identifiable items.

Research indicates that the distribution of items across factors, the consistency of the shared characteristics, and the strength of item loadings are essential factors for factor analysis (Guadagnoli & Velicer, 1988). A factor solution's stability, dependability, and reproducibility depend on strong data (Costello & Osborne, 2005; Wang et al., 2013). As a rule, the large-sample factor analysis element structure is likely stable even with small sample sizes (DeVellis, 2021). The data gathering was obtained 410 respondents for exploratory factor analysis and subject to further statistical analysis.

The objective of the quantitative survey, which was the third phase of this study, was to confirm the validity of the identified dimensions through a confirmatory factor analysis. Newly defined dimensions produced 29 items across 14 dimensions, with an ideal range of coefficients of  $+0.60$ . Moreover, adjustments in the total number of respondents have a similar effect on the precision of general goodness-of-fit indices, chi-square tests, and parameter estimates. On the other hand, models with strong dimension estimates and highly reliable variables may require smaller samples in CFA, though this oversimplifies the issue (Tabachnick & Fidell, 2013). As a result, the study attracted an additional 300 bank customers and was approved for use in CFA.

The basis for choosing respondents to take part in the survey was bank current clients aged 21 years and up who had at least completed high school, employed, self-employed, or otherwise, and who had been using mobile banking services with a cumulative experience of at least 6 months. In addition to these core criteria, consideration was given to factors such as frequency of mobile banking usage and location within Region X.

### Materials and Instruments

This research actively uses both structured and semi-structured data-generating tools. The researcher examined the features of e-CRM using a partially structured interview guide throughout the qualitative phase. The written responses and comprehensive verification probes collected from key participants formed the final set of item statements for the quantitative survey.

The second phase of the research used an organized questionnaire alongside an exploratory and confirmatory component analysis questionnaire, and two separate surveys divided into two phases. In the qualitative level, the researcher developed a 13-item EFA instrument from significant responses collected during the in-depth

interview. The process of assessing the reliability and validity of an instrument is through psychometric feature evaluation. The panels of experts confirmed that the survey items are highly credible, with an average validation value of 4.52.

To perform a confirmatory factor analysis, this study used a customized, structured version of the EFA. The completed CFA tool had just 29 items. The components mentioned earlier constitute the six dimensions examined regarding the attributes of e-CRM in the banking sector. Before administering the questionnaire to the participants, the study implemented an additional set of reliability-focused psychometric tests. Computed Cronbach's alpha as the reliability coefficient which ranging from 0.799 to 0.924. Hair et al. (1998) stated that an instrument passed the reliability test when the coefficient is at least 0.70.

### Design and Procedure

This research endeavor employed mixed-methods, exploratory, sequential strategy. The approach of scale-building and validation analysis is useful and valuable for researchers aiming to construct a reliable scale (Zhou, 2019). The scale development and validation process that was used to ascertain the project's research objectives is shown in Figure 1.

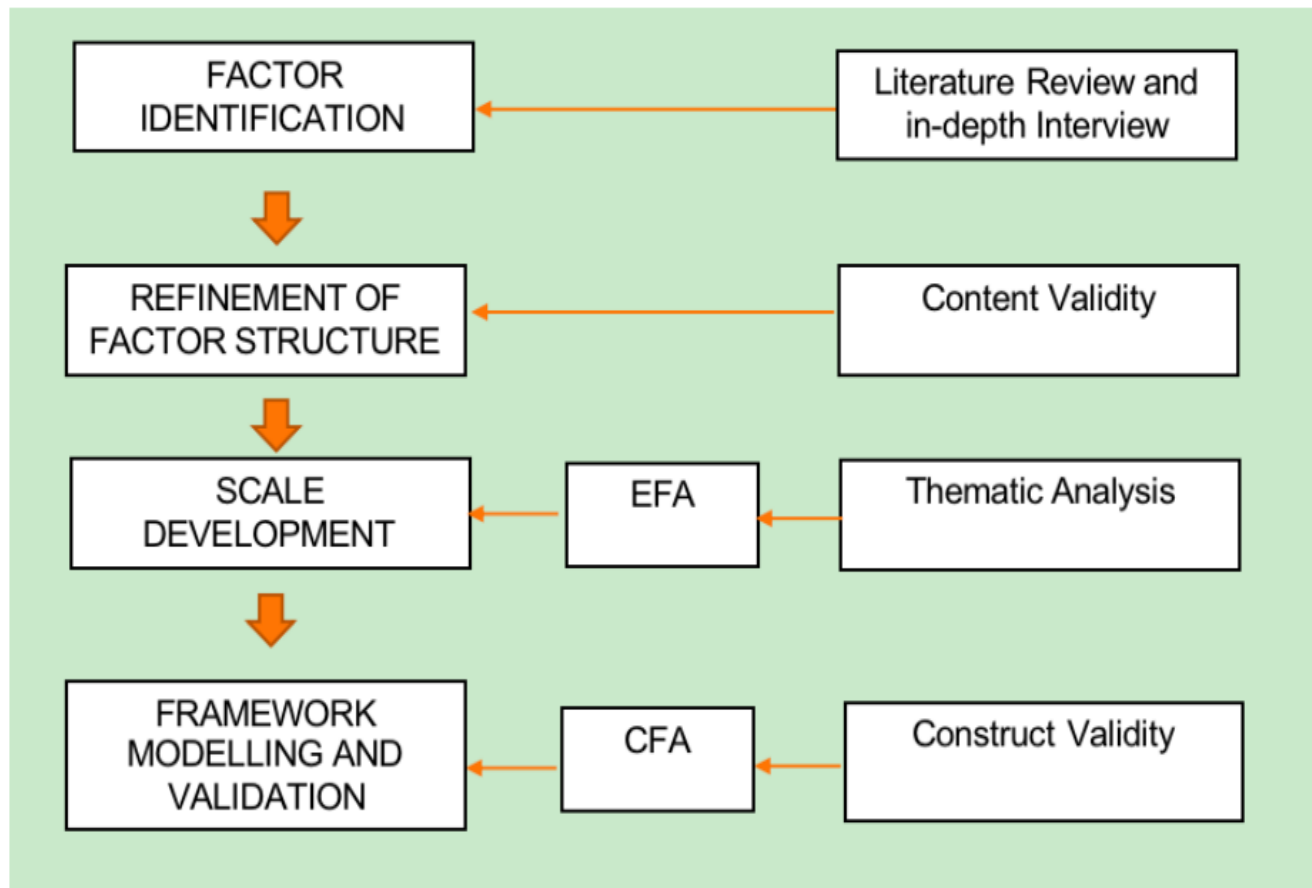


Figure 1. The Scale Development and Validation Process

### Qualitative Phase

It starts by gathering literature reviews and in-depth interviews, then proceeds to content validity to reinforce the factor structure and to thematic review as a component of the exploratory factor analysis in developing the scale. Next, determined the attributes of a successful e-CRM in the banking industry by assessing construct validity through confirmatory factor analysis and by applying the framework for modelling and validation. The study shared the findings with the dissertation adviser, the Committee panel members, and the research adviser for their consideration, comments, review, and approval of the proposal presentation. Following approval of the study proposal, the key informants provided informed consent for in-depth interviews. Relevant claims that resulted in the identification of the qualities generated and formulated using three probing questions and 13

