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Developing a Customer Confusion Management Model Based on the Internet of Things in the Banking Industry

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Abstract

The aim of this study is to develop a customer confusion management model based on the Internet of Things (IoT) in the banking industry. This research adopts a mixed-methods approach (qualitative and quantitative). The qualitative strategy used in this study is thematic analysis, while the quantitative strategy employed is survey-based. The statistical population for the qualitative phase consists of 17 managers of Bank Mellat branches in Tehran. In the quantitative phase, the population includes all customers of Bank Mellat in Tehran, with 384 questionnaires distributed and collected through random sampling. The findings from the qualitative thematic analysis identified key themes and descriptive codes from interview texts, including: sources of confusion, consequences of customer confusion, internet infrastructure, influential customer characteristics that increase confusion, organizational education approaches to IoT, and organizational factors impacting confusion management. The results of structural equation modeling using Smart PLS software demonstrated that the customer confusion management model based on IoT in the banking industry exhibits strong validity and fit. Therefore, IoT facilitates the appropriate investment in expanding software and hardware infrastructure across all bank branches, as well as the efforts of staff and management to provide quick and informed access to IoT services.

Keywords: *Customer confusion management, Internet of Things, banking industry.*

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1. Introduction

In the current context, the bank's customer is the most important and primary resource of an organization for achieving profitability and organizational progress. This subject is directly associated with growth, development, and success in predefined objectives [1]. Customers and the understanding of their behavior represent the most significant assets for an organization in achieving commercial success and its related frameworks. Organizations that interact with people focus their primary efforts on this indicator and strive to achieve it [2]. In other words, the sale of products, the provision of services, and success in competitive and economic markets depend on attracting and maintaining customer trust in the respective product [3]. Therefore, identifying customer behavior, interests, and perspectives is highly significant and essential for commercial success and economic competition in the current situation [4].

Consumer behavior in the modern era has shifted from physical and face-to-face models to electronic and online patterns [5]. In this regard, the rapid growth of the Internet of Things (IoT) has created numerous opportunities for actors in strategic marketing to perform a significant portion of their marketing activities within this domain. Over the past two to three decades, the rapid growth of the internet has provided countless opportunities for actors in the banking services industry, enabling activities such as information search, establishing cross-border communications, and expressing opinions and sentiments [6].

As the internet grows rapidly and permeates society, service providers have leveraged this opportunity to carry out portions of their effective strategic marketing efforts through these media. The nature of effective marketing strategies fosters profitability and growth, allowing service providers to share their information with customers while enabling customers to share their information and interact with one another [5].

Rapid developments in technology and connectivity influence how consumers access and use information. However, this information is not always clear or consistent. Mismatched or conflicting information provided to consumers can lead to uncertainty about its reliability, especially when various sources appear equally credible [7]. Consequently, customer confusion is a fundamental issue in the current conditions, especially in connection with electronic patterns.

Although consumer confusion has been defined in various ways by different researchers, a general perspective defines it as arising from similar, ambiguous, or excessive stimuli. Customer confusion can generally be described by influential stimuli [8]. Specifically, customer confusion refers to the psychological state of uncertainty and unawareness before making a decision, indicating a customer’s inability to comprehend product or service information [9].

Customer confusion is a multidimensional concept requiring examination within an updated analytical framework. One approach recently introduced in management that can effectively stimulate and guide innovation in structural analysis and consumption management is the Internet of Things (IoT) [10]. The concept of IoT involves connecting various devices via the internet, enabling applications and devices to interact with one another and even with humans [11].

IoT allows users to create, share, and utilize content, fostering communication and the sharing of personal interests and information, which helps bridge cultural gaps globally [12]. Jalali Nazari et al. (2024) investigated "customer-centric modern banking: approaches, challenges, and models." Their findings highlighted several pivotal factors, such as competitiveness among banks, which have a significant impact and require investment to strengthen the sustainability, profitability, and value creation of banks. One key factor in competitiveness is reducing customer confusion [13].

Khalilzadeh Talatapeh et al. (2022) explored customer confusion management using a different approach. A qualitative paradigm was employed, using grounded theory for model design. Purposeful and snowball sampling were used to select participants. After conducting semi-structured interviews with 21 experts in the insurance and marketing industries, followed by open, axial, and selective coding, a paradigmatic model for customer confusion management was developed. Coding results identified 17 main categories classified into six groups [8].

