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Structural–Interpretive Model of Customer Confusion Management Based on the Internet of Things in the Banking Industry

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Abstract

The present study was conducted with the aim of developing a structural–interpretive model (ISM) for customer confusion management based on the Internet of Things (IoT) in the banking industry. This research is applied in nature and qualitative in approach, employing thematic analysis and the structural–interpretive modeling method to explain the relationships among the factors influencing customer confusion management. The statistical population consisted of 17 managers and experts from Bank Mellat branches in Tehran, who were selected through purposive and snowball sampling methods. Data were collected using semi-structured interviews and analyzed with MAXQDA 2018 software. The results of the thematic analysis led to the identification of 77 indicators categorized into 14 main components and six key dimensions. These dimensions include sources of confusion, consequences of customer confusion, internet infrastructures, customer characteristics affecting the increase in confusion, organizational learning management approaches for IoT, and organizational factors influencing confusion management. The findings of the interpretive structural model indicated that the organizational learning management approach for IoT has the highest level of influence, while the sources and consequences of confusion occupy the lowest level. The results further revealed that employing IoT in the banking industry—through enhancing technological infrastructures, automating service processes, and implementing targeted customer education—can effectively reduce confusion and improve customer experience. Therefore, strengthening organizational learning, developing modern technologies, and increasing informational transparency are regarded as fundamental requirements for the effective management of customer confusion in banks.

Keywords: Customer Confusion, Internet of Things (IoT), Banking Industry, Thematic Analysis, Interpretive Structural Modeling (ISM)

1. Introduction

The rapid convergence of ubiquitous connectivity, sensorization, and data-driven service design has repositioned the Internet of Things (IoT) from a back-office efficiency technology to a front-stage enabler of customer experience in banking. In omnichannel financial journeys—mobile apps, smart ATMs, branch beacons, wearables, and connected home assistants—IoT creates dense streams of context that promise personalization, real-time risk management, and operational resilience, but it also multiplies touchpoints, jargon, permissions, and choices that many customers find opaque. At this intersection, "customer confusion" emerges not as a trivial nuisance but as a systematic barrier to adoption, loyalty, and value capture. Recent research on service contracts, digital quality, and rollover mechanisms shows how perceived value, convenience, and switching costs interact with confusion to shape satisfaction and loyalty outcomes in service settings, including finance (Butt et al., 2024; Kim & Yang, 2025). In parallel, structural models of e-banking point to the mediating role of satisfaction between digital dimensions and behavioral intentions, underscoring why confusion must be conceptualized and managed as a multi-determinant construct within the digital service system (Minhaj & Khan, 2025).

A sustained body of consumer behavior scholarship frames confusion as an outcome of information overload, similarity, and ambiguity, with demonstrated effects on decision quality and post-purchase evaluations (Chauhan & Sagar, 2021). In digital, self-service contexts, tasks formerly performed by clerks are reallocated to customers; when interfaces, rules, or error recovery pathways are unclear, confusion suppresses adoption and nudges customers toward status-quo choices or abandonment (Johnson et al., 2021). These mechanisms travel to banking, where risk perceptions and compliance steps compound the cognitive load: authentication flows, consent management, data-sharing prompts, and product disclosures often arrive fragmented across channels, magnifying ambiguity and cross-cue interference (Chauhan & Sagar, 2021; Johnson et al., 2021). Recent findings in adjacent service arenas further show that negative emotions mediate the link between confusion and downstream consequences, intensifying dissatisfaction, complaint intentions, and churn—an affective pathway highly relevant to anxiety-sensitive financial decisions (Sharma et al., 2023).

IoT both alleviates and aggravates these problems. On the one hand, connected sensing allows banks to tailor nudges and automate routine steps; on the other, every added device, data permission, and analytic overlay increases complexity at the edge of the service system. The "green" modernization of infrastructures—energy-efficient edge devices, low-power networks, and ML-based optimization—adds still more constructs and claims for customers to parse (Patel et al., 2021). The COVID-19 pandemic catalyzed an unprecedented uptick in IoT applications for public services and health, accelerating consumer contact with machine-mediated processes and normalizing remote, sensor-assisted interactions—momentum that spilled into financial routines but also widened the digital literacy gap (Singh et al., 2020). Within retail finance, digital quality under environmental uncertainty has been linked to satisfaction and loyalty, suggesting that high-fidelity, reliable IoT-enabled experiences can buffer uncertainty, while low-fidelity experiences may amplify it by creating mismatches between expectations and delivered functionality (Kim & Yang, 2025).

Marketing transformations intensify this landscape. AI-powered targeting and platform commerce now shape expectation formation long before customers enter a bank's proprietary channels. Evidence from social platforms indicates that algorithmic curation influences purchase decisions, cueing perceived relevance yet also introducing opaque heuristics that customers struggle to interpret—a pattern that echoes in financial product exploration across influencer content, app stores, and comparison portals (Yeo et al., 2022). Outside finance, studies of digital nutrition labeling apps show how interface claims, iconography, and scoring systems can themselves become sources of confusion, especially when criteria or data provenance are unclear; the analogy to risk and sustainability badges in fintech is direct (Zecevic et al., 2022). In the sustainability domain, greenwashing research documents how vague or overstated environmental claims elevate perceived "green risk" and confusion, eroding trust—an increasingly salient issue as banks tout green IoT, low-carbon data centers, and eco-scores without standardized disclosure frames (Nisa et al., 2022; Patel et al., 2021).