primary guide questions. The responses were subjected to thematic analysis, simplification, numerical placement, expert verification, and development. The response form was revised to comply with recommendations from the Thesis Advisory Committee and the institution's advisor. To secure approval for the research, the researcher sent letters of request to several banking institutions. After the study was approved, the proponent began the first section, which aimed to identify the characteristics of e-CRM in banking organizations.

### Quantitative Phase

In the investigation's introduction phase, to identify the features, an exploratory factor analysis was used to determine effective E-CRM systems that enable firms to make better data-driven decisions, simplify communication, and increase customer engagement. The researcher used the Kaiser-Meyer-Olkin (KMO) index to assess the number of respondents' sufficiency, and the test developed by Bartlett of sphericity was meant to evaluate the factorability. Principal component analysis determined construct dimensionality and reliability based on an eigenvalue of 1.0. In addition, to ascertain whether specific components measure commonly occurring variables, principal component analysis, or PCA, is employed. This study used an oblique Promax rotation to uncover how the different themes related to one another. In Catell's scree plot, the curve is graphically depicted in the final valid dimension used to calculate the number of factors. In contrast, we used initial eigenvalues greater than 1.0 to calculate the latent root criterion. The researcher investigated the characteristics of e-CRM using these criteria. The test methodology identified the features of an effective e-CRM and organized each component that reflects those traits by its unique qualities. After using EFA in the first phase of the study, examining and verifying the collected data through Confirmatory Factor Analysis (CFA) is essential in the next section of the investigation. This step assesses how closely actual components' loadings matched the theoretical values predicted by Malhotra et al. (2007). However, each factor should pass a reliability threshold before the CFA, as all indices met the necessary standards. This process established an accurate and consistent representation of the items and constructs found in the elements. Therefore, it is crucial to examine the scale correctness and reliability (Hair et al., 2009).

The second survey was distributed and collected in various bank clients yielding 300 research responses for the CFA. The role of CFA is to identify the most effective model for examining the attributes of e-CRM in the banking sector. Approximately six (6) of the multiple-fit metrics were produced and used in the investigation. To achieve a satisfactory model fit, the chi-square to degrees of freedom (CMIN/df) ratio, also known as relative chi-square, should not exceed 3.0 (Wuensch et al., 2008).

More specifically, the Goodness-of-Fit Index (GFI) indicates the proportion of the variance-covariance matrix that the model accounts for. To qualify as exceptional, the GFI value must exceed 0.95. (3) The Tucker-Lewis Index (TLI) is calculated by dividing the squared difference between the chi-squares of two models by the chi-square value of the independent model. The ideal TLI value, according to Bentler and Bonett (1980), is 0.95. Comparative Fit Index (CFI) is one metric used to assess the relative non-centrality of the independent and tested models. Wherein, a significance of 0.95 specifies the presence of an independent model. To evaluate and understand models, RMSEA and CFI are frequently used in tandem.

Models that meet the usual measurement criteria have a CFI of greater than 0.90 and RMSEA of less than 0.05. To determine whether the model's RMSEA is below 0.05, it uses one-sided null hypothesis testing to obtain the P-value of close fit (PCLOSE). The stringent requirement that the CFI must be greater than 0.95, as put forward by Hu and Bentler (1999); on the other hand, there is a less stringent RMSEA threshold of 0.06 or lower. In the statistical analysis, model configurations were employed. The model fit should be described as "close" if the p-value is above 0.05, which indicates that the result does not meet the criterion for statistical significance (Kenny, Kaniskan, and McCoach, 2015). Since model two satisfied all requirements, it became the best model.

More importantly, this study ensured that all basic ethical standards were strictly followed throughout its conduct. After the data instrument was reviewed and approved, before facilitating the questionnaire to the bank entities in Region X, the researcher obtained permission from the University of Mindanao Ethics Review Committee (UMERC). Furthermore, the study maintained close monitoring and involvement; the author closely followed the protocol evaluations and stringent criteria, especially for population monitoring and data collection. By allowing the subjects to provide their consent voluntarily, the researcher also ensured they were treated with

respect and able to give their consent. To make sure that management and respondents had no conflicts of interest, the researcher took precautions during data collection.

## RESULTS AND DISCUSSION

The subsequent discussions focus on creating an item pool for the e-CRM, the first stage of the scale development process. The discussions mostly center on creating item statement pools from in-depth interviews, determining the items' dimensions, content validity, and sampling adequacy using the study's initial survey, and selecting the best-fit model for banking's e-CRM.

### Dimensions of Electronic Customer Relationship Management (e-CRM)

#### Exploratory Factor Analysis

The study uses several statistical tools, Kaiser–Meyer–Olkin, Test of Sampling Adequacy, Bartlett's test, the latent root criterion, Cattell's scree plot, and principal component analysis (as shown in the rotated component matrix) to assess whether electronic customer relationship management was suitable for factor analysis.

The number of respondents was determined by the Kaiser-Meyer-Olkin (KMO) Index to see if it is currently large enough. By contrasting the values of the experiential and partial association coefficients, it evaluates the possibility of data coalescence components. KMPO values range from 0 to 1 and 0.6 is an acceptable limit for factor analysis. The number of participants in the study was deemed "meritorious" (Kaiser and Rice, 1974) beyond the desirable baseline value of 0.6, as indicated by the result of 0.859 in Table 1. By showing that the data support the use of EFA and that they may be divided into fewer sets of underlying elements, the totality index evaluates whether the dataset qualifies for factor analysis.

