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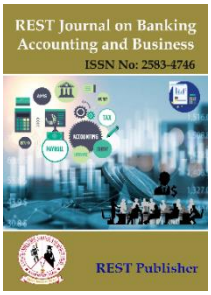

Evaluation of Quality Online Banking Services Using WASPAS Method

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Abstract: *The rapid expansion of the Internet and advances in digital technology have revolutionized traditional banking methods, leading to the emergence of online banking. Online banking enables customers to conduct financial transactions anywhere, anytime, with unprecedented convenience and accessibility. This paper provides a comprehensive analysis of online banking, examining its benefits, challenges and impact on both banks and consumers. Key aspects such as security concerns, customer satisfaction, cost effectiveness and complexity in implementing online banking systems are discussed. Also, how online banking is reshaping the banking landscape, promoting greater competition, financial inclusion and digital transformation in the global economy. The advent of the Internet and digital technologies has fundamentally changed the way financial institutions operate, paving the way for online banking. Online banking, also referred to as internet or e-banking, allows customers to access a wide range of financial services through digital platforms. These services include checking account balances, transferring funds, paying bills and managing investments all from the convenience of a personal device. As customers increasingly demand fast, convenient and secure banking services, financial institutions have responded by embracing digital transformation. The shift to online banking has brought significant benefits such as reduced operational costs, improved customer experience and increased efficiency in financial services. However, along with these advantages, banks also face challenges related to cyber security, customer trust and the need for continuous technological upgrades to meet evolving consumer needs. The importance of research related to online banking lies in its profound impact on the global financial system and its growing relevance in the digital age. Understanding online banking is important for financial institutions, regulators and customers as it changes traditional banking practices and introduces new opportunities and challenges. Technological Advances and Innovations: Online banking is at the forefront of financial technology (FinTech), creating innovations in service delivery. Exploring this area allows for a deeper understanding of how technological advances such as mobile banking, artificial intelligence (AI) and block chain are improving efficiency, customer experience and the competitive landscape of banking institutions. Customer Behavior and Satisfaction: As more consumers shift to digital platforms, research on online banking provides insights into changing customer expectations and behavior. It highlights key factors influencing customer satisfaction, including usability, convenience and trust, helping banks refine their services to meet growing demands for seamless, personalized experiences. Cost Efficiency and Operational Impact: The financial sector has experienced significant cost reductions and operational improvements through the adoption of online banking. Understanding how banks can use online platforms to optimize resource allocation, reduce transaction costs and improve efficiency is critical for stakeholders looking to stay competitive and increase profitability. Security and risk management: As online banking systems become more pervasive, so do the associated risks—especially those related to cyber security. Research in this domain is essential for developing effective security protocols, understanding fraud prevention strategies, and managing data privacy concerns. It ensures continuous improvement of security measures to protect both financial institutions and consumers. Customer Satisfaction (Benefit), Transaction Speed (Benefit, sec), Implementation Cost (Non-Benefit, $000), Security Rating (Non-Benefit). System A, System B, System C, System D, System E.*

1. INTRODUCTION

Over the past decade, online banking systems have gained significant popularity. These systems allow users to make financial transactions over the Internet using their electronic devices as long as they have an Internet connection. Online banking is known by various names including e-banking, virtual banking and internet banking. An online banking system generally consists of two main phases: the registration phase and the login phase.