Against this backdrop, banking strategy has pivoted toward "modern customer-centric" models that integrate analytics, platform partnerships, and embedded finance to orchestrate journeys end-to-end (Jalali Nazari & Saeednia, 2023). Yet customer-centricity presupposes intelligibility: value must be perceivable at the moment of choice, not merely provable in models. Work on perceived service value and dithering in brand selection shows that when propositions proliferate and cues conflict, customers oscillate—delaying, delegating, or defaulting—unless firms reduce ambiguity through design, education, and coherent framing (Ariosh et al., 2023). Empirical analyses of service-center business models add that the configuration of capabilities—knowledge codification, role of frontline experts, and digital enablement—conditions whether technology investments translate into performance and experience gains (Gaiardelli & Songini, 2021). In other words, the return on IoT is mediated by organizational choices that either dampen or amplify confusion.

Within Iranian and broader emerging-market contexts, the push toward fintech ecosystems, open banking interfaces, and data-rich CRM intensifies both opportunity and risk. Studies of IoT uptake in knowledge-based firms link deployment success to process redesign, data governance, and workforce capabilities—organizational prerequisites that also matter for banking's operational fabric (Esmaili Ranjbar et al., 2022). Research on CRM in retail settings using IoT and big data highlights segmentation, personalization, and real-time engagement as performance drivers—capabilities banks increasingly seek to port into savings, payments, and credit journeys (Rostami & Ghorchibeigi, 2022). Foresight work on the future of banking under fintech disruption underscores scenario-level uncertainties (regulation, infrastructure, platform dominance) that shape the pace and form of IoT integration—and by extension, the profile of confusion risks that banks must pre-empt (Momivand et al., 2022). Sector-specific investigations in Iran's financial services—such as mixed-method studies of customer confusion in life insurance—confirm the salience of information architecture, product comparability, and disclosure clarity as determinants of confusion and trust, providing construct-level anchors generalizable to banking (Khalilzadeh Talat Tapeh et al., 2022).

At the same time, the human resource substrate for digital operations is being rewired. Identifying IoT components that reshape HR processes—recruitment, training, performance monitoring—highlights how "back-office" capability build-up (e.g., IoT literacy, data stewardship, human-in-the-loop controls) conditions the "front-office" experience quality felt by customers (Bagheri, 2021). This is not cosmetic: misaligned training or over-automation without escalation paths can convert marginal friction into hard confusion. Smart marketing scenarios for banks using IoT—proximity offers, contextual prompts, device-level personalization—promise relevance but risk opacity if targeting logic and data use are not explained, or if consent designs are perfunctory (Shoaee Astaneh et al., 2022). Moreover, as digital channels adopt rollover service logics (auto-renewal, auto-upgrade, silent migration), the interplay of perceived value, convenience, and switching costs can entrench customers into paths they do not fully understand—increasing the likelihood that confusion coexists with nominal loyalty until a trust shock occurs (Butt et al., 2024).

Methodologically and operationally, segmentation is central to mitigation. Advances in clustering—such as improved density-based methods adapted to high-dimensional behavioral data—enable banks to identify micro-segments susceptible to confusion (e.g., low digital fluency/high product breadth) and to tailor interventions at scale (Yan et al., 2025). Complementarily, adoption research in mobile banking highlights the joint roles of interface design, system and service quality, security, and customer involvement—variables that are both design levers and confusion predictors (Muhammad et al., 2025). Structural models of e-banking show that satisfaction mediates the effects of these dimensions on loyalty and continued use, implying that confusion management is not a marginal hygiene factor but a core path through which digital investments yield behavioral outcomes (Minhaj & Khan, 2025). When environmental uncertainty is high—as with regulatory flux, cyber incidents, or macro shocks—digital quality (availability, responsiveness, consistency across devices) becomes an anchoring cue that reduces interpretive ambiguity and stabilizes expectations (Kim & Yang, 2025).

The literature also foregrounds the cross-domain portability of confusion mechanisms. Studies of platform-mediated fashion purchases reveal that AI-powered recommendations can both clarify and cloud judgments; when explanation is weak or signals conflict, customers discount relevance and infer manipulation, a dynamic pertinent to robo-advice, credit line suggestions, and savings nudges (Yeo et al., 2022). App-based nutrition evaluations demonstrate how scoring simplifications, badge clutter, and inconsistent category rules foster misclassification—analogous to risk meters, ESG badges, and fee labels in banking dashboards (Zecevic et al., 2022). In green consumption, the lack of verifiable claims exacerbates "green risk" and confusion; by analogy, banks' sustainability framing for IoT (e.g., "green data centers," "eco-transaction modes") requires evidentiary clarity to avoid the same traps (Nisa et al., 2022; Patel et al., 2021). Together these strands imply that confusion is not merely the byproduct of "too much information," but the signal of misaligned architectures among information, incentives, and interfaces.

From a managerial standpoint, modern customer-centric banking models articulate design logics for journey orchestration, but their success depends on rebalancing choice architectures: constraining irrelevant variability, sequencing disclosures, and scaffolding comprehension at points of high cognitive load (Jalali Nazari & Saeednia, 2023). Paradigm-level work on perceived value and dithering suggests that firms must translate technical superiority into experienced simplicity; where equivalently "good" options proliferate, value differences must be made legible through educational content, trialability, and post-choice reassurance (Ariosh et al., 2023). Service-center research contributes evidence that capability configurations—governance, knowledge processes, and metrics—predict service transformation outcomes, cautioning against technology-first rollouts that ignore organizational learning curves (Gaiardelli & Songini, 2021). In practice, IoT programs should pair deployment with customer education (micro-learning, explainable interfaces, graded permissions), frontline enablement, and transparent targeting and consent—elements repeatedly surfaced in confusion scholarship across sectors (Chauhan & Sagar, 2021; Johnson et al., 2021; Sharma et al., 2023).