Table 1. Kaiser-Meyer-Olkin (KMO) and Bartlett’s Test

Kaiser-Meyer-Olkin		0.859
Bartlett's Test of Sphericity	Approx. Chi-Square	8449.126
	df	1526
	p-value	0.000

Further, the test produced a degree of freedom (df) of 1526 and a high result (8449.126), while the significance threshold was 0.000. The dataset is therefore suitable for factor analysis in which the null hypothesis is disproved (Stewart, 1981). To reject the hypothesis, Bartlett's test of sphericity must have a p-value of less than 0.05.

As shown in Table 1, which calculates the total variance summarized by the eigenvalues of the variables and their related variances, the usual outcome of EFA can be determined using the latent roots criterion. The six (6) factors identified below, drawn from the items provided for factor analysis, characterize the attributes of effective electronic customer relationship management. This dimensions, also known as factor structures, account for 57.32% of the data's variance.

#### Latent Roots Criterion

Table 2. Latent roots criterion

	Eigenvalues	Proportion Variance	Cumulative Variance
Smart Service Accessibility	24.711	35.302	34.377
Dependable Banking Experience	5.932	8.474	42.72
User Access Assurance	4.07	5.815	47.746
Secure System Performance	2.995	4.279	51.635
Convenient Digital Engagement	2.444	3.492	54.818
Easy-Access Account Management	2.203	3.147	57.532

**Scree Plot**

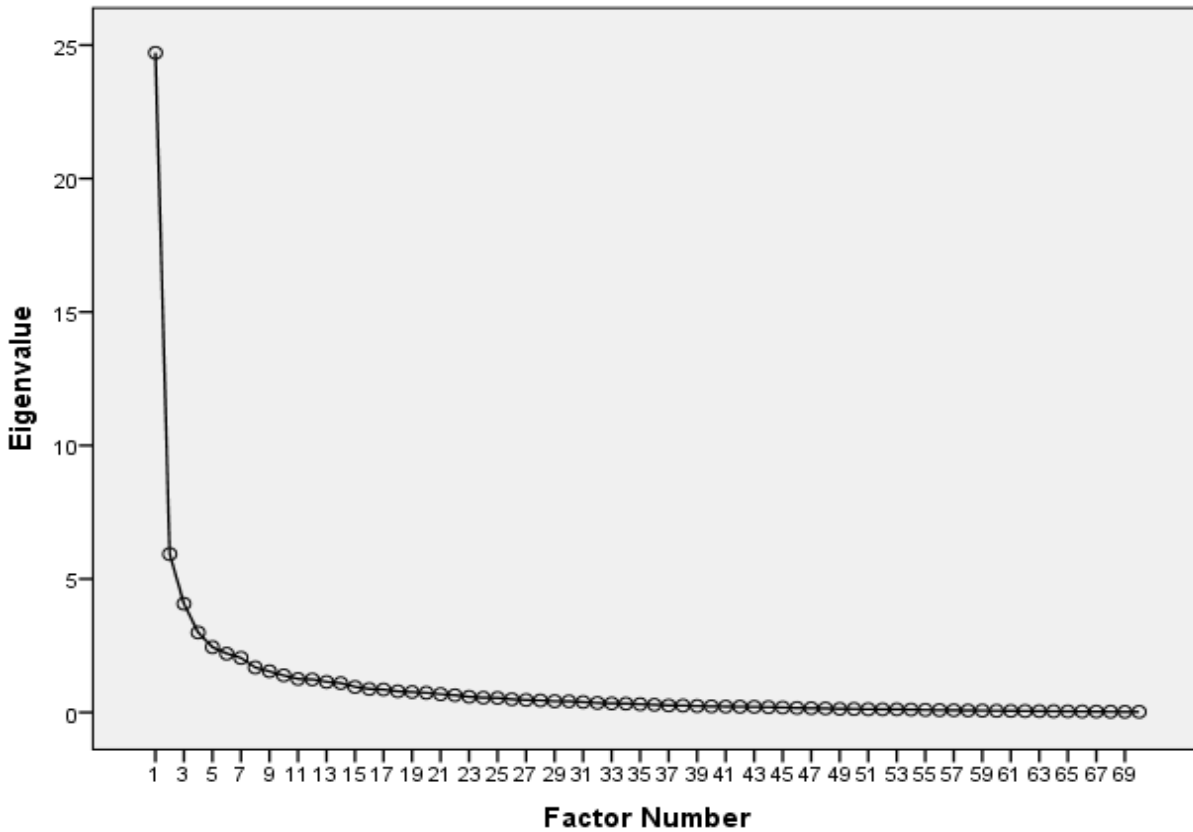


Figure 2. Scree Plot Showing the Extracted Factor

The Catell scree test, usually a graph plotted with eigenvalues within the x-axis, approximately reveals the six components in the y-axis, each with its corresponding eigenvalue. These results show an inclination to change when they decline towards the subsequent parts on the right, confirming a multidimensional structure. The scree plot is used to determine the optimal factor to retain (Buguis & Castro, 2025), eliminate once the drop stops, remove all elements after the one that initiated the elbow. It will result in a less steep descent when the curve forms alongside the elbow (Bartholomew et al., 2008).

In Table 3, principal component analysis (PCA) determines the factor loadings of the variables to assess whether particular items contribute to the shared data structure. It demonstrates how the particular items have been grouped based on the parameters determined. Moreover, Factor rotation improves the row and column arrangements, thereby optimizing the loading of a variable onto a single component (Hair et al., 2021). The research used the Promax rotation method to allow for correlations among components, resulting in a more distinct factor structure and a more robust evaluation of construct validity. The factor correlation matrix, which revealed strong inter-factor correlations and indicated that an oblique rotation was suitable, mostly supported these choices.

Table 3. Structure Loadings

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Uniqueness
I_30	0.665						0.253
I_38	0.769						0.257
I_39	0.767						0.369
I_40	0.630						0.51
I_41	0.815						0.197
I_42	0.678						0.227
I_43	0.709						0.402
I_44	0.74						0.331

I_46	0.685						0.318
I_48	0.718						0.273
I_27		0.775					0.23
I_67		0.683					0.291
I_77		0.889					0.117
I_79		0.836					0.162
I_56			0.707				0.361
I_58			0.746				0.194
I_61			0.771				0.277
I_63			0.806				0.248
I_49				0.813			0.265
I_50				0.855			0.147
I_51				0.709			0.349
I_74				0.705			0.343
I_18					0.645		0.448
I_19					0.779		0.198
I_20					0.76		0.279
I_22					0.657		0.305
I_31						0.7	0.343
I_32						0.761	0.291
I_37						0.606	0.236

Note: The applied Rotation Method is Promax.

