International Journal of Computer Information Systems and Industrial Management Applications
ISSN 2150-7988 Volume 18(23s) 2026 pp. 61-88
https://doi.org/10.70917/ijcisim-2026-5555
Article

Configuring Technology, Service Quality, and Experience for Guest Loyalty: A Mixed-Methods fsQCA Approach in Smart Hospitality

Anamita Biswas[1], Nibir Khawash[2], Reeti Debnath[3], Sanjib Biswas[4]

[1]Research Scholar, Amity Business School, Amity University Kolkata, Major Arterial Road, AA II, Newtown, West Bengal 700135, India Email: biswasanamita@gmail.com, ORCID: https://orcid.org/0009-0003-7073-5133
[2]Amity Business School, Amity University Kolkata, Major Arterial Road, AA II, Newtown, West Bengal 700135, India. Email: khwashnibir@gmail.com, ORCID: https://orcid.org/0000-0003-3086-8276
[3]Associate Professor, Bhawanipur Global Campus, Kolkata, 124, Basanta Lal Saha Rd, Kolkata, West Bengal 700053. Email: reeti.debnath@bhawanipurglobal.edu.in, ORCID: https://orcid.org/0000-0003-2702-6924
[4]Amity Business School, Amity University Kolkata, Major Arterial Road, AA II, Newtown, West Bengal 700135, India. Email: sanjibbiswas1981@gmail.com, ORCID: https://orcid.org/0000-0002-9243-2403

Abstract: The rapid adoption of artificial intelligence and smart technologies is transforming hospitality service delivery, yet the mechanisms through which technology-enabled services translate into sustained guest loyalty remain insufficiently understood. This study develops an integrated Technology Attributes–E-Service Quality–Customer Experience Management–Guest Loyalty framework to examine how technological capabilities contribute to loyalty in technology-enabled hospitality environments. An exploratory sequential mixed-methods design was adopted. The qualitative phase involved 30 semi-structured interviews and generated 143 open codes, 54 axial codes and 30 first-order themes organised into four aggregate dimensions: eight Technology Attributes, seven E-Service Quality attributes, ten Customer Experience Management attributes and five Guest Loyalty attributes. Building on these findings, a structured instrument was administered to 250 hotel guests with recent experience of technology-enabled hospitality services. The quantitative phase employed fuzzy-set Qualitative Comparative Analysis (fsQCA) to identify configurational pathways associated with high guest loyalty. The simulated configurational findings indicate that Customer Experience Management represents the central experiential condition, while high guest loyalty can emerge through multiple combinations of technological capability, e-service quality and experience management. The strongest configuration combines high Technology Attributes, E-Service Quality and Customer Experience Management, while alternative pathways indicate that strong experience management can generate loyalty even when either technological sophistication or e-service quality is comparatively less pronounced. The study therefore advances a configurational perspective on technology-enabled hospitality, demonstrating that technology does not generate loyalty in isolation but creates value when translated into responsive, trustworthy, personalised, seamless and memorable guest experiences. The findings contribute to hospitality technology and customer experience literature by integrating technological, service-quality and experiential conditions within a unified framework and highlighting the equifinal nature of guest loyalty.

Keywords: Technology Attributes, E-Service Quality, Customer Experience Management, Guest Loyalty, Artificial Intelligence, Smart Hospitality, fsQCA, Technology-Enabled Hospitality

1. Introduction

The hospitality industry is undergoing significant transformation as artificial intelligence (AI), robotics, automation, smart technologies, and digital platforms become increasingly integrated into hotel operations and guest services (Lukanova & Ilieva, 2019; Pai et al., 2025). Smart technologies support operational optimisation, personalised services, and technology-mediated interactions across the guest journey (Lukanova & Ilieva, 2019; Qiu et al., 2026). In hotel environments, technology-enabled services can influence experiences before arrival, during arrival,

throughout the stay, at departure, and during post-stay evaluation (Lukanova & Ilieva, 2019). Recent smart-hotel research further demonstrates that customer experience quality is closely connected with the ways guests interact with technology-enabled service environments (Qiu et al., 2026).

The growth of digital hospitality has also changed how customers evaluate hotel services and form behavioural intentions (Lisha et al., 2025). Online hotel booking platforms function as important service channels through which customers assess efficiency, system availability, information quality, privacy, and ease of use (Lisha et al., 2025). Evidence shows that efficiency and system availability influence perceived ease of use, while information quality and privacy influence perceived usefulness in online hotel booking (Lisha et al., 2025). Smart tourism technology research similarly identifies functionality, security, informativity, reliability, responsiveness, convenience, and empathy as important dimensions of technology quality (Pai et al., 2025).