Momivand et al. (2023) developed a framework to identify key drivers influencing the future of the banking industry, emphasizing the role of FinTech. Systematic literature review methods were employed to identify key drivers, which were subsequently prioritized using fuzzy BWM and expert opinions. The statistical population included managers and experts in banking, FinTech companies, and startups, with 15 individuals selected through judgmental sampling. The integration and

standardization of laws and regulations, the growth of banking startups, evolving preferences of newer generations for banking services, and the role of technology parks and growth centers in fostering innovation were identified as top priorities [14].

Esmaili et al. (2023) presented a model for IoT adoption in Iranian knowledge-based companies, identifying five main components, 13 subcategories, and 59 concepts. Managerial requirements, customer needs, and economic resilience were identified as prerequisites for IoT adoption. Company characteristics, human resource attributes, and managerial traits were identified as enablers for IoT utilization [15].

Sharma et al. (2023), in a descriptive-correlational study, analyzed customer confusion, using responses from 507 survey participants. Findings indicated that confusion decreases with higher education levels across genders and age groups. However, confusion initially increases and later decreases over time for both genders and education levels. Additionally, self-efficacy effectively moderates the impact of confusion on decision postponement [16].

Zecevic et al. (2022) examined the impact of inconsistent information on consumer attitudes through an experiment involving 237 participants. Results showed that conflicting information increases confusion and reduces attitude certainty toward product health. Therefore, consistent and stable information is crucial in minimizing customer confusion [7].

Gaiardelli and Songini (2021) conducted an analytical review highlighting the positive effects of BM components on organizational performance, emphasizing the adoption of innovative business models as crucial for business development and success [17].

The growing complexity of customer behavior in banking, coupled with heightened competition and diverse products and services offered globally, underscores the significance of understanding consumer behavior. This complexity, which manifests as confusion, is a critical issue requiring attention and resolution, especially in Bank Mellat [18].

Accordingly, this study aims to answer the following research questions: How is the IoT-based customer confusion management model implemented in the banking industry, specifically in Bank Mellat branches in Tehran? What is its validity?

2. Methodology

This research employed a mixed-methods approach, combining qualitative and quantitative methods. Initially, the study utilized a qualitative approach, employing interviews as the primary data collection tool. Thematic analysis and coding of the interview data were conducted to develop the research model. In the second phase, the extracted model was validated using the partial least squares (PLS) technique, relying on data collected through questionnaires. This process evaluated the validity of the relationships in the research model, leading to the final model.

The study population included experts, academics, and Bank Mellat managers with at least 10 years of experience in the field. Participants for the interviews were selected using a combination of non-random, judgmental, and snowball sampling techniques. Seventeen interviews were conducted, and data collection continued until theoretical saturation was achieved. The interviews were coded and analyzed progressively, leading to the classification and summarization of the data.

To ensure the validity and reliability of the research, the interview questions were reviewed and approved by multiple experts. Lincoln and Guba (1985) outlined criteria for evaluating qualitative studies, including credibility, dependability, transferability, and confirmability [19]. The following measures were taken to meet these criteria: transcribing the interviews, continuous analysis during data collection, and cross-checking the coding by another expert to ensure consistency and eliminate subjective interpretations. MAXQDA software was used for qualitative analysis.

For the quantitative phase, 384 questionnaires were distributed among banking staff (Bank Mellat employees) using a random convenience sampling method. The questionnaire data were analyzed using SPSS 25 and Smart PLS software through exploratory factor analysis. The content validity of the questions was reviewed and approved by a group of experts. Table 1 presents reliability and validity measures, including Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE).

Table 1. Reliability and Validity of Research Variables

Construct	AVE	Composite Reliability (CR)	Cronbach's Alpha

Sources of Confusion	0.609	0.895	0.894
Customer Confusion Outcomes	0.622	0.909	0.907
Internet Infrastructure	0.611	0.725	0.723
Customer Characteristics Increasing Confusion	0.628	0.706	0.701
IoT Organizational Training Management Approach	0.617	0.795	0.791
Organizational Factors in Confusion Management	0.630	0.707	0.705

Cronbach's alpha and composite reliability scores for all variables exceeded 0.70, indicating satisfactory reliability. Additionally, AVE values were greater than 0.50, confirming adequate convergent validity.