**Note: Items with no factor loadings did not pass the ±0.60 factor loadings required in the analysis and are therefore eliminated**

Using the thematic analysis, the emerging factors are: (1) smart service accessibility, (2) dependable banking experience, (3) user access assurance, (4) secure system performance, (5) convenient digital engagement, and (6) easy-access account management. Twelve (12) items omitted from the factor analysis result, item numbers 4, 10, 11, 12, 13, 14,15,16,17, 24, 59, and 60. They failed to achieve the ±0.60 standard factor loadings for these items.

Table 4 displays the factor correlational analysis, indicating how closely the five extracted components are related to one another. To avoid split loading of the identified items, choose the rotation technique based on the table. Since the factors were significantly correlated (correlation coefficient = .70), oblique rotation (Promax) was used rather than orthogonal varimax.

Table 4. Factor Correlations

Component	1	2	3	4	5	6
1	1.000	0.296	0.548	0.363	0.379	0.127
2	0.296	1.000	0.599	0.24	0.596	0.447
3	0.548	0.599	1.000	0.502	0.646	0.406
4	0.363	0.24	0.502	1.000	0.33	0.088
5	0.379	0.596	0.646	0.33	1.000	0.405
6	0.127	0.447	0.406	0.088	0.405	1.000

**Factor 1: Smart Service Accessibility.** Table 5 presents that the first identified theme has removed 10 items. The coefficient range is 0.63 to 0.815. "I like being able to monitor my account through bank transfers and savings" had the highest values of 0.63 and 0.815, while the lowest was for the statement "I use QR codes for quicker payment transactions." All the coefficients of the items in this factor exceed the minimal threshold of +0.60. These ten statements are about easily accessing, controlling, and completing the transactions. Hence, the factor is termed "*Smart Service Accessibility*."

Table 5. Item loadings under Factor 1: Smart Service Accessibility

Item #	Item Statement	Coefficient	Factor
I_41	I like being able to monitor my account through bank transfers and savings.	0.815	Smart Service Accessibility
I_38	I like having full control over my account details and transactions.	0.769	
I_39	My transactions mainly involve bills payment, savings, credit card payments, and utilities	0.767	
I_44	I prefer digital banking for its convenience, accessibility, and BSP regulated.	0.74	
I_48	Loan balances are checked and updated once posted.	0.718	
I_43	I prefer digital transactions because they're easier and more convenient in today's digital age.	0.709	
I_46	I can easily link my bank account to bills payment in real-time, making transactions fast, convenient, and reliable.	0.685	
I_42	Banking is available 24/7 without needing ATM withdrawals.	0.678	
I_30	The banking app is user-friendly and accessible.	0.665	
I_40	I use QR codes for quicker payment transactions.	0.63	

Smart service accessibility in this study refers to the seamless, technology-infused provision of banking services that allow customers to easily access, control, and complete financial transactions in any place at any time.

Banking services have recently been used in more sophisticated ways in digital-only banking, which is sometimes referred to as virtual or internet-only banking. Digital savings accounts are savings accounts opened and maintained via a bank's website or mobile application, as defined by Odeh and Yousef (2021). It is nearly identical to other savings bank accounts in terms of characteristics. E-banking benefits include ease of use, accessibility, and quick service delivery, such as savings, which reduces the time customers spend in banks.

The study by van den Akker, Stewart, and Isoni (2023) revealed that contactless payment transactions are associated with a significant increase in savings, primarily due to more internal transfers (between an individual's accounts) from accounts without contactless payment to those with contactless technology. The digital era offers users the option to choose how they wish to manage their productivity and finances (Agravante, Soque, Villanueva, and Bragas, 2025). QR (Quick Response), which was initially a means of viewing information or websites, is now a crucial remote payment system that customers are growing accustomed to, particularly at eateries, cafes, bars, and other hospitality venues (Sorensen, 2021).

These days, QR code m-payment services are widely used, particularly in technologically savvy societies, because they are accepted more quickly, readily, and safely than other mobile payment methods (Liu et al., 2021a, b; Sun et al., 2021). The strengths of digital innovation hold its reputation for a convenient and fast-paced approach, which connects humans according to their appointments and everyday activities (Agravante, Soque, Villanueva, and Bragas, 2025).

**Factor 2: Dependable Banking Experience.** Table 6 unveils four items extracted from the second factor. The range of the coefficients is from 0.889 to 0.683. The statement "I find the bank's services reliable, responsive, and convenient." Had the highest value of 0.889 and 0.683 as the lowest for the statement "Login features like fingerprint or face recognition make me feel more secure when using mobile banking." All the coefficients of the items in this factor exceed the minimum threshold of +0.60. These four items speak to the features of highly effective e-CRM to achieve this; it must be secure, responsive, and reliable. Thus, it is termed as a "*Dependable Banking Experience*".

Table 6. Item loadings under Factor 2: Dependable Banking Experience

Item #	Item Statement	Coefficient	Factor
I_77	I find the bank's services reliable, responsive, and convenient.	0.889	Dependable Banking Experience
I_79	The bank has shown improvements in its service offerings, security features, and customer support.	0.836	

I_27	Banking is now convenient without the need to visit a physical branch.	0.775	
I_67	Login features like fingerprint or face recognition make me feel more secure when using mobile banking.	0.683	

Dependable Banking Experience in this study refers to the consistent delivery of secure, reliable, and responsive digital banking services that enhance customer trust and satisfaction.

Responsiveness belonged to the speed and quality of a company's products based on the interests of its customers (Reddy and Megharaja, 2021; Ramirez and Montecillo, 2022). In customer service, response time can be significantly improved through real-time analytics. Without the inconvenience of waiting for information to be available, chatbots, and virtual assistants can respond quickly to consumers' queries and concerns (Rane, 2023; Rane, Achari, and Choudhary, 2023). When compared to other banking tools, mobile banking offers unparalleled convenience. To encourage their clients to use m-banking, financial institutions advertise their services for their affordability and ease of use (Shankar et al., 2021).