Finally, the regional foresight and policy discourse emphasize boundary conditions. National infrastructures (identity rails, payments switches), data protection regimes, and industry standards shape how far IoT can advance—and how confusion is distributed across the population (Momivand et al., 2022). Organizational readiness in knowledge-based and financial firms—process maturity, analytics talent, and governance—mediates the translation of IoT promise into customer-visible clarity (Bagheri, 2021; Esmaili Ranjbar et al., 2022). CRM programs that harness IoT and big data offer a proving ground for segmentation-led education and for experimentation with consented personalization at scale (Rostami & Ghorchibeigi, 2022). Layered onto this, evolving evidence on rollover contract design, choice overload, and switching frictions underscores the ethical stakes of "dark patterns" in financial UX, where confusion can entrench vulnerabilities even as nominal KPIs improve (Butt et al., 2024). Accordingly, the aim of this study is to develop and justify an interpretive structural model for managing customer confusion in IoT-enabled banking by identifying, structuring, and hierarchically relating the sources and consequences of confusion, internet infrastructures, customer characteristics, organizational learning–based educational approaches, and organizational factors that together shape confusion dynamics and their mitigation

2. Methods and Materials

This research was conducted with a qualitative–exploratory approach aimed at designing a structural–interpretive model (ISM) for customer confusion management based on the Internet of Things (IoT) in the banking industry. In the first stage, the required data were collected through semi-structured interviews with experts in the fields of banking and modern technologies. The main research instrument was an open-ended interview guide developed to identify the dimensions, components, and indicators affecting customer confusion management. The collected data were analyzed using the thematic analysis method through the stages of open, axial, and selective coding. The result of this stage was the extraction of an initial conceptual model for customer confusion management based on the Internet of Things in Bank Mellat branches in Tehran.

In the second stage, in order to determine the relationships among the components and their hierarchical levels, the interpretive structural modeling (ISM) method was used. Accordingly, after identifying the components through thematic analysis, their interrelationships were determined based on expert opinions, and the reachability and antecedent matrices were constructed. Then, according to the ISM results, the final levels of variables were identified, and the structural model of the research was drawn. Subsequently, using MICMAC analysis, the degree of influence and dependence of each factor was analyzed, and their positions in the final model were determined.

The statistical population of this study consisted of specialists, academic experts, and Bank Mellat managers with at least ten years of experience in banking and modern financial technologies. A combination of non-probability, judgmental, and snowball sampling methods was used to select the participants, and a total of 17 interviews were conducted. Data collection continued until theoretical saturation was reached. To ensure the validity and reliability of the research, the interview questions were reviewed and confirmed by several experts. Moreover, based on the criteria of Lincoln and Guba (1985) for qualitative research evaluation, the indicators of credibility, dependability, confirmability, and transferability were observed. To this end, the interviews were carefully transcribed, continuous data analysis was performed during data collection, and the coding process was reviewed by a second researcher to ensure accuracy and impartiality of the analyses. Finally, the data were analyzed using MAXQDA 2018 software.

3. Findings and Results

To identify the indicators and components of the research model variables, the thematic analysis method was employed. Based on the interviews conducted with 17 experts, a total of 1,681 codes were identified according to their semantic and conceptual similarities.

Table 1 presents the dimensions, components, and indicators of the customer confusion management model based on the Internet of Things, each of which is elaborated in detail within the concepts.