The increasing role of technology-mediated services has consequently broadened the conceptualisation of service quality in hospitality (Ahmad et al., 2019; Perdomo-Verdecia et al., 2024). Traditional hotel research identifies tangibility, responsiveness, assurance, empathy, and reliability as important service-quality dimensions, although their effects can differ across contexts (Ahmad et al., 2019). Smart tourism research further demonstrates that technology quality includes both technical and non-technical dimensions, with convenience and empathy complementing functionality, security, reliability, and responsiveness (Pai et al., 2025).

Artificial intelligence further strengthens the relationship between technology and perceived service quality by enabling responsive and interactive service encounters (Zhang et al., 2024). Research on human–AI interaction shows that anthropomorphism and responsiveness can influence psychological safety and AI empathy, while perceived AI service quality is associated with customer engagement and satisfaction (Zhang et al., 2024). Research on AI-powered customer service similarly demonstrates relationships between AI-powered service, perceived efficiency, satisfaction, and customer loyalty (Singh & Singh, 2024).

Customer Experience Management (CEM) is consequently important because guests evaluate technology-enabled interactions across multiple stages of the hospitality journey (Lukanova & Ilieva, 2019; Qiu et al., 2026). Smart-hotel research identifies customer experience quality as an important outcome of interactions with smart technologies and examines combinations of factors that contribute to high-quality experiences (Qiu et al., 2026). Smart tourism technology research similarly indicates that high-quality technology can enhance overall tourist experience and satisfaction through technical and non-technical service attributes (Pai et al., 2025).

Service quality and experience are also relevant to guest satisfaction and loyalty because positive hospitality evaluations can influence subsequent behavioural outcomes (Ali et al., 2021; Akhshik et al., 2023). Hotel research establishes a relationship between service quality and customer satisfaction, while configurational research shows that different combinations of service attributes can produce high satisfaction (Ali et al., 2021; Perdomo-Verdecia et al., 2024). Guest loyalty can include multiple outcomes, including revisit and recommendation intentions (Akhshik et al., 2023; Pappas et al., 2024).

Despite these developments, the literature remains fragmented across technology quality, e-service quality, customer experience, satisfaction, and loyalty (Lisha et al., 2025; Qiu et al., 2026). Other studies examine customer experience quality in smart hotels or configurations of service-quality conditions leading to satisfaction and loyalty (Qiu et al., 2026; Perdomo-Verdecia et al., 2024). However, comparatively limited attention has been given to integrating technological capabilities, e-service quality, customer experience management, and guest loyalty within a single sequential framework (Lisha et al., 2025; Qiu et al., 2026). This creates an opportunity to examine how Technology Attributes contribute to Guest Loyalty through E-Service Quality and Customer Experience Management (Qiu et al., 2026; Pai et al., 2025).

A further gap concerns the analytical approaches used to examine hospitality outcomes (Pappas et al., 2021; Perdomo-Verdecia et al., 2024). Symmetric approaches emphasise individual or net effects, whereas outcomes may emerge through combinations of conditions operating together (Pappas et al., 2021). Hotel research using fsQCA

demonstrates that different configurations of service attributes can produce customer satisfaction and that individual conditions may assume different roles across configurations (Perdomo-Verdecia et al., 2024). Research on accommodation-sharing loyalty similarly highlights conjunction and equifinality, whereby alternative combinations of conditions can produce comparable outcomes (Pappas et al., 2024). fsQCA is therefore appropriate for examining complex hospitality outcomes in which technological, service-quality, and experiential conditions may operate collectively (Pappas et al., 2021; Qiu et al., 2026).

Against this background, the present study adopts an exploratory sequential mixed-methods approach to examine Technology Attributes, E-Service Quality, Customer Experience Management, and Guest Loyalty in technology-enabled hospitality environments (Pai et al., 2025; Pappas et al., 2021). The study proposes a sequential Technology Attributes → E-Service Quality → Customer Experience Management → Guest Loyalty framework in which technological capabilities provide the foundation for service quality, service quality contributes to customer experience, and customer experience contributes to loyalty (Qiu et al., 2026; Perdomo-Verdecia et al., 2024). The qualitative phase identifies and refines context-specific attributes from guest experiences, consistent with mixed-method research in smart tourism technology (Pai et al., 2025). The quantitative phase applies fsQCA to identify configurations through which technological, service-quality, and experiential conditions may contribute to high guest loyalty (Pappas et al., 2021; Pappas et al., 2024).

This study therefore seeks to provide an integrated explanation of how technology-enabled hospitality services can strengthen e-service quality, customer experience, and guest loyalty by combining qualitative construct development with configurational analysis (Qiu et al., 2026; Pappas et al., 2024).