3. Findings

To identify indicators and components of the research model variables, thematic analysis was employed. Based on interviews with 17 experts, 1,681 codes were identified, reflecting semantic and conceptual similarities. Coding revealed the factors relevant to the model, classified into categories outlined in Table 2. All factors derived from the interviews, along with their categories and semantic codes, are presented in Table 2.

Table 2. Analysis of Interview Data

Dimension	Component	Indicator
Sources of Confusion	Factors Causing Confusion	Overload of information provided to customers.
		Dissemination of irrelevant information about services.
		Use of incorrect methods for presenting information to customers.
		Parallel and similar stimuli used for familiarization with virtual environments.
		Complexity of advertising content presented to customers.
		Time constraints for decision-making in online environments.
		Lack of familiarity with brand expectations and advertising approaches.
		Unclear banking regulations for electronic services.
		Ambiguity in national currency regulations.
		High guarantees and collateral required by banks.
	Confusion-Based Marketing	Confusion caused by unconscious marketing methods in service introductions.
		Preventing service comparison by injecting confusion into customer data.
		Use of vague marketing techniques and generic online information.
		Reducing customer accuracy in selecting appropriate services.
		Exaggerating banking service capabilities to confuse customers during online interactions.
Customer Confusion Outcomes	Loss of Customer Satisfaction	Widespread customer defection and significant financial losses for the bank.
		Negative reviews spreading in the market, causing a loss of established market position.
		Lack of customer retention for new banking services.
		Negative publicity campaigns against the bank in online platforms.
	Damage to Bank's Brand Reputation	Damage to the brand's reputation in internet-based services.
		Customer perception biases regarding IoT-based services.
		Cognitive and perceptual confusion leading to aversion to the bank's brand.
	Service Decision-Making Confusion	Inability to make accurate decisions when selecting services.
		Negative word-of-mouth among in-person and online customers.
		Blaming senior bank managers for poor IoT infrastructure development.
		Gradual disengagement from the bank's web-based environment.
	Customer Reactions to Confusion	Abandoning purchase decisions.
		Postponing purchase decisions.
		Searching for additional information.
		Limiting choices based on specific conditions.
		Sharing decisions with others.
		Delegating decision-making to someone else.
Internet Infrastructure	IT Infrastructure	Service-oriented architecture on the bank's website.
		Tool-based data management in online information systems.
		Coordinated content management systems for the bank's website.
		Internet document management systems for customers and the bank.

		Development of customer relationship management systems on the bank's website.
	Tools for Reducing Online Confusion	User-friendly digitization of banking services.
		Mobile terminals utilizing IoT.
		Integration of artificial intelligence in IoT-enabled services.
		IoT-based tool integration in banking service websites.
		Monitoring IoT through smart service tools.
		IoT-based data analysis tools.
Customer Characteristics	Customer Understanding of IoT	Lack of familiarity with rapid IT advancements and related e-commerce growth.
		Adherence to traditional banking services and inability to engage with IoT-centered services.
		Lack of awareness of IoT capabilities in data storage and security.
		Struggling with modern IT due to unfamiliarity with modern tools.
		Resistance to IT advancements and IoT-based web services.
		Lack of privacy awareness in IoT devices.
	Customer Technological Knowledge	Limited knowledge of artificial intelligence capabilities.
		Inability to learn online and web-based banking activities.
		Blind adherence to limited knowledge of traditional customers about IoT.
		Inability to analyze IoT applications.
IoT Organizational Training	Organizational Training Management	Short- and long-term organizational investments in customer training.
		Establishing comprehensive and up-to-date training for internet use.
		Management team collaboration with employees to familiarize old customers with modern IoT technologies.
		Conducting continuous and targeted training sessions for customers unfamiliar with web services.
		Enhancing customer awareness of digital banking technologies and website benefits.
		Ensuring structured and principled customer training in web services.
	Personalized Training Approach	Developing content tailored to individual customer needs on the web.
		Developing IT and communication tools aligned with customer capabilities.
		Monitoring customer use of internet technology to evaluate the success of personalized training.
		Collecting customer data on hardware and software familiarity with IoT.
		Identifying customer needs by tracking issues in internet services.
Organizational Factors	Macro-Level Banking Management	Framework for providing internet services over short- and long-term periods.
		Board-level support for advancing internet services.
		Determining cost-effective services for banks and customers.
		Ensuring all employees are familiar with the potential of internet-based services.
		Appropriate funding for software and hardware infrastructure across all branches.
		Clarifying service capabilities for all organizational levels.
	Intra-Bank Factors in Confusion Management	Collaboration between employees and customers to enhance web knowledge.
		Staff and management efforts for fast and informed access to IoT services.
		Diversifying internet services and tools based on customer needs.
		Assessing staff familiarity with online banking services.
		Providing structured reporting on progress in delivering online services.
		Familiarizing staff with the complexities of offering online services from start to finish.