"Cashless" while enhancing the security of the current system. This system with robust, extensive safety measures is necessary to make users feel safe and, consequently, discourage the use of cash, which is essential for people to believe in the idea of going completely paperless (Abesoyi et al., 2021). Recent research on security concerns in digital banking suggests that, since verification is almost impossible to circumvent, biometric-based security measures further enhance the usefulness and effectiveness of mobile banking. The reason is that passwords are easier to obtain than biometric traits, such as fingerprints, facial photographs, palm veins, irises, etc (Wodo et al., 2021). A highly secure and dependable security technology, the facial recognition system is gaining popularity all over the world.

**Factor 3: Sense of Accountability and Trust.** Table 7 presents the third factor, which has been eliminated from five statements. The range of coefficients is 0.806 to 0.707. The record "The use of AI fraud detection and two-factor authentication increases my confidence in the security of my transactions." had the highest value of 0.806 and 0.707 as the lowest for the statement "Only registered phones are allowed to access the account." Every item's coefficient in this factor is greater than the minimal cut-off point of +0.60. These four items pertain to the use of artificial intelligence (AI) to enhance users' confidence in the accessibility and security of their transactions. Thus, the factor is termed as "*User Access Assurance*."

Table 7. Item loadings under Factor 3: User Access Assurance

Item #	Item Statement	Coefficient	Factor
I_63	The use of AI fraud detection and two-factor authentication increases my confidence in the security of my transactions.	0.806	User Access Assurance
I_61	Regular system updates are likely done to enhance security.	0.771	
I_58	Oftentimes, I receive constant reminders about hacking risks and not sharing OTPs.	0.746	
I_56	Only registered phones are allowed to access the account.	0.707	

User Access Assurance in this study reflects using artificial intelligence (AI) and security measures to ensure safe access and build users' confidence in their online banking transactions.

Artificial Intelligence (AI) offers automated, real-time detection and prevention, making it a possible solution for stopping fraud in mobile banking. Compared to conventional methods, AI-driven solutions employ machine learning algorithms to explore large volumes of transaction data, identify trends, and more accurately predict fraudulent events (Li et al., 2022; Mai et al., 2021). AI technologies, which include anomaly detection, natural language processing (NLP), and deep learning, have shown considerable potential in identifying suspicious behavior and reducing false positives, a common challenge in fraud detection (Baesens et al., 2021). For instance, transaction tampering is prevalent, involving the modification or interception of mobile banking transactions, often at the point of authorization, leading to unauthorized fund transfers (Bui-Huu, Le-Nhat, and Nguyen-An, 2024). AI-driven systems enable real-time transaction monitoring, delivering prompt notifications when questionable conduct is detected.

Biometrics is more reliable and trustworthy than traditional password means of authentication, such as OTP (One-Time Password) (Sane, 2021; as quoted in (Machap, 2023). In addition to the fact that the user does not need to enter their PIN, biometric input is a specific characteristic of the human body, such as fingerprints, faces, irises, etc. (Machap, 2023). To further enhance security, facial recognition can be used in conjunction with passcode authentication to replace one-time passwords, thereby strengthening a mobile banking system (Symanovich, 2021). These systems adopted the following authentication methods: biometrics (facial recognition, fingerprint), contextual (location, device recognition), and classic (password, PIN). To balance security and user ease, the AI component automatically decides whether additional criteria are needed (Salman and Mishra, 2024).

**Factor 4: Secure System Performance.** Table 8 below shows the fourth factor, which extracted four items. The range of coefficients is 0.813 to 0.705. The statement "I feel confident and worry-free about my banking transactions and security" had the highest values of 0.813 and 0.705. At the same time, the lowest was for the statement "Failed transactions during downtime are processed once the system is restored." All the coefficients of the items in this factor exceed the minimum threshold of +0.60. These four items suggest that e-CRM must make its clients worry-free and secure in their digital transactions. Thus, the factor is termed "*Secure System Performance*."

Table 8. Item loadings under Factor 4: Secure System Performance

Item #	Item Statement	Coefficient	Factor
I_50	The system works smoothly for me — no glitches, no lost funds, and no breaches.	0.855	Secure System Performance
I_49	I feel confident and worry-free about my banking transactions and security.	0.813	
I_51	Account access is secure through facial or eye authentication.	0.709	
I_74	Failed transactions during downtime are processed once the system is restored.	0.705	

Secure System Performance in this study reflects users' confidence in safe, reliable banking, ensured by fraud prevention, fund protection, and smooth transaction recovery.

Several studies by Indrasari et al. (2022), Khatoon et al. (2020), and Manju (2020) have shown that client fulfilment is determined primarily by security, and an individual's level of pleasure depends on how confident they feel about their anonymity. Customer trust in the protection of consumer privacy is a fundamental need for contentment while the security is the primary determinant of customer satisfaction. Vejačk (2021) found that, when it comes to the confidence and security of using digital banking, security measures are crucial for gaining people's trust. Additionally, users should keep their accounts up to date to strengthen account protection. Evidence also supports that these practices are effective in enhancing overall account security (Riasat, Shah, and Gonul, 2025).

Cybersecurity has expanded significantly and is a critical pillar of E- CRM; consequently, security breaches on E- CRM sites have resulted in significant financial losses (Jafari and Rasoolzadegan, 2020). Data on user accounts should be readily available, which is made possible by the 'A' in the CIA triad: availability. It usually happens when a failed transaction during system maintenance is processed only when the system resumes. When there is a disruption or failure in m-banking services, this may result in lower client satisfaction and have negative consequences on their usage patterns (Kamboj, Sharma, and Sarmah, 2022). The availability of the services makes a customer return again and again to the mobile banking services, but with an equal proportion of security performance (Malhotra, 2025).

**Factor 5: Convenient Digital Engagement.** Below is Factor 5, which extracted four items in Table 9. The range from coefficients is 0.779 to 0.645. The statement "Bank's sale alerts, promos, and discounts also appear on my social media accounts." had the highest value of 0.779 and 0.645 as the lowest for the statement "My bank frequently sends updates on savings rates, loans, insurance, promos, and rewards." All the statement's coefficient values in this factor pass the minimal requirement of +0.60. These four items suggest that a highly effective e-CRM must implement painless engagement while intensifying its marketing campaign. The bank has prioritized convenience and engagement at par. Thus, the factor is termed "*Convenient Digital Engagement*."

Table 9. Item loadings under Factor 5: Convenient Digital Engagement

Item #	Item Statement	Coefficient	Factor
I_19	Bank's sale alerts, promos, and discounts also appear on my social media accounts.	0.779	Convenient Digital Engagement
I_20	Bank's social media sites shares financial tips, savings advice, and promotional offers.	0.76	
I_22	I find it easy to open an account online through the bank's website.	0.657	
I_18	My bank's frequently sends updates on savings rates, loans, insurance, promos, and rewards.	0.645	

Convenient digital engagement in this study refers to the ease of interacting with the bank through digital platforms, wherein customers can receive timely updates, promotions, and financial services with minimal effort.