Although the registration process is generally the same across all banks, there are two levels of security at the login stage. The first uses a user ID and transaction password, while the second level uses advanced security measures such as one-time passwords, grid authorization cards, QR codes, biometric systems, security questions and e-tokens. These security mechanisms are designed to protect customer accounts from cybercriminals. Skilled hackers can compromise financial institutions' online systems, introduce malicious viruses, or compromise banking information by corrupting data, reducing the effectiveness of these systems. As a result, banks implement high-level password protection systems to prevent such attacks. This survey will provide an in-depth analysis of advanced password protection systems used by various banks and compare nationalized and private sector banks from different perspectives.[1]. The banking sector is currently leading the way in providing technology-based services. Interestingly, it is banks, not consumers, who are moving towards these technology-based services by encouraging customers to use more cost-effective delivery channels. This change affects the perceived value of banking services as customer interactions with the service are increasing without direct contact with bank employees. Customers are now engaging with technology-based self-services such as ATMs, online platforms and mobile apps to manage their banking needs. These self-service technologies, defined as "technological interfaces that enable customers to perform services without direct employee involvement," allow customers to create value without the direct participation of the service provider. Some argue that technology is replacing personal service interactions entirely. Consequently, how to create service value in this new landscape is a key challenge for the banking industry. Traditional value-adding elements no longer hold the same importance. Most research in the banking industry focuses on measuring and describing service quality rather than exploring the concept of service value. However, There is a growing interest in investigating factors influencing the quality and adoption of technology-based banking services. Although research on e-service value is not as extensive as e-service quality, despite its importance in online banking, there is a significant gap in studies addressing e-service value. This paper aims to develop a conceptual framework to better understand the value derived from online banking services. Drawing from the Nordic School research paradigm, grounded in service management and marketing studies, it emphasizes value in use from the customer's perspective. Previous research has proposed a four-dimensional value model, including functional, temporal, spatial, and relational aspects. Recent studies have extended this model by introducing sub-dimensions within the temporal and spatial dimensions. Advances the field by developing a new four-dimensional model that provides a comprehensive overview of online banking service value. It first assesses the relative importance of each dimension and examines its sub-dimensions. By providing a multidimensional and hierarchical framework for online banking service value, this study enriches the existing literature by combining both qualitative and quantitative methods through a channeling research approach. Quantitative analysis, using integrative analysis, underscores the importance of temporal and spatial dimensions, while qualitative insights reveal the different ways each dimension can help increase service value. For the banking industry, this concept provides practical insights by shifting the focus from service quality to service value..[9]. Online banking, also known as Internet banking or e-banking, has revolutionized the way individuals and businesses manage their finances. With the use of the Internet, banks now offer a wide range of services that allow customers to make transactions, monitor accounts and access financial information at their convenience. Unlike traditional banking that relies heavily on in-person visits and physical documents, online banking provides a digital interface that enables users to handle their banking needs from anywhere with an internet connection. The evolution of online banking has been driven by advances in technology that have changed customer expectations and the banking landscape. As financial institutions continue to innovate, they are pushing customers towards more cost-effective, technology-based service delivery channels such as mobile applications, automated teller machines (ATMs) and web-based platforms. These digital interfaces allow users to complete transactions independently without face-to-face interaction with bank staff. As online banking is integrated into everyday life, security and privacy concerns have also increased. Financial institutions have responded by developing stronger security systems, including multi-factor authentication, encryption technologies and biometric verification systems. This ensures that customers' sensitive data and accounts are protected from unauthorized access and cyber threats. As customers' trust in online banking increases, the industry faces new challenges and opportunities. Understanding customer needs, improving service value and maintaining security are now critical for banks to succeed in a rapidly evolving environment. Online banking, often referred to as Internet or e-banking, has become the cornerstone of modern financial services, allowing customers to manage their accounts and conduct transactions from anywhere with Internet access. Over the past few decades, it has transformed the traditional banking model, providing convenience, efficiency and accessibility to millions of users around the world. Unlike traditional banking, which requires a physical presence at a branch, online banking enables customers to access various financial services through digital platforms such as transferring funds, paying bills, checking balances and applying for loans. This change is driven by advances in technology and the growing demand for more convenient, self-service financial tools. Banks have invested heavily in online systems to meet customer expectations. However, as online banking grows in popularity, so do security concerns. Financial institutions are now using advanced security measures such as multi-factor authentication, encryption and biometric systems to protect customer information from cyber threats. As online banking continues to evolve, its

importance in the financial sector deepens, presenting both challenges and opportunities for organizations to improve user experience, ensure security, and build trust with customers. Virtual banks, also known as "branchless banks," represent a relatively new concept in banking. These companies operate without a physical branch, offering their services exclusively through the Internet and ATMs for tasks such as depositing or withdrawing funds. Online banking differs significantly from traditional branch banking, particularly in how customers connect to the bank's information processing system. In the past, customers interacted with front-desk staff who accessed the bank's systems on their behalf. However, with online banking, customers can directly access the bank's information system from any location with an internet connection, such as home, work or school. In this new system, the customer becomes the end user of the bank's data processing system, with their personal computer playing an important role in making transactions. Users of online banking typically engage in tasks such as transferring funds between accounts, requesting credit card advances, ordering checks, managing investments, and trading stocks. From the bank's point of view, using the Internet for service delivery is more efficient than traditional delivery methods because it helps expand the customer base. With the increasing convenience around online banking, many believe that it is necessary for community banks to offer such services. Esser and Simpson's research highlights the key benefits of e-banking, including gaining competitive advantage, improving customer retention and attraction, increasing revenue, and reducing costs. The following sections examine behavioral adoption theories, examine various models that explain how users adopt new technologies, and highlight their similarities and differences.[13]. Online banking can be defined in various ways. Daniel described a bank as providing information and services to its customers electronically, wired or wirelessly. In the financial industry, the terms online banking, electronic banking (e-banking) and internet banking are commonly used interchangeably. As outlined by the Central Bank of Malaysia (Bank Negara Malaysia, BNM), online banking is divided into three categories of websites: information, communication and transaction. Online banking is expected to grow significantly in Malaysia. In the future, many scholars have identified ten key factors that affect the adoption of online banking in Malaysia: ease of use, accessibility, available features, bank reputation and management, security, privacy, website design, content, speed, and fees, et al., accessibility, reluctance, They indicated that cost, trust in banking, security concerns, convenience and ease of use, awareness, attitude towards technological change, cost of computer and internet access, trust in banking, security, ease and convenience were important factors in adopting online banking.[18]. The advent of the Internet and technological advancements, particularly with the introduction of sales and commercial financial transaction systems, have changed the landscape significantly in recent years. Financial institutions now face greater risks due to factors such as the global and ubiquitous nature of electronic systems, the rapid pace of technological innovation, the integration of online transaction protocols, and reliance on legacy networks coupled with the growing trend of outsourcing. Many financial institutions recognize that online transactions primarily increase data security risks. Risk management practices evolve slowly compared to the rapid growth of companies that often overlook incorporating these principles into their business strategies. This chapter provides an overview of the various risks associated with online financial transactions and effective methods for managing these risks. Types of Online Banking Risks: Online financial transactions do not introduce entirely new types of risk, but instead emphasize risks that many financial institutions already face. It is imperative that boards and senior management are aware of these risks and address them appropriately.[23]. Customers engage with their banks in a variety of ways. While branch counters have traditionally been the primary point of transactions, advances in technology have eased the burden on customers. The introduction of ATMs in the center made certain transactions easier. Telephone banking, which started with human operators, later switched to automated voice systems, further reducing the need for physical visits to bank branches. The rise of the Internet has significantly improved the ease of banking and enabled institutions to offer additional services, further reducing the need for branch visits. The cost of building transactional websites has dropped significantly in recent years, making the associated cost savings more profitable. Although exact figures for setting up such websites are difficult to determine, financial consulting firm Client estimates that building an internal online banking system costs more. However, outsourcing this service is significantly cheaper, making it a more attractive option for smaller banks like those in our sample.[24].