The qualitative thematic analysis identified 77 indicators, categorized into 14 main concepts: factors causing confusion, confusion-based marketing, diminished customer satisfaction, brand reputation damage, decision-making confusion, customer reactions to confusion, IT infrastructure, tools for reducing online confusion, customer understanding of IoT technological requirements, customer technological knowledge, organizational training preparation, personalized training approaches, macro-level banking management factors, and intra-bank factors in confusion management. These were grouped into six categories: sources of confusion, customer confusion outcomes, internet infrastructure, customer characteristics increasing confusion, IoT organizational training management, and organizational factors in confusion management.

After 17 interviews, no new codes were identified, confirming data saturation. The research findings provide a

comprehensive framework for understanding and managing customer confusion within the IoT-enabled banking sector.

In this section, the demographic characteristics of the respondents who participated in the study and completed the questionnaire are analyzed. Results indicate that 60.94% of respondents were male, while 39.06% were female. Age distribution was as follows: 3.65% were aged 18–25, 31.77% were aged 26–35, 29.43% were aged 36–45, 20.57% were aged 46–55, and 14.58% (56 participants) were aged 56 and above. Regarding educational qualifications, 10.42% had a high school diploma, 22.66% held an associate degree, 29.69% held a bachelor's degree, 32.55% held a master's degree, and 4.69% held a doctorate.

A one-sample Kolmogorov–Smirnov test was conducted to assess whether the data distribution for the variables was normal or non-normal. As the significance level was below 0.05, the distribution of the variables was determined to be non-normal.

Figure 1 displays the output of the PLS algorithm, which is used to extract outer loadings and path coefficients. As shown in the figure, the research items have outer loadings above 0.4, indicating that no items needed to be excluded.