Table 1. Analysis of Data Obtained from Interviews

Dimensions	Components	Indicators
Sources of Confusion	Factors Causing Confusion	Information overload transmitted to customers; Proliferation of irrelevant information about services; Use of incorrect methods of presenting information to customers; Use of similar and parallel stimuli for familiarization with the virtual environment; Complexity of advertising content presented to customers; Imposed pressures resulting from time constraints for decision-making in online environments; Lack of familiarity with brand expectations and advertising approaches; Banking regulations in electronic banking services; Unclear national currency regulations; Banking regulations in credit payment; Obligation of customers to provide high-value guarantees and collateral.
	Confusion-Based Marketing	Confusing customers through unintentional marketing methods in introducing banking services; Making service comparison impossible by injecting confusion into customers' input data; Using ambiguous marketing techniques and providing general online information in virtual spaces; Reducing customers' accuracy in selecting appropriate services; Exaggerating the power of banking services to confuse customers while using online services.
Consequences of Customer Confusion	Customer Satisfaction Loss	Broad customer defection from the bank causing significant financial losses; Spread of negative opinions in the market and loss of established position in the financial sector; Failure of customers to return for new banking services; Emergence of negative online campaigns against the bank.
	Brand Credibility Damage	Damage to the brand's credibility in online services; Customer perceptual and cognitive bias toward IoT-based banking services; Cognitive confusion and aversion toward the bank's website and brand.
	Confusion in Service Decision-Making	Inability to make correct decisions when selecting appropriate services; Initiating negative customer sentiment in both online and in-person interactions; Blaming top banking executives for insufficient IoT infrastructure development; Gradual withdrawal from the bank's website environment.
	Reactions of Confused Customers	Abandoning purchase; Postponing purchase; Seeking additional information; Limiting options under specific conditions; Sharing decision-making with others; Delegating decision-making to another person.
Internet Infrastructure	IT Infrastructure	Service-oriented architecture on the bank's website; Tool-based data management in online information systems; Website content synchronization systems; Internet-based document management systems for customers and banks; Development of online customer relationship management systems.
	Development of IoT-Based Anti-Confusion Tools	User-friendly digitization of banking services; Deployment of mobile terminals based on IoT; Development of artificial intelligence in IoT-based service platforms; Integration of IoT tools into the banks' service websites; IoT monitoring through smart service tools; Data analysis tools based on IoT.
Customer Characteristics Affecting Confusion Increase	Customer Perception of IoT Technological Requirements	Lack of familiarity with the rapid expansion of information technology and the consequent growth of computerized and online business processes; Adherence to traditional banking services and inability to establish fast, efficient IoT-based interactions; Unfamiliarity with IoT capabilities in storing and protecting personal information; Struggling within modern technological environments due to lack of knowledge of contemporary tools; Resistance to the rapid growth of IT and web-based services; Lack of awareness of privacy issues related to IoT devices.
	Customer Technological Literacy	Lack of knowledge about artificial intelligence capabilities; Inability to learn online and web-based banking operations; Blind adherence to limited knowledge of older customers regarding IoT; Inability to analyze IoT applications.
Organizational Learning Management Approach for IoT	Management of Educational Infrastructure Development	Short- and long-term organizational investment in customer education; Creating a foundation for comprehensive and up-to-date analysis of the necessity of online services; Managerial focus on close cooperation between employees and older customers to familiarize them with modern IoT technologies; Conducting continuous and targeted training sessions for customers unfamiliar with the online environment; Enhancing customer awareness of digital banking technologies and the benefits of online platforms; Ensuring proper and structured training of customers in online environments.
	Personalization of Educational Approaches	Creating and developing content tailored to individual customer needs in online platforms; Developing IT and communication industries according to customer capabilities; Continuous monitoring and evaluation of customer engagement with IoT technologies to assess the success of individual educational strategies; Collecting customer-specific information about hardware and software capabilities in IoT familiarity; Exploring individual customer needs through monitoring issues arising in online services.
Organizational Factors Influencing Confusion Management	Macro-Level Banking Management Factors	Structuring the process of providing online services in short- and long-term timeframes; Strategic support from the board of directors for advancing online services; Setting cost-effective service fees for both the bank and customers; Ensuring that all employees across organizational levels are familiar with the power and reach of online services; Providing adequate financial resources to develop software and hardware infrastructures across all bank branches; Ensuring service transparency at all organizational levels.
	Intra-Bank Factors in Confusion Management	Continuous collaboration between employees and customers to improve knowledge of the bank's website; Employee and managerial efforts for quick and informed access to IoT services; Diversification of online services and tools based on customer needs; Assessing employee competence in providing online banking services; Providing suitable platforms for preparing scheduled progress reports on online service delivery; Familiarizing employees with the complexity of online service provision processes from start to finish.

After the interviews with the experts, the extracted codes were compiled, and by the seventeenth interview, no new codes were added, indicating theoretical saturation as the extracted codes were repetitive.

The qualitative findings of the study, based on the thematic analysis method, indicated that through a careful review and classification of the descriptive codes extracted from the interview transcripts, a total of 77 indicators were identified. These indicators, considering their similarities, overlaps, and semantic affinities, were organized into 14 principal concepts. The extracted concepts included factors causing confusion, confusion-based marketing, erosion of customer satisfaction, damage to the bank's brand credibility, confusion in service decision-making, reactions of confused customers, information technology infrastructure, development of internet-based de-confusion tools, customers' understanding of the technological requirements of the Internet of Things (IoT), customer technological literacy, management of the process of providing educational infrastructures, personalization of the educational approach, macro-level banking management factors, and intra-bank factors in confusion management.

In the next step, these concepts—based on their nature, function, and content-related interconnections—were placed into six main categories, namely: sources of confusion; consequences of customer confusion; internet infrastructures; customer characteristics that contribute to increased confusion; organizational learning management approach for IoT; and organizational factors affecting confusion management. This classification formed the conceptual structure of the research model and helped explain the relationships among the dimensions influencing customer confusion in IoT-based banking contexts.

Based on the findings from the thematic analysis, it can be concluded that customer confusion in the banking industry is a multifaceted and dynamic phenomenon shaped by the interaction of technological, behavioral, and organizational factors. Indeed, alongside the expansion of digital technologies, the increase in information volume, the diversity of services, and multimedia advertising, customers' perception and decision-making become more complex. Particularly in online and IoT-based banking environments, insufficient customer familiarity with technology, lack of informational transparency, and the use of ambiguous advertising messages can lead to confusion, dissatisfaction, and diminished trust in the bank's brand.

The results of this phase served as the basis for the study's interpretive structural model; subsequently, the relationships among the components were stratified using the ISM method. Accordingly, the organizational learning management approach for IoT was positioned at the highest level of influence and played a strategic role in the effective management of customer confusion, whereas the sources of confusion and their consequences were placed at the lowest level of the model and were the most influenced by the other levels.

To address the research question concerning the dimensions and stratified components of the IoT-based customer confusion management model in the banking industry, the interpretive structural modeling (ISM) method was employed. This method is a systematic approach to analyzing the internal relationships among the components of a complex phenomenon and enables the identification of levels of influence and dependence among variables.

In this approach, the logical and contextual relationships among the identified factors are determined based on expert opinions and judgments. ISM, by drawing on group decision-making techniques such as brainstorming, the nominal group technique, and pairwise comparative analysis, extracts the structure of relationships among components and displays it as a hierarchical model.

In the present study, to determine the contextual relationships among the selected codes derived from the thematic analysis, the perspectives and judgments of experts in banking and modern financial technologies were utilized. After collecting their views and forming the structural relationship matrix, the process of transforming it into the reachability matrix and stratifying the components was conducted. Ultimately, based on the analysis results, the interpretive structural model of IoT-based customer confusion management in the banking industry was constructed.