Customer engagement can be achieved by offering personalized experiences, using predictive analytics to anticipate future demand, enabling real-time interactions, and analyzing customer sentiment and comments. Businesses can improve overall customer satisfaction by using these capabilities to develop more meaningful and responsive communication strategies (Ijomah, et al., 2024). To attract and retain an active clients, the business may strategize its marketing operations through tailored retention offers for example, promotional discounts or special services, through understanding those early signs of losing customers, such as decreased usage or unfavorable reviews (Solomon et al., 2024a; Uzougbo et al., 2024b). At the same time, marketing messages that are timely and contextually relevant can be delivered by real-time analytics. When clients approach the physical store, for instance, a retailer can send push alerts about flash deals or special offers to their smartphones (Singla & Jangir, 2020; Uzougbo, Ikegwu, & Adewusi, 2024e).

Personalized product offers are affecting the e-CRM bank's efficiency. Banks must also remain up to date with their customers' needs to deliver their goods and services in line with customer requirements (Al-Hashem, Al-Laham, and Almasri, 2022). Through technological advancements, digital banks can offer superior and additional service benefits, thereby providing a better customer experience (Chauhan et al., 2022). It aims to satisfy each client and to develop a close relationship with them. Customers want individualized interactions and advice in today's competitive marketplace (Ikegwu, Joel, & Oguanobi, 2024; Joel & Oguanobi, 2024c; Lopez, 2023). The CRM strategies are intended to increase client pleasure and loyalty by proactive interaction, targeted marketing, and individualized services (Imenda & Mpundu, 2025).

**Factor 6: Easy-Access Account Management.** Below is Factor 6, which extracted three (3) items in Table 10. The range from coefficients is 0.761 to 0.606. The statement "Updating my personal information is easy and convenient" had the highest value of 0.779 and 0.645, as the lowest for the statement, "Loan applications are easier due to accessible bank statement tracking." All the statement's coefficient values in this factor pass the minimal requirement of +0.60. These three items suggest that to achieve effective e-CRM, there should be the convenience of handling personal and financial information, allowing users to update, process, and manage transactions efficiently. Thus, the factor is termed "*Easy-Access Account Management*."

Table 10. Item loadings under Factor 6: Easy-Access Account Management

Item #	Item Statement	Coefficient	Factor
I_32	Updating my personal information is easy and convenient.	0.761	Easy-Access Account Management
I_31	Mobile banking is convenient, with real-time payments and no clearing delays.	0.7	
I_37	Loan applications are easier due to accessible bank statement tracking.	0.606	

Easy-access account management in this study refers to the convenience of managing personal and financial transactions through digital platforms with ease and efficiency.

The published studies conducted by Siswoyo and Irianto (2023); and Elhajjar and Ouaida (2020) asserted that consumers' attitudes toward using mobile banking will be positively impacted by how simple it is for them to do

so, as well as the quantity of payment options that make it simpler for them to use a single application. Furthermore, Ho and Chow (2023) stated that client happiness or contentment is significantly associated with trust. While, Siswoyo and Irianto (2023) noted that service accessibility significantly affects clients' expectations for the benefits of an application service, such as mobile banking.

This means that demonstrating greater service security will enhance consumer trust, which in turn will boost customer satisfaction. Convenience is what mobile banking offers customers. With it, a person can conduct transactions without visiting a physical bank branch and manage their money at any time and place. Gupta and Sharma (2021) found that mobile banking enhances customer satisfaction by offering quick and simple access to financial services.

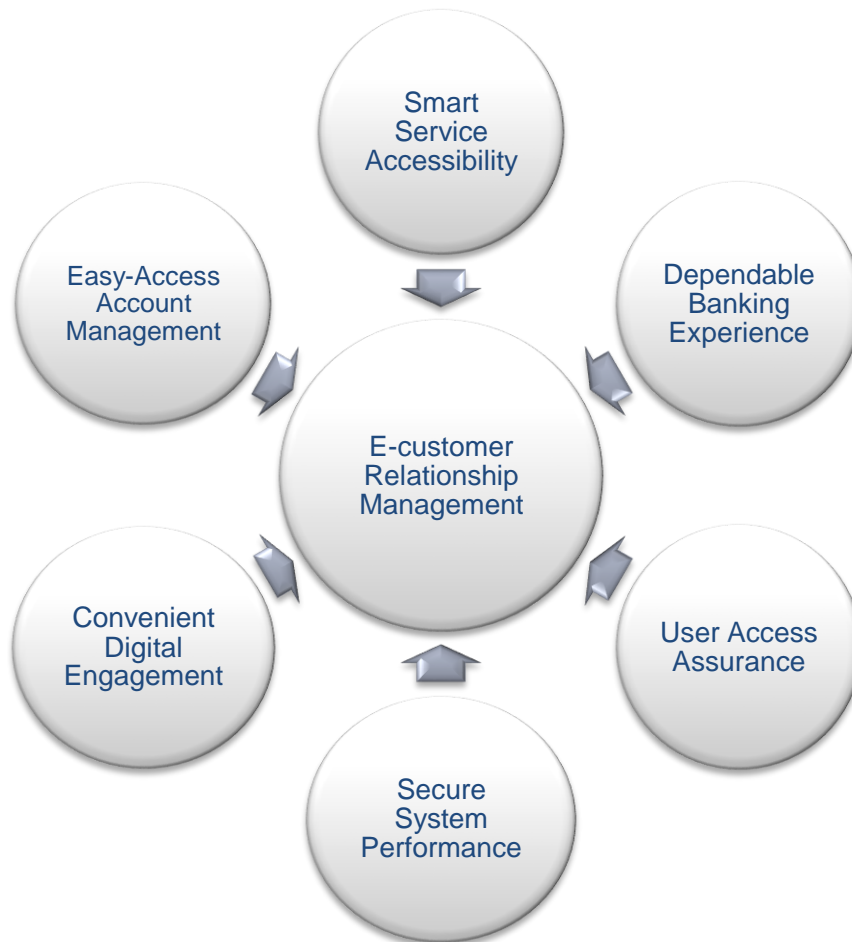


Figure 3. Dimensions of e-Customer Relationship Management in Banking Sector

### Confirmatory Factor Analysis

This phase focuses on the outcomes of model creation, with the intention of validating the measuring tool. The objective is to determine the essential components of a highly successful e-CRM. The researcher uses confirmatory factor analysis (CFA) in the 28-item validation; however, it is necessary to conduct a CFA once the elements have been carefully analyzed. CFA is a statistical analysis used to determine how many factors, features, and observed factor loadings correspond to theoretical predictions.