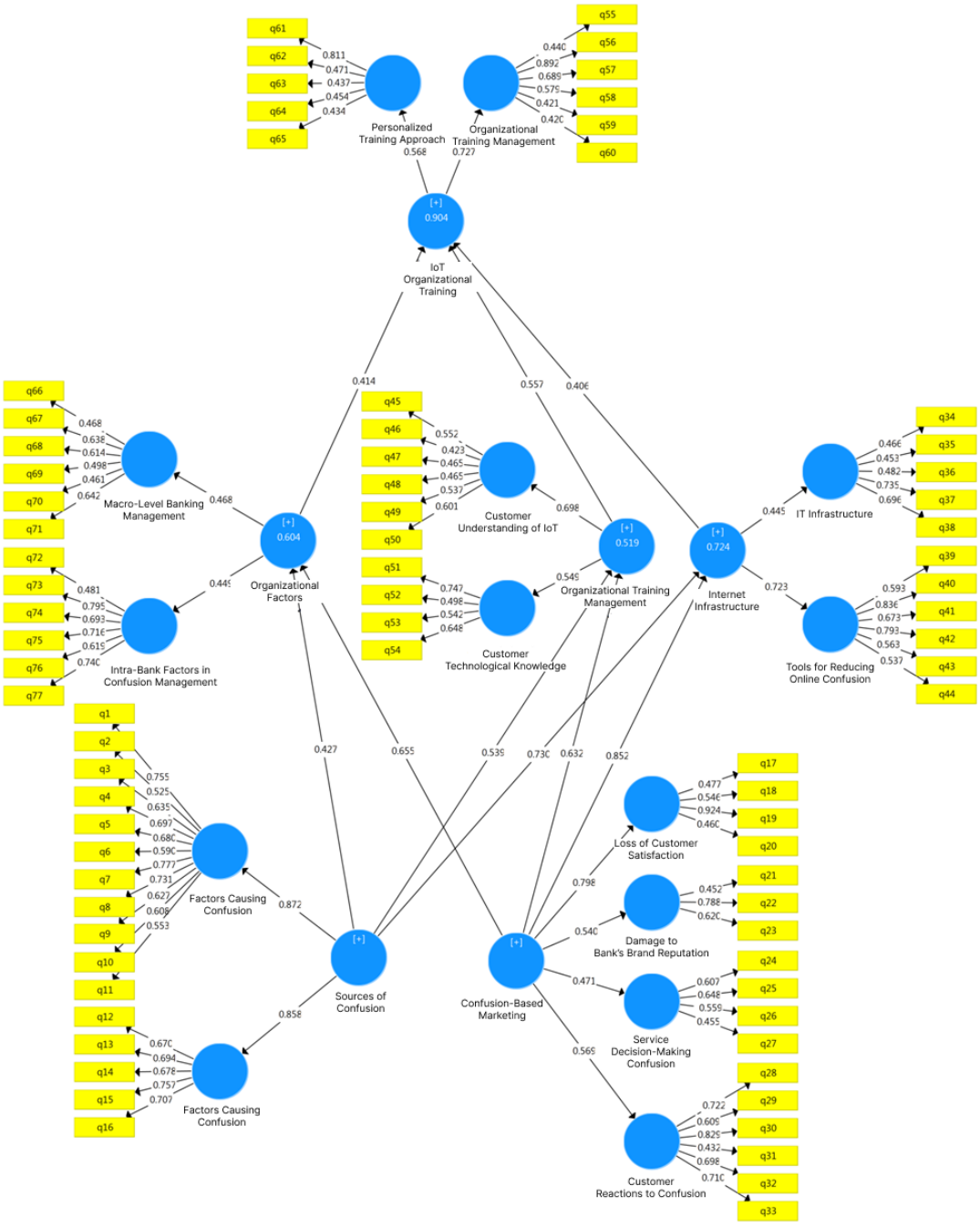

Figure 1. Conceptual Research Model with Path Coefficients and Outer Loadings

In this study, the GOF (Goodness of Fit) criterion for the overall model fit was calculated as 0.49, which exceeds the threshold of 0.36, indicating strong model fit. Additionally, the SRMR (Standardized Root Mean Square Residual) value was used to evaluate the model fit in SmartPLS. The SRMR value was calculated as 0.073, which is below the threshold of 0.08, confirming that the research model has a very good fit.