2. MATERIALS AND METHODS

Banking Technologies: ATMs: Machines used for withdrawing, depositing and other transactions without the need to visit a branch. Telephone Banking Systems: Initially human operated and later automated systems were used to perform banking transactions over the phone. Transaction Portals: Websites designed to facilitate online banking transactions, offering services such as account management, bill payments and fund transfers. Cost Data: Internal Online Banking Systems: Historical cost estimates for setting up internal online banking systems. Outsourced systems: The relative costs of outsourcing online banking services are significantly lower than developing them in-house. Internet Infrastructure: Internet Service Providers (ISPs): Essential for providing reliable Internet access to banks and their customers for online transactions. Secure Transaction Protocols: Encryption and security technologies to protect customer data during online banking transactions. Historical

analysis: Data on the development and implementation of online banking technologies were collected from financial consulting firms (eg, Celent) and historical records of ATM and website implementation. Cost Analysis: A comparison between the costs of setting up in-house and outsourced online banking systems, focusing on the cost reduction trend to date. Technical Assessment: ATM Deployment: Assessed the impact of ATMs on transaction efficiency and customer interaction with bank branches. Telephone banking: An analysis of the transition to human-operated voice-automated systems and its effect on branch traffic. Internet Banking: An assessment of the increased use of online banking, focusing on its role in reducing branch visits and providing new services. Bank Sample: Data was collected from a sample of small banks to assess the financial feasibility of implementing online banking systems, particularly through outsourcing. This section outlines the tools, technologies, and methods used to study the evolution and implementation of online banking, with a focus on cost efficiency and customer convenience. Online Banking Platforms: Transaction Portals: Websites used by banks to facilitate online banking services including account management, bill payments and transfers. ATMs and Telephone Banking: Used as comparative technologies to evaluate efficiency and cost savings from online banking. Performance Parameters: Cost Efficiency: The total cost of implementing online banking platforms (eg, initial setup, maintenance and operational costs). Customer Satisfaction: Measured through surveys or customer feedback on the convenience, usability and overall experience of online banking. Security: Evaluating online security features such as encryption and secure protocols to ensure the safety of financial transactions. Implementation complexity: The level of difficulty in setting up and maintaining an online banking platform, especially for smaller banks. Online Banking Systems: Transactional Websites: Websites that provide banking services such as account management, bill payment and fund transfer. Mobile Banking Apps: Applications for Smartphone and tablets that provide functionality similar to transaction e-sites. Technology Infrastructure: Internet and Network Infrastructure: Essential for running online banking services including ISPs and secure network connections. Security Protocols: Technologies to secure online transactions such as SSL/TLS encryption, multi-factor authentication, and fraud detection systems. Cost Data: Development and Maintenance Costs: Data on costs associated with developing and maintaining online banking systems, including in-house development and outsourced solutions. Operational Costs: Ongoing costs associated with operating online banking services, including server costs, software updates and customer support. Customer Data: Satisfaction Surveys: Customer perception of online banking experience, including ease of use, reliability and overall satisfaction. Usage Statistics: How often customers use online banking services and the types of transactions made. Performance metrics: Cost-Efficiency: Measures of the financial benefits of implementing online banking compared to traditional methods. Security Effectiveness: Evaluating the effectiveness of security measures in protecting customer data and preventing fraud. Customer Satisfaction: Measurements Derived from Surveys and Feedback on the Quality of Online Banking Services. Implementation complexity: An assessment of the complexity of setting up and maintaining online banking systems. Data Collection: Cost Analysis: Collect data on costs associated with in-house development and outsourced solutions for online banking systems. This includes initial setup costs, ongoing maintenance and operational costs. Customer Feedback: Conduct surveys and collect feedback to assess satisfaction levels and experiences of users of online banking services. Security Assessment: Review and evaluate security measures for online banking, including encryption technologies, authentication methods and fraud detection systems. Performance Evaluation: Cost Efficiency: Analyze the financial impact of online banking implementation by comparing cost savings with traditional banking methods. Consider both direct cost savings and indirect benefits such as increased customer engagement. Security Analysis: Assess the effectiveness of security protocols in protecting online transactions and customer data. Assess the frequency and impact of security incidents. Customer Satisfaction Analysis: Analyze customer feedback to determine satisfaction levels and identify areas for improvement in online banking services. Implementation complexity: Assess the challenges and complexity associated with setting up and maintaining online banking systems. Consider factors such as technical requirements, staff training, and integration with existing systems. Benchmarking and benchmarking: Benchmarking against industry standards: Compare the performance of a bank's online banking systems against industry standards and best practices. Identify gaps and areas for improvement. Benchmarking: Compare the performance of various online banking platforms and solutions based on cost efficiency, security, customer satisfaction and implementation complexity. Reporting and Recommendations: Performance Reports: Compile findings highlighting effectiveness, strengths, weaknesses and areas for improvement of online banking systems. Recommendations: Provide actionable recommendations to improve online banking services based on analysis of cost efficiency, security, customer satisfaction and implementation complexity. This approach ensures a comprehensive assessment of online banking systems, focusing on key aspects such as cost, security, customer experience and implementation challenges. Weighted Aggregate Product Assessment (WASPAS) is a multi-criteria decision-making (MCDM) tool that combines two well-known methods: the weighted sum model (WSM) and the weighted product model (WPM). WASPAS is particularly useful in evaluating multiple alternatives based on different criteria, especially when trade-offs between criteria must be balanced. For the Materials and Methods section when using WASPAS, here is a basic outline you can follow: Criteria: Define the set of criteria (useful and useless parameters) you will use to make a