Table 2. List of Selected Codes for IoT-Based Customer Confusion Management in the Banking Industry

Selected Codes	Symbol
Sources of Confusion	A
Consequences of Customer Confusion	B
Internet Infrastructures	C
Customer Characteristics Contributing to Increased Confusion	D
Organizational Learning Management Approach for IoT	E
Organizational Factors Affecting Confusion Management	F

Step One: Formation of the Structural Self-Interaction Matrix (SSIM)

By considering the contextual relationship for each variable, the existence of a relationship between any two components (i and j) and the direction of that relationship are examined. Four symbols are used to indicate the direction of the relationship between two components (i and j) (Mathiyazhagan et al., 2013): V: component i will help achieve component j. A: component j will help achieve component i. X: components i and j will help achieve each other. O: components i and j are unrelated. The SSIM for the selected codes of IoT-based customer confusion management in the banking industry is presented in Table 7. In this table, the majority opinion is taken as final. For example, suppose that, when comparing two selected codes (a single cell in the structural self-interaction matrix), out of 17 experts, 10 assign the value V. Because more than half of the experts expressed this view, V is selected for that cell. In other words, the mode of the opinions is used. (Mathiyazhagan et al., 2013).

Table 3. Final Structural Self-Interaction Matrix (SSIM)

	A	B	C	D	E	F
A	X	X	V	V	V	V
B		X	V	V	V	V
C			X	X	V	X
D				X	V	X
E					X	O
F						X

Step Two: Formation of the Initial Reachability Matrix

At this stage, the reachability matrix is developed from the SSIM. The SSIM format is initially converted into the format of the initial reachability matrix by transforming each SSIM cell into binary values (i.e., one or zero). This conversion is performed using the following rules (Mathiyazhagan et al., 2013).

Table 4. Initial Reachability Matrix

	A	B	C	D	E	F
A	X	X	V	V	V	V
B		X	V	V	V	V
C			X	X	V	X
D				X	V	X
E					X	O
F						X

Step Three: Formation of the Final Reachability Matrix

The final reachability matrix for the selected codes, shown in Table 8, is obtained by incorporating transitivity.

Table 5. Final Reachability Matrix

	A	B	C	D	E	F
A	X	X	V	V	V	V
B		X	V	V	V	V
C			X	X	V	X
D				X	V	X
E					X	O
F						X

Step Four: Determination of Variable Levels

After identifying the top-level element, it is removed from the remaining variables. In this study, the six selected codes and their levels are presented in Table 10.

Table 6. Levels, Driving Power, and Dependence Power of the Selected Codes for IoT-Based Customer Confusion Management in the Banking Industry

Selected Codes	Symbol	Input	Output	Intersection	Level	Driving Power	Dependence Power
Sources of Confusion	A	A–B	A–B–C–D–E–F	A–B	3	6	2
Consequences of Customer Confusion	B	A–B	A–B–C–D–E–F	A–B	3	6	2

Internet Infrastructures	C	A–B–C–D–F	C–D–E–F	C–D–F	2	4	5
Customer Characteristics Contributing to Increased Confusion	D	A–B–C–D–F	C–D–E–F	C–D–F	2	4	5
Organizational Learning Management Approach for IoT	E	A–B–C–D–E	E	E	1	1	6
Organizational Factors Affecting Confusion Management	F	A–B–C–D–F	C–D–E–F	C–D–F	2	4	5

The principle of MICMAC is based on the multiplicative properties of matrices. The objective of MICMAC analysis is to examine driving power and dependence power. This is carried out to identify the key factors that steer the system in different categories (Mathiyazhagan et al., 2013). Subsequently, the plot of driving power versus dependence power for the criteria was constructed, as shown in Figure 1.