The main objective is to evaluate a present latent structure under the guidance of a theory (Byrne, 1998; Hoyle and Panter, 1993). In this study, validating the structure of the qualities of an efficient e-CRM in the banking industry is essential. Based on the recently identified high-impact characteristics that facilitate successful e-CRM deployment in the banking sector, this analysis helps determine the best model to apply. Statistics has provided several criteria for determining proper fit indices. While a 0.90 result was previously considered acceptable, the authors suggested that values above 0.95 now indicate a suitable fit. They also suggested using various assessments to support a model exhibiting acceptable fit indices (McNeish and Wolf, 2021; Goretzko, Siemund, and Sterner, 2024). Hence, it is imperative to evaluate any changes or modifications to the model from both

theoretical and statistical lenses when deciding which the most suitable model is, choose one with 95% or greater accuracy.

The results showed that the Confirmatory Final Model best captured the characteristics of a highly effective e-CRM in banking. This model emerged with both theoretical and statistical soundness in mind. The confirmatory final model's structural validity and excellent fit to the data are supported by the study reported in Table 11, in which all key fit indices fall within acceptable limits. The model's Chi-square to degrees of freedom ratio ( $\chi^2/df$ ) of 2.915 was sufficient, well below the suggested maximum of 3.00.

Supporting this result, the gradual fit indices showed a high degree of model adequacy and overall fit, above the desired threshold of 0.95 for both the Tucker–Lewis Index (TLI = 0.956) and the Comparative Fit Index (CFI = 0.973) (Hu & Bentler, 1999; Hair et al., 2019). The work of Byrne (2016) indicates that the Goodness-of-Fit Index (GFI = 0.999) suggests that the model provides an excellent absolute fit by accounting for almost all identified covariances in the dataset (Byrne, 2016). Further, Root Mean Square Error of Approximation (RMSEA = 0.080) indicates an acceptable level of approximation inaccuracy by meeting the recognized upper limit of < 0.08 (Hooper, Coughlan, and Mullen, 2008). The proposed model, in conclusion, represents a believable and statistically admissible reproduction of the population covariance matrix, as indicated by the p-value (PCLOSE = 0.045). Combined, the numerous fit indices show strong and persistent growth, confirming the model's structural validity and applicability for precisely evaluating the characteristics of an effective e-CRM.

These fit indices collectively show a steady improvement from Model 1 to the finished model, demonstrating the value of iterative model improvements informed by both theory and empirical data. By more accurately and concisely reflecting the fundamental variable structure, the final model is a better fit, highlighting its suitability as the final measurement model (Schumacker & Lomax, 2016; Hair et al., 2019).

Table 11. Model Fit Indices for the e-Customer Relationship Management

	X <sup>2</sup>	X <sup>2</sup> /df	GFI	CFI	TLI	RMSEA	PCLOSE
Baseline mode	2530.267	6.989688	0.967	0.656	0.614	0.141	0
1. Modification (Dependable Bank Experience) & (easy-account mgt.)	37.894	2.915	0.999	0.973	0.956	0.08	0.045
Acceptable Values		<3.00	>0.90	>0.90	>0.90	<0.08	>0.05

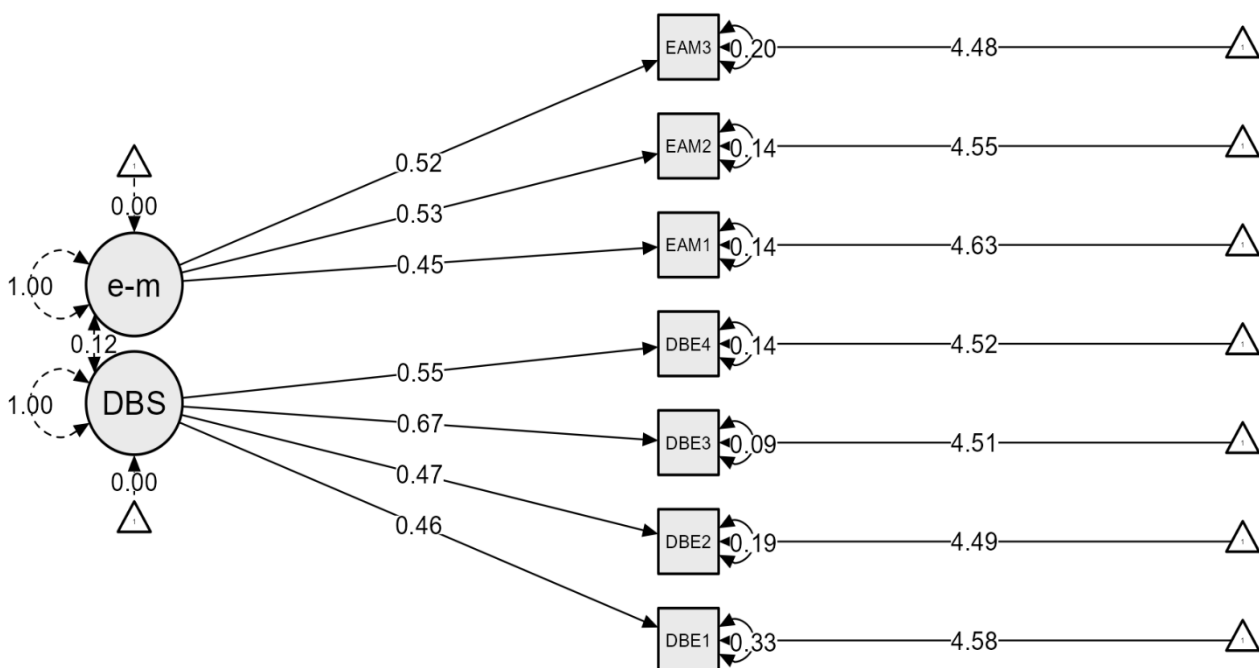


Figure 4. CFA Final Model Diagram

In the final model, each fit parameter fell within the acceptable range, and the connections between the underlying attributes were significant ( $p < 0.05$ ). These findings support the claim of Sathyanarayana and Mohanasundaram (2024), who explained that they developed the model with consideration for both theoretical and statistical soundness. This posits that the two tested models fit each other better, as seen by the bigger values of these model fitness indices.