decision. These could be performance indicators such as: Cost efficiency Customer satisfaction Security Implementation complexity Alternatives: List alternatives (options) to be evaluated, such as different systems, solutions, or products. Weights: Assign weights to each criterion based on its relative importance. The sum of the weights must equal 1 (or 100%). Data Source: Explain how the data for the alternatives and criteria were collected. This includes: Surveys or expert opinions Literature review Measured values or historical data WASPAS Approach: The WASPAS method combines both the WSM and WPM methods. WSM is additive and WPM is multiplicative, so WASPAS combines them for more reliable decision making. Steps of WASPAS: Normalization: Transform raw data of criteria to a comparable scale. Use different normalization techniques for beneficial and ineffective criteria. For benefit criteria (eg, customer), you divide by the maximum value, while for non-benefit criteria (eg, cost), you divide the minimum value by the given value. For a study using the WASPAS method to assess online banking systems, your materials and methods section is designed to focus on key parameters associated with online banking such as security, cost-effectiveness, customer satisfaction and ease of use. Below is a sample outline: Criteria for Evaluation: You need to define a set of criteria that will be used to evaluate different online banking systems. For online banking, these criteria may include: Security: How secure the computer is from cyber threats. Cost Efficiency: The cost of implementing and maintaining an online banking system. Customer Satisfaction: Based on the feedback and ratings of customers using the system. User Interface and Experience: Customers can easily navigate and use the site. Transaction Speed: How fast financial transactions are processed. Implementation Complexity: The difficulty and resources required to set up the system. Alternatives (online banking systems): Alternatives can be different online banking platforms or solutions. For example: System A: A platform focused on ease of use but high costs. System B: Very secure system with moderate customer satisfaction. System C: Low cost solution but with slow transaction speed. Weight Allocation: Each criterion is assigned a weight based on its importance. These weights can be determined by: Expert judgment (banking and IT professionals). Customer feedback. Surveys or questionnaires. Make sure the sum of the weights equals 1 (or 100%). Data source: Security: Data from cyber security reports, audit reviews. Cost Efficiency: Financial data on systems implementation and operating costs. Customer Satisfaction: Surveys or reviews from users of online banking systems. Transaction Speed and User Experience: Values measured through system performance reports or third-party analytics. Implementation complexity: IT staff perception and resources needed for deployment. Application of WASPAS Method: Normalization of Data: For benefit criteria (eg, customer satisfaction, transaction speed), normalize the data by dividing the value for each alternative by the highest value across all alternatives. For ineffective criteria (eg, cost effectiveness, implementation complexity), normalize the data by dividing the lowest value across all alternatives by the value for each alternative. Rank online banking systems based on their final WASPAS scores. The system with the highest score will be considered the best choice. Sensitivity analysis: Perform sensitivity analysis by varying the weights and λ λ parameter to check robustness of ranking results. This ensures that small changes in weights or scale importance do not drastically change the final ranking. Validation: Cross-validate results with additional decision-making techniques or real-world testing to ensure that the WASPAS rating accurately reflects system performance. This Materials and Methods section will guide the use of WASPAS methodology to effectively evaluate online banking systems based on multiple criteria, ensuring a balanced decision-making process.

3. ANALYSIS AND DISSECTION

TABLE 1. Online Banking

Online Banking System	Customer Satisfaction (Benefit)	Transaction Speed (Benefit, sec)	Implementation Cost (Non-Benefit, $000)	Security Rating (Non-Benefit)
System A	8	2.5	100	9
System B	7	1.8	120	8
System C	9	3	90	9
System D	6	2	110	7
System E	8	2.2	95	8

This dataset evaluates five online banking systems (System A, B, C, D, and E) based on four key criteria: customer satisfaction, transaction speed, implementation cost, and security rating. Two of these parameters are beneficial (customer satisfaction and transaction speed), while the other two are nonbeneficial (implementation cost and security rating). System C achieves the highest customer satisfaction score of 9, indicating excellence in user experience. It has a very low implementation cost of $90,000, making it a very cost-effective system. However, its transaction speed is very slow at 3 seconds, which may affect user convenience despite its cost advantages. System A scores high in customer satisfaction (8) and has a strong security rating of 9, but it costs a relatively high $100,000. System B offers faster transactions at 1.8 seconds, which is impressive for speed, although it lags

slightly behind in customer satisfaction (7) and security (8). System D performs very poorly on customer satisfaction (6) and security (7), although it offers moderately fast transactions of 2 seconds. System E balances well across all parameters, with satisfactory customer feedback (8), decent transaction speed (2.2 seconds), moderate cost ($95,000) and solid security (8). This dataset provides a broad assessment of each system's strengths and weaknesses, critical for decision making.