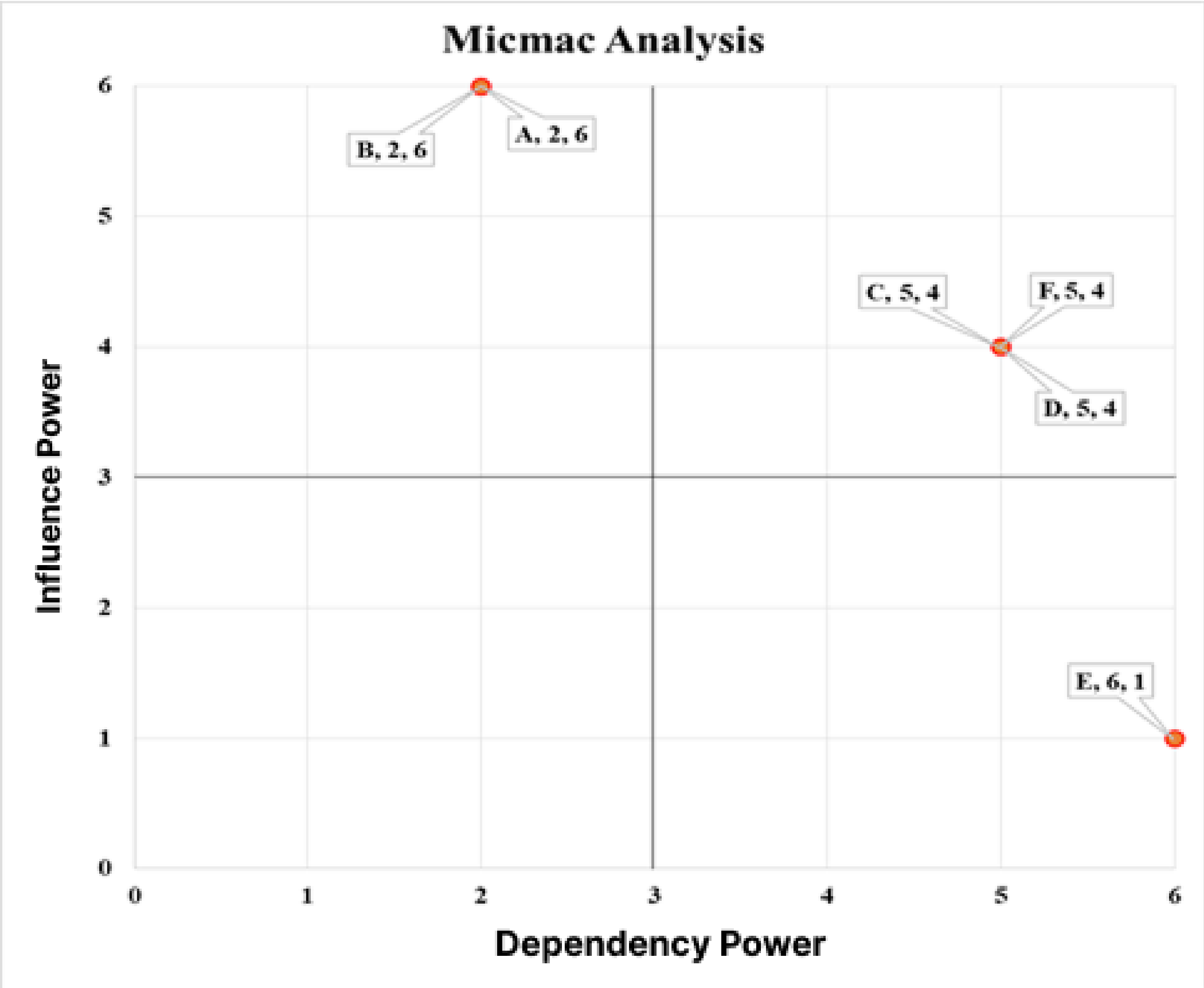

Figure 1. Driving Power and Dependence Power

From the perspective of driving and dependence power, the study model is shown in Figure 2. Accordingly, the selected code "Organizational Learning Management Approach for IoT" is of the dependent type. The selected codes "Internet Infrastructures," "Customer Characteristics Contributing to Increased Confusion," and "Organizational Factors Affecting Confusion Management" are linkage variables. The selected codes "Sources of Confusion" and "Consequences of Customer Confusion" are independent variables. Linkage variables have high driving and dependence power; in other words, the influence and susceptibility of these criteria are very high, and any minor change in them can lead to fundamental changes in the system.

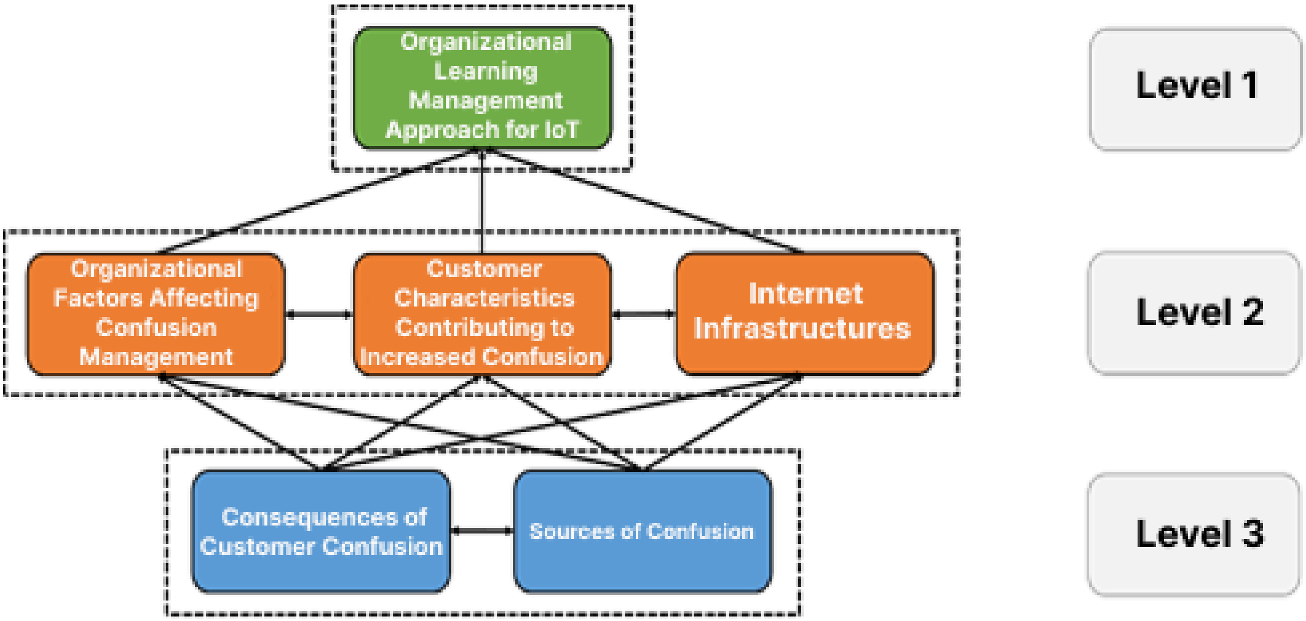

Figure 2. Stratification of Factors Influencing IoT-Based Customer Confusion Management in the Banking Industry

Accordingly, the selected code "Organizational Learning Management Approach for IoT" is at level one. The selected codes "Internet Infrastructures," "Customer Characteristics Contributing to Increased Confusion," and "Organizational Factors Affecting Confusion Management" are at level two. Finally, the selected codes "Sources of Confusion" and "Consequences of Customer Confusion" are at level three.