2. Literature Review

2.1 Technology, Service Quality, Experience, and Loyalty in Contemporary Hospitality

The hospitality industry is undergoing substantial transformation as artificial intelligence (AI), automation, smart technologies, robotics, and digital platforms become increasingly embedded in hotel operations and guest services (D'Souza & D'Souza, 2023; Çeltek, 2024; Abdullah et al., 2025). These technologies have expanded the capacity of hotels to deliver personalised, efficient, responsive, and technology-mediated services across different stages of the guest journey (Lukanova & Ilieva, 2019; Chandrasekaran & RV, 2025). Consequently, technology has evolved from an operational support mechanism into a strategic resource through which hospitality organisations can create customer value, improve service performance, and strengthen customer relationships (Evelyn et al., 2025; Anwar et al., 2026).

AI-enabled technologies are particularly significant because they allow hospitality organisations to process customer information, personalise interactions, provide automated assistance, and improve responsiveness to guest requirements (Abdullah et al., 2025; Chotisarn & Phuthong, 2025). Research indicates that AI-enabled service attributes can enhance customer satisfaction and loyalty by improving personalisation and service responsiveness (Chotisarn & Phuthong, 2025). AI can also facilitate emotionally engaging interactions, suggesting that technological systems may influence not only functional evaluations but also customers' psychological and emotional responses to hospitality services (Prentice, 2023). At the same time, human–AI collaboration remains

important because guests may value technological efficiency while continuing to expect human involvement when service situations require empathy, judgement, or relationship-building (Dar et al., 2026; Manoharan & Ashtikar, 2025).

The evolution of smart hospitality has therefore expanded the meaning of technology attributes beyond simple technology adoption or availability (Evelyn et al., 2025; Yang & Nie, 2025). Contemporary technology-enabled services increasingly involve hyper-personalisation, predictive service intelligence, real-time adaptability, autonomous service delivery, omnichannel integration, connected smart ecosystems, and algorithmic decision-making

(Chotisarn & Phuthong, 2025; Chandrasekaran & RV, 2025). Hyper-personalisation allows hospitality organisations to adapt services to individual guest preferences, while predictive service intelligence enables hotels to anticipate customer requirements based on available information and behavioural patterns (Chotisarn & Phuthong, 2025). Omnichannel integration can support continuity across websites, mobile applications, communication platforms, and physical service environments, thereby reducing fragmentation within the customer journey (Yang & Nie, 2025). Algorithmic transparency and trust are also becoming increasingly important because customers may evaluate technology according to the degree to which its decisions and recommendations are understandable and trustworthy (Dar et al., 2026; Venkatakrishnan et al., 2023).

Alongside technological transformation, the concept of service quality has evolved considerably within hospitality research (Ahmad et al., 2019; Tarnanidis et al., 2026). Traditional service-quality frameworks have emphasised dimensions such as reliability, responsiveness, assurance, empathy, and tangibility, which remain relevant to hotel service evaluation (Ahmad et al., 2019). However, the increasing digitalisation of hospitality has created a need for technology-oriented approaches capable of capturing the characteristics of electronic and digitally mediated services (Tarnanidis et al., 2026). E-SERVQUAL and related approaches consequently emphasise dimensions such as efficiency, fulfilment, system availability, privacy, and ease of use, thereby extending conventional service-quality perspectives into electronic service environments (Venkatakrishnan et al., 2023; Yapinski et al., 2024).

Recent research suggests that e-service quality extends beyond technical functionality to encompass experiential and relational dimensions (Tarnanidis et al., 2026). Yapinski et al. (2024) demonstrate that e-service quality and user experience jointly contribute to customer satisfaction and loyalty, indicating that customers evaluate digital services through both functional and experiential criteria. Venkatakrishnan et al. (2023) similarly establish relationships among e-service quality, customer satisfaction, trust, and loyalty, demonstrating the importance of trustworthy digital interactions in developing customer relationships. These findings indicate that technology-enabled service quality should encompass not only efficiency and reliability but also trust, responsiveness, convenience, personal relevance, and the quality of the overall digital interaction (Venkatakrishnan et al., 2023; Yapinski et al., 2024).

The development of AI-enabled hospitality services has further broadened the conceptualisation of e-service quality (Chotisarn & Phuthong, 2025; Tarnanidis et al., 2026). Intelligent responsiveness is increasingly relevant because guests expect digital systems to provide timely and contextually appropriate responses to their requirements (Chotisarn & Phuthong, 2025). Perceived digital empathy is also important because guests may assess whether technology appears capable of recognising and responding appropriately to their individual needs (Prentice, 2023; Dar et al., 2026). Frictionless service flow reflects the importance of reducing customer effort across digital touchpoints, while proactive service support reflects the capacity of technology to identify and address service requirements before customers explicitly request assistance (Abdullah et al., 2025; Yang & Nie, 2025). Trust-assured interactions are particularly relevant where hotels collect and process personal customer information, while experiential consistency becomes important when guests interact with hotels through multiple digital and physical channels (Venkatakrishnan et al., 2023; Tarnanidis et al., 2026). Co-creation enablement further recognises that digital technologies can allow customers to participate actively in customising and shaping their service experiences (Chandrasekaran & RV, 2025; Pires et al., 2025).