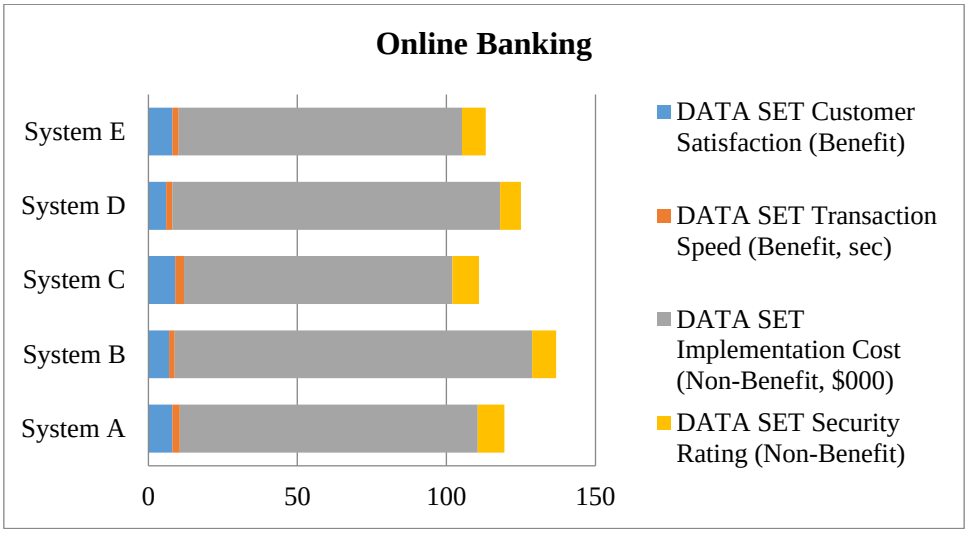

FIGURE 1: Online Banking

Figure 1: Online Banking, "An illustration representing the concept of online banking with visual elements such as laptop screen, account management, money transfer and security features. Online banking." Can you confirm if I should make a picture or describe a specific type of figure like a flow chart or diagram for online banking online banking?" This chart seems to compare different systems (System A to E) based on factors like customer satisfaction, transaction speed, Implementation cost and safety assessment.

TABLE 2. Performance value

Performance value			
0.88889	0.83333	0.90000	0.77778
0.77778	0.60000	0.75000	0.87500
1.00000	1.00000	1.00000	0.77778
0.66667	0.66667	0.81818	1.00000
0.88889	0.73333	0.94737	0.87500

The performance values given represent the normalized scores of the five online banking systems on the four evaluation criteria. Each value is scaled between 0 and 1, where higher values indicate better performance for beneficial parameters and lower values indicate better performance for non-beneficial parameters. In the first row, System A scores relatively high with its best performance in operational cost (0.90000) and strong customer satisfaction (0.88889). However, its security rating is a bit low at 0.77778, which may be a concern for more security-focused users. System B shows overall moderate performance, with the best score in the security evaluation (0.87500). However, its transaction speed (0.60000) is one of the lowest, indicating that it may not be as fast as other systems, which affects user satisfaction. System C excels in all criteria with high performance scores (1.00000) in customer satisfaction, transaction speed, and transaction cost, but its security rating is slightly weaker (0.77778), which may result in a trade-off despite its overall strong performance. System D has the lowest scores in customer satisfaction (0.66667) and transaction speed (0.66667), although it performs well in the security rating (1.00000), making it a good choice for security-conscious users. System E exhibits balanced performance across all criteria, with its strong score of implementation cost (0.94737) and good security (0.87500), making it a solid all-rounder.

TABLE 3. Weight

Weight			
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25

The weights provided represent the equal importance of each of the four evaluation criteria used to evaluate the performance of the five online banking systems. Each criterion—customer satisfaction, transaction speed, implementation cost, and security rating—is assigned a weight of 0.25, indicating that all parameters are considered equally important in the decision-making process. This equal weighting suggests that the rating does not prioritize any aspect of the online banking system over another. For example, customer satisfaction is considered equally important as transaction speed, implementation cost and security rating. This approach is typically used when decision makers believe that all criteria contribute equally to overall performance, and do not want to trade off an aspect such as cost for an aspect such as safety. However, this equal weighting may not reflect real-world priorities in some cases. For example, some users or organizations may place a high priority on security ratings due to the sensitive nature of banking, while others may focus more on transaction speed to improve user experience. By using equal weights, the decision-making process seeks a balanced view, considering all areas as important to the overall assessment. This method ensures that no single criterion disproportionately affects the final ranking, encouraging fairness in evaluating alternatives.