4. Discussion and Conclusion

The purpose of this study was to construct and interpret an integrated structural–interpretive model for managing customer confusion in the banking industry through the application of Internet of Things (IoT) technologies. The findings derived from the thematic analysis and interpretive structural modeling (ISM) revealed that six major dimensions—sources of confusion, consequences of confusion, internet infrastructures, customer characteristics influencing confusion, organizational learning management approach for IoT, and organizational factors affecting confusion management—jointly explain the multi-layered nature of confusion in digital banking environments. Among these, the *organizational learning management approach for IoT* was identified as the highest-level and most influential factor in mitigating confusion, while *sources of confusion* and *consequences of confusion* were positioned at the lowest level, reflecting their high dependence and susceptibility to other systemic variables.

The first significant finding is that confusion in IoT-based banking arises from a confluence of informational, technological, and behavioral sources. Customers often experience informational overload, inconsistent service cues, and cognitive saturation when navigating complex digital ecosystems. This aligns with previous studies that identify confusion as an outcome of excessive information, ambiguous communication, and overlapping stimuli in service interfaces (Chauhan & Sagar, 2021). In banking, where security, compliance, and service diversity intersect, such complexity becomes more pronounced, producing decision paralysis or deferral. The interpretive structural model confirmed that these confusion sources form the foundation of the system, influencing all higher-level constructs. This observation supports empirical results suggesting that confusion is most pronounced in service sectors characterized by intangibility, heterogeneity, and high perceived risk (Sharma et al., 2023). Moreover, it echoes findings in digital contract and rollover service models, which demonstrate that unclear renewal terms and multi-channel messaging can amplify confusion and erode satisfaction (Butt et al., 2024).

A second key result highlights the role of *organizational learning management for IoT* as the dominant driver in mitigating confusion. The analysis indicated that structured, continuous, and customer-focused learning programs—both internally for staff and externally for customers—form the strategic core of confusion management. This finding aligns with research emphasizing that digital transformation success depends on adaptive learning systems capable of translating technological capabilities into understandable value propositions (Ariosh et al., 2023; Jalali Nazari & Saeednia, 2023). Educational personalization, feedback loops, and iterative engagement help customers internalize digital processes, reducing uncertainty and promoting perceived control. Consistent with prior evidence from AI-driven service contexts, transparent communication and user training have been shown to moderate the adverse effects of complexity and perceived risk (Kim & Yang, 2025; Muhammad et al., 2025). Therefore, organizational learning is not merely a support function but an active governance mechanism that stabilizes customer perceptions within high-technology banking ecosystems.

The third empirical result concerns the *internet infrastructures* dimension, which functions as both a driver and a linkage variable within the system. The results indicate that robust, secure, and interoperable infrastructures reduce confusion by ensuring consistency across digital touchpoints. Poor system integration, latency, or mismatched data flows were identified by experts as primary enablers of confusion. This finding corroborates studies demonstrating that digital quality—defined by accessibility, responsiveness, and seamlessness—strongly influences satisfaction, trust, and loyalty in uncertain environments (Kim & Yang, 2025). Similarly, prior analyses of IoT applications in human resource management and knowledge-based organizations underscore that infrastructure readiness determines both operational efficiency and user comprehension (Bagheri, 2021; Esmaili Ranjbar et al., 2022). Hence, infrastructure development serves not only a technical but also a psychological function, shaping the perceptual clarity of service encounters.

The results further revealed that *customer characteristics*—specifically technological literacy, resistance to innovation, and misunderstanding of IoT functionalities—mediate the relationship between infrastructure and confusion outcomes. This finding extends prior research identifying digital fluency as a moderator of satisfaction and adoption in e-banking systems (Minhaj & Khan, 2025). Customers with low technological competence often misinterpret interface cues, security protocols, or data-sharing mechanisms, perceiving higher risk and lower transparency. Similar patterns were observed in mobile self-checkout and e-hospitality contexts, where confusion emerged from self-service complexity and insufficient guidance (Johnson et al., 2021; Sharma et al., 2023). The results emphasize that customer heterogeneity must be addressed through segmented educational initiatives and user experience design, consistent with evidence that improved interface design and tailored communication can unlock mobile and online banking adoption (Muhammad et al., 2025; Yan et al., 2025).

A further insight from the model concerns *organizational factors*, which exert indirect but substantial effects on confusion management through governance, investment, and cultural readiness. Strategic alignment between top management and digital initiatives enhances the clarity of service delivery structures, reduces redundancy, and ensures transparency. These findings mirror previous research on business model reconfiguration in service centers, where performance improvements depend on managerial commitment and learning orientation (Gaiardelli & Songini, 2021). Additionally, scenario analyses of the banking industry under fintech disruption highlight that organizational agility, regulatory responsiveness, and interdepartmental coordination determine how effectively IoT-related confusion can be anticipated and managed (Momivand et al., 2022). The inclusion of these organizational variables in the ISM hierarchy underscores that confusion is as much a management challenge as it is a customer perception issue.

In contrast, *consequences of confusion* such as reduced satisfaction, damaged brand credibility, and withdrawal from digital channels appear as dependent variables in the model, reflecting their symptomatic nature. The thematic analysis and expert interviews confirmed that persistent confusion undermines customer trust, delays purchase or usage decisions, and generates negative word-of-mouth. This aligns with prior evidence that confusion is negatively correlated with satisfaction, loyalty, and retention (Butt et al., 2024; Sharma et al., 2023). Moreover, research in insurance and service sectors corroborates that when customers cannot differentiate between alternatives or comprehend service terms, they resort to avoidance behaviors that ultimately erode relationship quality (Khalilzadeh Talat Tapeh et al., 2022). The ISM results thus reinforce the notion that confusion management should be viewed as a preventive strategy rather than a remedial one, focusing on upstream factors such as education, design, and infrastructure.