The investigations also revealed a correlation between the parameters used to identify the characteristics of e-CRM in the banking sector offers a reliable banking experience and convenient account management. The value of e-CRM is that it provides a successful means of understanding customer needs and creating experiences that increase customer happiness and trust in the digital age (Ahmad and Hameed, 2025). The research by Kim and Park (2021) indicates that high service quality in the form of the reliability, responsiveness, and personalization of services results in increased customer satisfaction with the services and, hence, enhanced customer retention rates.

E-CRM is a technology, system, or software tool that makes it simple to access client information to improve service delivery to their customers (Peppers et al., 2021). The need to integrate e-CRM systems to sustain client loyalty shows that advanced e-CRM systems that provide personalized experiences and efficient service increase customer satisfaction and, hence, the loyalty (Nguyen & Cao, 2021). On the other hand, banks can build closer connections with their customers and increase loyalty with the help of E-CRM systems, thanks to enhanced features and functions that enable personalized, efficient, and responsive service. More meaningful interactions with customers and impact on their overall happiness and retention may be achieved if banks engage with and optimize their E-CRM strategies (Suchitra & Merugu, 2023).

## CONCLUSIONS AND RECOMMENDATIONS

The study revealed six dimensions of an effective e-CRM. Specifically, these include smart service accessibility, dependable banking experience, user access assurance, security system performance, convenient digital engagement, and easy-access account management.

These recommendations aim to align emerging e-CRM trends in the banking industry with the relevant dimensions identified in the developed measurement framework. In relation to this, Factor 1 Smart Service Accessibility in this study had the highest eigenvalue. But it was removed due to the absence of distinct construct identity and apparent item redundancy, suggesting the presence of a 'general factor'. This indicates a potential overlap in the initial item generation phase that required more rigorous distillation. In contrast, the final model's discriminant validity and model fit improved with the unique attributes of Easy-Access Account Management and Dependable Banking Experience. The established e-CRM model, which is backed by exploratory and confirmatory factor analyses, explains the crucial role of technological development in strengthening DBE and promoting EAM, both of which improve customer engagement, service personalization, and operational efficiency. The ability of current e-CRM systems to adapt must be periodically reviewed to ensure they can keep pace with the evolving digital landscape, new regulations, and changing customer needs. On top of that, combining e-CRM framework with digital banking operations can provide businesses a long-term advantage in uncertain times brought by new technologies and changing consumer demands. By providing a survey validated and informed by theory, this work explains us our understanding of e-CRM in digital banking contexts.

The final model comprises Dependent Banking Experience (DBE) and Easy Access Account Management (EAM), two distinct yet strongly associated dimensions of e-CRM. It has received a little attention in quantitative development research, but this idea has recently become an even more critical component in the digital financial world.

First, bank management and policymakers are encouraged to use the validated e-CRM framework, especially in their company's performance assessment and strategic planning activities. Moreover, financial institutions will be able to evaluate the quality of client engagement, system functionality, and service-responsive delivery. Data-driven decision making and continuous improvement can be best supported by incorporating these e-CRM dimensions into management monitoring dashboards, which are capable of providing actual data when it comes to customer satisfaction and loyalty.

Second, operational managers and the Internet Technology (IT) division are encouraged to improve their digital infrastructure, while make sure that their systems are well integrated and adequately supported for digital banking operations. Also, they strongly encourage conducting regular audits, applying updates on time, and strengthening cybersecurity to ensure dependable service and protect customer trust. Combining technological improvements with user experience, operational efficiency, and service quality can improve customer transactions, primarily through the validated e-CRM dimensions such as DBE and EAM.

Third, human resources and training departments may conduct an annual capacity building initiative to update employees' e-CRM competencies. Specifically, those assigned to the customer service associate and digital support departments should be capable of managing digital platforms and e-CRM systems and effectively responding to clients in the digital sphere. Integrating key e-CRM concepts into staff training and performance appraisal can further strengthen customer-centered practices and the priority of maintaining the best digital service experience.

Fourth, marketing and customer experience teams may use the e-CRM indicators of this study to refine how they accurately categorize their clients and design engagement strategies. They can also personalize their marketing efforts, communication approaches, and loyalty programs to harmonize with customer activity patterns in the digital banking system by understanding which e-CRM functionality contributes to customer satisfaction and retention.

Meanwhile, academic institutions that offer courses such as marketing, business, or financial technology may integrate this validated e-CRM scale in their learning materials to help their students understand more about customer relationship management and digital banking practices. It can also scaffold case discussions, practical simulations, and research projects focusing on customer retention, trust building, and personalized services in digital banking systems.

Finally, to enhance future research, scholars may expand the geographical scope beyond a single region to validate the framework's applicability across varied cultural and economic landscapes. There is also a critical need to investigate how these e-CRM dimensions influence long-term user loyalty and satisfaction, moving beyond structural validation toward examining behavioural outcomes. Future studies may examine the serviceability of e-CRM dimensions for underbanked groups, such as baby boomers and retirees, who often encounter barriers to adopting digital banking services in areas with low financial inclusion. Investigating e-CRM strategies can increase awareness of inclusive and equitable digital financial services by influencing digital onboarding, trust building, and service acceptance among the unbanked community.

In conclusion, the objective of this study was to fill the empirical gap in the Philippine context by developing and validating a specialized, contextually relevant scale that captures the characteristics of e-CRM in the banking industry. The findings showed six underlying dimensions that offered a well-defined framework for assessing digital relationship experiences: smart service accessibility, dependable banking experiences, user access assurance, security system performance, convenient digital engagement, and easy-access account management. The final model retained dependable banking experience (DBE) and easy-access account management (EAM) as one of the notable predictors, demonstrating an important role in establishing continual relationships and client trust. This study is grounded in Berry's Relationship Marketing Theory; these findings showed that, in the face of growing competition brought by the accelerating rate of the digital revolution, delivering digital services in a consistent, dependable, and uninterrupted manner is essential to enhancing retention and acquisition of clients. Building on these insights, banks may maintain their market position by incorporating AI-driven and real-time data into their e-CRM systems. Through scalable digital infrastructures, institutions can be developed to better understand changing customer patterns and compete in a digitally driven financial market.

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