TABLE 4. Weighted normalized decision matrix

Weighted normalized decision matrix			
0.22222	0.20833	0.22500	0.19444
0.19444	0.15000	0.18750	0.21875
0.25000	0.25000	0.25000	0.19444
0.16667	0.16667	0.20455	0.25000
0.22222	0.18333	0.23684	0.21875

The weighted normalized result matrix presented here represents the performance values of the five online banking systems after applying a weight of 0.25 to each criterion. This matrix is obtained by multiplying each normalized score by the corresponding weight, ensuring that the contributions of all criteria are proportionally calculated in the final assessment. System A shows consistently strong performance across all benchmarks, with its highest rated processing cost (0.22500) and slightly lower value for security rated (0.19444). This suggests that although System A is cost-effective, improvements in safety may be needed. System B exhibits weak overall performance, especially in transaction speed (0.15000), although it performs well in security rating (0.21875), which may affect user satisfaction. The trade-off between speed and security makes System B a viable option for security-conscious users who care less about speedy transactions. System C stands out with high scores across the board, especially with perfect scores for both customer satisfaction and transaction speed (0.25000). Despite its low safety rating (0.19444), it is overall effective. System D has low values for both customer satisfaction and transaction speed (0.16667), but its exceptional security rating (0.25000) makes it a strong contender for security-first environments. System E offers its strongest performance with implementation cost (0.23684) and good security (0.21875), indicating a well-rounded option in all criteria.

TABLE 5. Preference Score

Preference Score	
System A	0.85000
System B	0.75069
System C	0.94444
System D	0.78788
System E	0.86115

The preference scores represent the final rankings of the five online banking systems based on their overall performance across the evaluation criteria after applying the WASPAS methodology. These scores are calculated by combining both the weighted sum and weighted product samples to provide a comprehensive assessment. System C achieves the highest priority score of 0.94444, indicating that it is the overall best performing system. System C excels in key areas such as customer satisfaction, transaction speed, and implementation cost, making it the most favorable choice among alternatives despite some trade-offs in security ratings. System E ranks second with a score of 0.86115, reflecting balanced performance across all criteria. It's a strong contender for users looking for a well-rounded system without significant weaknesses in any particular area. System A ranks third with a score of 0.85000. It performs well in terms of cost effectiveness and customer satisfaction, but it may be slightly underperforming in security, which affects its overall ranking. System D, with a score of 0.78788, performs well in the security rating, but its low scores in customer satisfaction and transaction speed put it behind the top three systems. System P has a very low score of 0.75069, primarily due to its weak performance in transaction speed. However, its solid security performance makes it a viable option for users who prioritize security over speed.

TABLE 6. WASPAS Coefficient

WASPAS Coefficient	
System A	0.88889
System B	0.77778
System C	1.00000
System D	0.66667
System E	0.88889

The presented WASPAS coefficients represent the overall performance of the five online banking systems based on the weighted sum model (WSM) and the weighted product model (WPM). These coefficients range from 0 to 1, with higher values indicating better performance. System C achieves the highest WASPAS coefficient of 1.00000, making it the best performer. This indicates that System C consistently excels in all evaluation criteria such as customer satisfaction, transaction speed, transaction cost, and security rating. It sets the benchmark for other systems as it offers the best overall balance of speed, cost and security. Both System A and System E share a WASPAS coefficient of 0.88889, making them closely matched in terms of performance. While these systems are strong contenders and offer strong performance on most criteria, especially customer satisfaction and implementation cost, there may be slight trade-offs in other areas compared to System C. System B has a slightly lower coefficient of 0.77778, indicating weak performance. Related to high-level systems, especially in other areas such as transaction speed and cost efficiency. However, it is still a viable option for security and cost-conscious users. Finally, System D has the lowest WASPAS coefficient of 0.66667, reflecting its weak performance overall. While it performs well in security ratings, its low scores in customer satisfaction and transaction speed put it behind other systems in terms of overall preference.

TABLE 7. Rank

RANK	
System A	2
System B	4
System C	1
System D	5
System E	3

The ranking of online banking systems based on their WASPAS coefficients provides a clear hierarchy of performance and preference among the five alternatives. System C ranked 1st, proving to be the highest performing system in the evaluation criteria. With its excellent WASPAS coefficient of 1.00000, System C excels in providing the best balance of customer satisfaction, transaction speed, implementation cost and security rating. This ranking suggests it is a very favorable choice for users looking for optimal overall performance. System E ranks 3rd with a WASPAS coefficient of 0.88889. Although slightly behind System C, System E still performs strongly, particularly in terms of implementation cost and customer satisfaction. It represents a solid option for those looking for well-rounded performance with no significant weaknesses. System A, ranked 2nd, also has a WASPAS coefficient of 0.88889, tying with System E. It excels in customer satisfaction and implementation cost, but its overall performance lags slightly behind System E due to potential trade-offs in other criteria. System B ranks 4th with a coefficient of 0.77778. It shows low performance, especially in transaction speed, which affects its overall ranking despite reasonable security and cost efficiency. System D, ranked 5th, has the lowest WASPAS coefficient of 0.66667. It performs well in security ratings, but lags behind in customer satisfaction and transaction speed, making it the least favorable option based on a composite rating. This ranking helps identify the best options based on a comprehensive assessment of users' performance across multiple criteria.