An interesting comparative dimension arises when juxtaposing these findings with non-financial domains. Studies of digital retail and social media marketing reveal that algorithmic opacity and greenwashing phenomena similarly induce confusion by masking information asymmetry and eroding interpretive confidence (Nisa et al., 2022; Yeo et al., 2022; Zecevic et al., 2022). This parallel suggests that confusion is a cross-sectoral issue in digital ecosystems, transcending product type or market maturity. For banks, the implication is that transparency standards, data ethics, and responsible communication are critical not only for compliance but also for customer cognition. The integration of IoT in green finance, for example, must be accompanied by clear articulation of data use, sustainability claims, and customer benefits to prevent "green confusion" analogous to what has been observed in environmentally marketed products (Nisa et al., 2022; Patel et al., 2021).

Another important aspect derived from the MICMAC analysis is the interdependence among linkage variables—particularly internet infrastructures, customer characteristics, and organizational factors. These elements exhibit both high driving and dependence power, meaning that small perturbations can propagate system-wide effects. This finding mirrors systems-theory interpretations of digital transformation, where socio-technical subsystems coevolve rather than linearly interact (Esmaili Ranjbar et al., 2022; Rostami & Ghorchibeigi, 2022). From a managerial perspective, this underscores the need for holistic governance frameworks that synchronize technological, human, and organizational dimensions. Such coherence aligns with evidence that successful IoT adoption in banking requires co-design among IT departments, marketing units, and compliance teams to ensure consistent messaging and process integration (Shoaee Astaneh et al., 2022).

The results also validate that confusion is inherently dynamic and context-dependent. As IoT devices proliferate, the boundaries between physical and digital service encounters blur, producing new interpretive demands on customers. Studies of IoT-based HRM, knowledge firms, and customer relationship management reveal similar complexity cycles, where the introduction of smart systems initially raises uncertainty before learning mechanisms stabilize expectations (Bagheri, 2021; Esmaili Ranjbar et al., 2022; Rostami & Ghorchibeigi, 2022). Hence, confusion management should be conceptualized as an ongoing adaptive process rather than a one-time corrective measure.

Finally, the hierarchical pattern obtained through ISM—the positioning of educational management at the top and confusion sources at the base—supports a causal inference chain: *learning and governance → infrastructure and customer characteristics → confusion sources and consequences*. This configuration resonates with strategic models of customer-centric banking, which posit that the fusion of digital technologies and organizational learning creates a self-reinforcing cycle of satisfaction and innovation (Jalali Nazari & Saeednia, 2023). Consistent with the paradigm model of customer dithering, continuous communication and perceived service value serve as interpretive anchors that reduce hesitation and enhance decision efficiency (Ariosh et al., 2023). Thus, the study contributes to theory by demonstrating that confusion management in IoT-enabled banking is best understood as an integrative system, where technological, organizational, and psychological components interact through learning and infrastructure mechanisms to influence customer cognition and behavior.

This research, while comprehensive, is subject to several limitations. First, the qualitative–interpretive nature of the study restricts the generalizability of the findings to broader populations or different national banking contexts. The participant pool, though composed of experts with significant experience, was limited to Bank Mellat in Tehran, which may reflect contextual biases specific to Iranian digital banking infrastructure and regulatory frameworks. Second, the ISM method, by design, relies on expert judgment to infer directional relationships among constructs; although this technique elucidates hierarchy and interdependence, it does not capture the statistical magnitude or potential nonlinear effects among variables. Third, the study's reliance on self-reported perceptions from semi-structured interviews may have introduced subjective interpretation bias, particularly regarding the perceived influence of educational management and technological literacy. Finally, while the thematic analysis identified 77 indicators across 14 core components, the exclusion of quantitative validation (e.g., structural equation modeling) limits the empirical robustness of causal inferences derived from the qualitative structure.

Future investigations should aim to quantitatively validate the interpretive structural relationships identified here, using hybrid methodologies that combine ISM with confirmatory factor analysis or partial least squares structural equation modeling (PLS-SEM). Longitudinal designs could examine how confusion evolves over time with the diffusion of new IoT technologies or regulatory reforms. Cross-country comparative studies would also be valuable to explore cultural and infrastructural moderating effects on confusion perception and mitigation strategies. Researchers should further integrate behavioral data—such as clickstream analytics or eye-tracking in digital interfaces—to triangulate self-reported confusion with observable cognitive load. Expanding the sample to include customers across demographic segments, especially those with differing levels of digital literacy, would enhance external validity. Moreover, future work could investigate the ethical dimensions of confusion in financial UX design, exploring the thin line between persuasive design and manipulative architecture in IoT-based services.

From a managerial and practical standpoint, the results emphasize the necessity of embedding confusion management into the strategic architecture of digital banking. Banks should institutionalize organizational learning programs that target both employees and customers, ensuring familiarity with IoT functionalities, privacy mechanisms, and digital risk management. Clearer user interfaces, transparent communication about data use, and tiered educational content can substantially reduce interpretive overload. Infrastructure investments should prioritize integration, consistency, and real-time feedback to maintain user confidence. Managers should design consent, onboarding, and troubleshooting processes that align with varying levels of customer technological literacy, ensuring that every interaction reinforces clarity rather than complexity. Finally, developing cross-functional governance teams—linking IT, compliance, marketing, and customer relations—can foster a systemic approach to reducing confusion, enhancing trust, and sustaining long-term digital engagement in IoT-enabled banking environments.

Ethical Considerations

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

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Conflict of Interest

The authors report no conflict of interest.

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