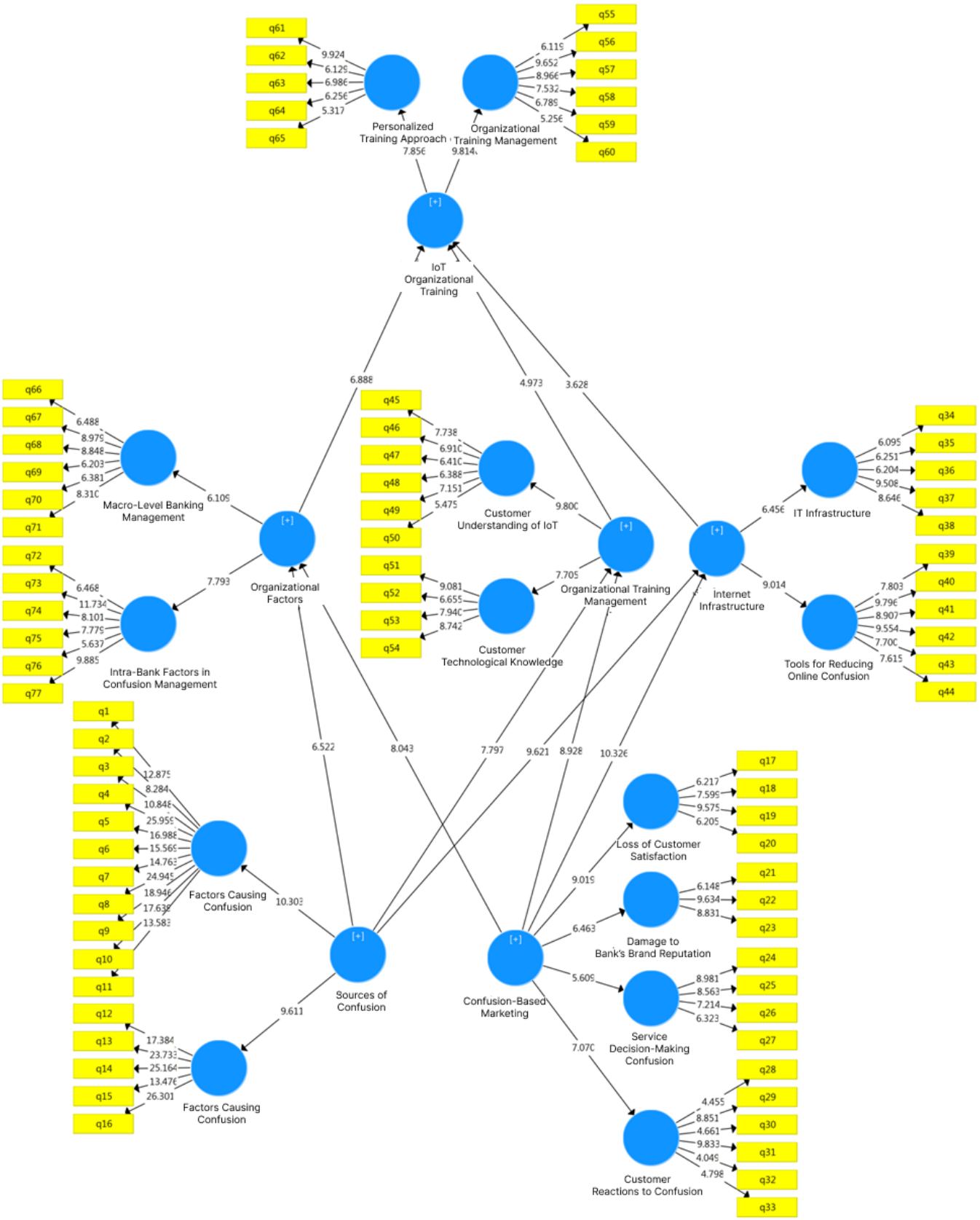

Figure 2. Conceptual Research Model with t-Values

Based on the findings in Figure 2, all research hypotheses had p-values below 0.05. Therefore, these hypotheses are accepted with 95% confidence.

Table 3. Summary of Hypothesis Testing Results

Relationship	Path Coefficient	T-Statistic	P-Value	Result
Organizational Factors in Confusion Management → IoT Organizational Training Management Approach	0.414	6.888	0.000	Accepted
Customer Confusion Outcomes → Organizational Factors in Confusion Management	0.655	8.043	0.000	Accepted
Internet Infrastructure → IoT Organizational Training Management Approach	0.406	3.628	0.000	Accepted
Customer Characteristics Increasing Confusion → IoT Organizational Training Management Approach	0.557	4.973	0.000	Accepted
Sources of Confusion → Organizational Factors in Confusion Management	0.427	6.522	0.000	Accepted
Customer Confusion Outcomes → Internet Infrastructure	0.852	10.326	0.000	Accepted
Sources of Confusion → Customer Characteristics Increasing Confusion	0.539	7.797	0.000	Accepted
Customer Confusion Outcomes → Customer Characteristics Increasing Confusion	0.632	8.928	Accepted	

4. Discussion and Conclusion

The purpose of this study was to propose a customer confusion management model based on the Internet of Things (IoT) in the banking industry. In response to the qualitative research question—What are the components and indicators of the customer confusion management model based on IoT in the banking industry?—the findings, analyzed using MAXQDA (2018), revealed that the model comprises the following components: sources of confusion, customer confusion outcomes, internet infrastructure, customer characteristics contributing to confusion, IoT organizational training management approach, and organizational factors influencing confusion management.