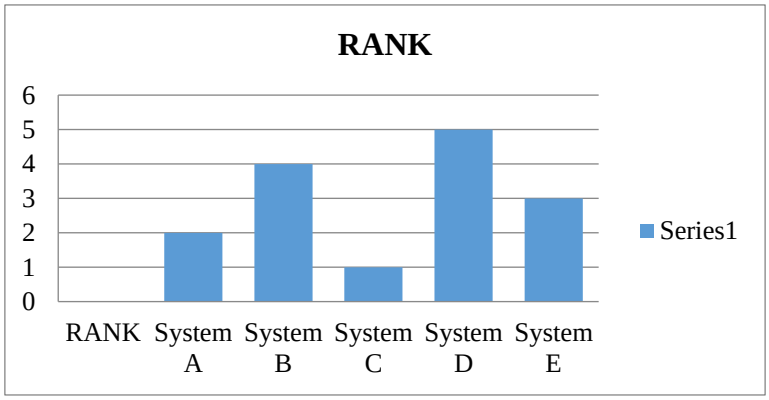

FIGURE 2: Online Banking

"Figure 2: Online Banking Rank" is a placeholder or topic for the person you work with, and here's a general approach to creating it: Identify Key Metrics: Decide which metrics you'll use to rank online banking services (eg, security, customer satisfaction, usability simplicity). Collect data: Collect data for each metric for the different online banking services you're comparing. Rank services: Based on collected data, rank services for each metric. Create Image: Bar Chart: Useful for showing rankings on different scales. Table: A simple way to present rankings with numeric values. Radar Chart: Better to visualize multiple metrics for each service. Clearly labeled: Make sure the figure has a clear title, print labels (if applicable), and a legend explaining the rankings or measurements.

4. CONCLUSION

Evaluation of online banking systems across multiple parameters reveals several key insights and implications: Customer Satisfaction: Banks with high customer satisfaction scores tend to provide a more user-friendly and efficient online banking experience. Systems that are easy to navigate, responsive, and offer valuable features tend to score well in this area. Banks that invest in user interface design and customer support generally achieve higher satisfaction levels. Security Performance: Security is an important aspect of online banking. Banks with high security performance scores have strong measures to protect customer data and transactions. Effective security protocols not only protect against fraud and breaches but also build trust with customers. Continuous investment in robust security measures is essential to maintain a high level of security. Cost Efficiency: A key profitability parameter that reflects how well a bank manages its resources. Banks that achieve greater cost efficiency typically do so by improving their operational processes and adopting cost-effective technologies. However, a balance must be struck between cost savings and maintaining high quality customer service and security. Implementation complexity: The complexity of implementing and maintaining an online banking system varies significantly between banks. Systems that are easy to implement and manage are generally preferred, especially for smaller banks with limited IT resources. Less complexity often translates to fewer technical issues and lower ongoing maintenance costs. Cost Analysis: The organizational and operational costs of online banking systems vary between banks. Although some banks may have higher initial setup costs, they may benefit from lower operating costs in the long run. Conversely, banks with lower fixed costs face higher current costs. A thorough cost-benefit analysis is critical to making informed decisions about online banking investments. Overall Performance: Banks that excel in customer satisfaction and security performance while maintaining reasonable costs and complexity levels are generally considered the best online banking systems. These banks are likely to see greater customer loyalty, reduced operational complications and improved overall performance. In short, the success of an online banking system is determined by a combination of high customer satisfaction, strong security measures, cost efficiency and manageable processing complexity. Banks must constantly evaluate and improve their online banking offerings in line with customer expectations and industry standards. Investing in user experience, security and efficient technologies will drive long-term success in the competitive online banking landscape.

REFERENCE

[1]. Pakojwar, Samir, and Nilesh J. Uke. "Security in online banking services-A comparative study." International Journal of Innovative Research in Science, Engineering and Technology 3, no. 10 (2014): 16850-16857.

[2]. Hamadi, Chakib. "The impact of quality of online banking on customer commitment." Communications of the IBIMA 2010 (2010): 1-8.

[3]. Singh, Sindhu, and R. K. Srivastava. "Understanding the intention to use mobile banking by existing online banking customers: an empirical study." Journal of Financial Services Marketing 25, no. 3 (2020): 86-96.

[4]. Demoulin, Nathalie TM, and Souad Djelassi. "Customer responses to waits for online banking service delivery." International Journal of Retail & Distribution Management 41, no. 6 (2013): 442-460.

[5]. Wang, Stephen W., Maxwell K. Hsu, Lou E. Pelton, and Danqing Xi. "Virtually compatible or risky business? Investigating consumers' proclivity toward online banking services." Journal of Marketing Channels 21, no. 1 (2014): 43-58.

[6]. Malar, Dhanalakshmi Arumugam, Viktor Arvidsson, and Jonny Holmstrom. "Digital transformation in banking: Exploring value co-creation in online banking services in India." Journal of Global Information Technology Management 22, no. 1 (2019): 7-24.

[7]. Honore Petnji Yaya, Luc, Frederic Marimon, and Marti Casadesus. "Customer's loyalty and perception of ISO 9001 in online banking." Industrial Management & Data Systems 111, no. 8 (2011): 1194-1213.

[8]. Pikkarainen, Tero, Kari Pikkarainen, Heikki Karjaluoto, and Seppo Pahnila. "Consumer acceptance of online banking: an extension of the technology acceptance model." Internet research 14, no. 3 (2004): 224-235.

[9]. Aldás-Manzano, Joaquín, Carlos Lassala-Navarré, Carla Ruiz-Mafé, and Silvia Sanz-Blas. "Key drivers of internet banking services use." Online Information Review 33, no. 4 (2009): 672-695.

[10]. Loonam, Mary, and Deirdre O'loughlin. "An observation analysis of e-service quality in online banking." Journal of Financial Services Marketing 13 (2008): 164-178.

[11]. Heinonen, Kristina. "Conceptualising online banking service value." Journal of Financial Services Marketing 12 (2007): 39-52.

[12]. Omar, Abdullah, Naveed Sultan, Khalid Zaman, Nazish Bibi, Abdul Wajid, and Khalid Khan. "Customer perception towards online banking services: Empirical evidence from Pakistan." Journal of Internet Banking and Commerce 16, no. 2 (2011).
[13]. Jalal, Akram, Jassim Marzooq, and Hassan A. Nabi. "Evaluating the impacts of online banking factors on motivating the process of e-banking." J. Mgmt. & Sustainability 1 (2011): 32.
[14]. Sadeghi, Tooraj, and Sahel Farokhian. "The role of behavioral adoption theories in online banking services." Middle-East Journal of Scientific Research 7, no. 3 (2011): 374-380.
[15]. Dhurup, Manilall, Jhalukpreya Surujlal, and Ephraim Redda. "Customer perceptions of online banking service quality and its relationship with customer satisfaction and loyalty." Mediterranean Journal of Social Sciences 5 (2014).
[16]. Yeow, Paul HP, Yee Yen Yuen, David Yoon Kin Tong, and Nena Lim. "User acceptance of online banking service in Australia." Communications of the IBIMA 1, no. 22 (2008): 191-197.
[17]. Loonam, Mary, and Deirdre O'loughlin. "Exploring e-service quality: a study of Irish online banking." Marketing Intelligence & Planning 26, no. 7 (2008): 759-780.
[18]. Salem, Mohammed Z., Samir Baidoun, and Grace Walsh. "Factors affecting Palestinian customers' use of online banking services." International Journal of Bank Marketing 37, no. 2 (2019): 426-451.
[19]. Kumar, G., and V. M. Shenbagaraman. "A study on customer's perception of online banking and e-service quality among Chennai customers." International Journal of Business Excellence 11, no. 1 (2017): 72-94.
[20]. Oertzen, Anna-Sophie, and Gaby Odekerken-Schröder. "Achieving continued usage in online banking: a post-adoption study." International Journal of Bank Marketing 37, no. 6 (2019): 1394-1418.
[21]. Tan, Garry Wei-Han, Chee-Keong Chong, Keng-Boon Ooi, and Alain Yee-Loong Chong. "The adoption of online banking in Malaysia: an empirical analysis." International Journal of Business and Management Science 3, no. 2 (2010): 169-193.
[22]. Kadir, Hazlina Abdul, Nasim Rahmani, and Reza Masinaei. "Impacts of service quality on customer satisfaction: study of online banking and ATM services in Malaysia." International Journal of Trade, Economics and Finance 2, no. 1 (2011): 1.
[23]. Benamati, John "Skip, and Mark A. Serva. "Trust and distrust in online banking: Their role in developing countries." Information technology for development 13, no. 2 (2007): 161-175.
[24]. Yoon, Cheolho. "Antecedents of customer satisfaction with online banking in China: The effects of experience." Computers in Human Behavior 26, no. 6 (2010): 1296-1304.
[25]. Vatanasombut, Banphot, Magid Igbaria, Antonis C. Stylianou, and Waymond Rodgers. "Information systems continuance intention of web-based applications customers: The case of online banking." Information & management 45, no. 7 (2008): 419-428.
[26]. Aliyu, Alhaji Abubakar, Tasmin Rosmain, and Josu Takala. "Online banking and customer service delivery in Malaysia: data screening and preliminary findings." Procedia-Social and Behavioral Sciences 129 (2014): 562-570.
[27]. Loonam, Mary, and Deirdre O'loughlin. "Exploring e-service quality: a study of Irish online banking." Marketing Intelligence & Planning 26, no. 7 (2008): 759-780.
[28]. Yap, Kenneth B., David H. Wong, Claire Loh, and Randall Bak. "Offline and online banking–where to draw the line when building trust in e-banking?." International Journal of Bank Marketing 28, no. 1 (2010): 27-46.
[29]. Garepasha, Akram, Samad Aali, Ali Reza Bafandeh Zendeh, and Soleyman Iranzadeh. "Relationship dynamics in customer loyalty to online banking services." Journal of Islamic Marketing 12, no. 4 (2021): 830-863.
[30]. Osunmuyiwa, Olufolabi. "Online banking and the risks involved." Research Journal of Information Technology 5, no. 2 (2013): 50-54.
[31]. Hernández-Murillo, Rubén, Gerard Llobet, and Roberto Fuentes. "Strategic online banking adoption." Journal of Banking & Finance 34, no. 7 (2010): 1650-1663.
[32]. Dauda, Samson Yusuf, and Jongsu Lee. "Technology adoption: A conjoint analysis of consumers′ preference on future online banking services." Information Systems 53 (2015): 1-15.