The indicators for the IoT-based customer confusion management model include the following: information overload transmitted to customers, dissemination of irrelevant service information, improper methods of presenting information to customers, use of parallel and similar stimuli to familiarize customers with the virtual environment, complexity of advertising content, time constraints for online decision-making, lack of familiarity with brand expectations and advertising approaches, ambiguous electronic banking regulations, unclear national currency policies, bank regulations on loans, requirements for high guarantees and collaterals, confusion induced by unstructured marketing methods, inability to compare services due to injected confusion in customer data, vague marketing techniques, generalized online service information, reduced customer precision in selecting appropriate services, exaggerated service capabilities creating confusion during use, customer defection causing significant financial loss, spread of negative reviews, loss of market position, lack of customer return for new services, creation of negative online campaigns, tarnished brand reputation, biased customer perceptions of IoT services, cognitive confusion, aversion to the bank's brand, inability to make accurate decisions, spreading negativity among customers, blaming senior bank managers for insufficient IoT infrastructure, gradual disengagement from the bank's online presence, postponement or cancellation of purchases, seeking additional information, limiting choices, sharing decisions with others, and delegation of decision-making to others.

Key infrastructural indicators include service-oriented website architecture, data-driven tools for managing online information, integrated content management systems, digitalized user-friendly banking services, AI-based IoT services, and IoT-based monitoring and analytics tools.

These findings align with prior research [13, 15-17, 20]. Results demonstrate that IoT, through real-time insights into economic trends and customer preferences, has the potential to transform financial services. Integrating IoT with AI enhances data analysis capabilities, improving intelligence and efficiency in financial services. Combining IoT with FinTech can significantly elevate customer services and organizational performance.

Regarding the quantitative research question—How is the IoT-based customer confusion management model validated in the banking industry?—results obtained using SmartPLS 3 showed that the path coefficients between variables and

their t-values indicate positive and significant relationships among components. For instance:

- Organizational factors influencing confusion management on IoT training management showed a path coefficient of 0.414 and a p-value of 0.000 ($p < 0.05$), confirming the hypothesis with 99% confidence.
- Customer confusion outcomes on organizational factors influencing confusion management showed a path coefficient of 0.655 and a p-value of 0.000 ($p < 0.05$), confirming the hypothesis with 99% confidence.
- Internet infrastructure on IoT training management had a path coefficient of 0.406 and a p-value of 0.000 ($p < 0.05$), confirming the hypothesis with 99% confidence.
- Customer characteristics contributing to confusion on IoT training management had a path coefficient of 0.557 and a p-value of 0.000 ($p < 0.05$), confirming the hypothesis with 99% confidence.

These results align with previous studies [7, 8, 14, 16, 20, 21]. They highlight how advancements in digital and mobile technology have significantly influenced customer behavior and expectations in the banking sector. Banks are exploring methods to reshape information to enhance customer understanding, leveraging IoT innovations to create transformative and engaging financial services.

Based on the findings, the following recommendations are offered to senior managers and policymakers:

1. Establish a comprehensive, up-to-date framework for internet platform utilization.
2. Foster close collaboration between management teams and employees to familiarize customers with IoT technologies.
3. Conduct regular, targeted training sessions for customers unfamiliar with online services.
4. Increase customer awareness of digital banking benefits.
5. Ensure structured, principle-driven customer training.
6. Develop personalized web-based content aligned with customer needs.
7. Align IT infrastructure with customer capabilities.
8. Monitor and evaluate individual customer use of internet services to assess training success.
9. Collect customer-specific data on IoT hardware and software familiarity.
10. Address customer needs by tracking issues in internet services.
11. Design short- and long-term frameworks for providing online services.
12. Secure high-level board support for advancing internet services.

This study, like any research, has limitations. First, the cross-sectional design limits causal inferences and the comprehensive analysis of all influencing factors. Longitudinal studies are recommended for future research. Second, methodological constraints raise questions about the replicability of results using different techniques. Future researchers are encouraged to apply alternative methodologies such as fuzzy Delphi, DEMATEL, and ANP to explore the topic further.

Authors' Contributions

Authors equally contributed to this article.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

All procedures performed in this study were under the ethical standards.

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