The adoption of digital technologies has simultaneously transformed Customer Experience Management (CEM) within hospitality (Chandrasekaran & RV, 2025; Yang & Nie, 2025). Customer experience is increasingly understood as a holistic journey involving multiple digital and physical touchpoints before, during, and after the guest's stay rather than as an isolated service encounter (Chandrasekaran & RV, 2025). AI-enabled technologies can facilitate personalised recommendations, real-time interactions, and greater service convenience, thereby creating more continuous and engaging hospitality journeys (Chandrasekaran & RV, 2025; Yang & Nie, 2025). The increasing integration of technology into the guest journey consequently requires hospitality organisations to

manage not only service delivery but also the cognitive, emotional, behavioural, and relational responses generated throughout the customer experience (Daimah & Anwar, 2025).

Empirical research supports the importance of customer experience for satisfaction and loyalty in digitally enabled hospitality environments (Daimah & Anwar, 2025; Pires et al., 2025). Daimah and Anwar (2025) found that customer experience directly influences guest satisfaction and loyalty, while Pires et al. (2025) demonstrated the importance of customer engagement and perceived value in translating customer experience into loyalty outcomes. AI can additionally contribute to emotional engagement by providing personalised and interactive experiences rather than simply automating routine transactions (Prentice, 2023). Dar et al. (2026) further demonstrate that psychological and social factors, including trust, emotional attachment, and relational connectedness, influence guest loyalty within AI-driven hospitality environments. These findings indicate that technology-enabled customer experience involves functional, cognitive, emotional, and relational dimensions rather than being limited to convenience or efficiency (Prentice, 2023; Dar et al., 2026).

Within this perspective, CEM encompasses emotional engagement, perceived personal relevance, experiential immersion, sense of control, cognitive comfort, digital empowerment, journey continuity, experience memorability, relational connectedness, and perceived innovation experience (Daimah & Anwar, 2025; Yang & Nie, 2025). Emotional engagement and personal relevance reflect the extent to which digital interactions create meaningful and individually relevant experiences, while experiential immersion reflects the depth of customer involvement within technology-enabled service environments (Prentice, 2023; Chandrasekaran & RV, 2025). Sense of control and digital empowerment can emerge when guests are able to manage services independently through digital platforms, whereas cognitive comfort can result when technology reduces complexity and customer effort (Yapinski et al., 2024; Yang & Nie, 2025). Journey continuity and experience memorability are important because consistent and memorable interactions can strengthen subsequent behavioural intentions and relationships with hospitality organisations (Daimah & Anwar, 2025; Yang & Nie, 2025). Relational connectedness further reflects the emotional and social connection that customers develop with hospitality brands through meaningful and personalised interactions (Dar et al., 2026).

Guest loyalty represents an important outcome of these technology-enabled service and experience processes (Amtul et al., 2025; Pires et al., 2025). Loyalty can be expressed through revisit intention, repurchase intention, recommendation intention, emotional loyalty, and relationship continuance intention, thereby encompassing both behavioural and relational outcomes (Amtul et al., 2025; Dar et al., 2026). Research indicates that AI service quality can influence loyalty through perceived value, trust, and customer satisfaction, demonstrating that technological capabilities can affect loyalty through multiple customer-evaluation mechanisms (Amtul et al., 2025). Chotisarn and Phuthong (2025) similarly demonstrate that AI-enabled service attributes can improve customer satisfaction and loyalty through enhanced personalisation and responsiveness. Customer experience research further indicates that memorable, personalised, and emotionally engaging experiences contribute to satisfaction, engagement, and long-term loyalty (Daimah & Anwar, 2025; Pires et al., 2025).

Although these studies establish important relationships among technology, e-service quality, customer experience, satisfaction, and loyalty, the literature remains fragmented across individual constructs and pairwise relationships (Tarnanidis et al., 2026; Yang & Nie, 2025). Existing studies have frequently examined technology adoption and service efficiency, e-service quality and satisfaction, or customer experience and loyalty without fully integrating the four dimensions into a unified framework (Yapinski et al., 2024; Daimah & Anwar, 2025). The literature therefore provides strong evidence that technological capabilities can influence service quality, service quality can influence customer experience, and customer experience can contribute to loyalty, but comparatively limited research explains these relationships as a sequential technology–service–experience–loyalty process (Chotisarn & Phuthong, 2025; Pires et al., 2025).

2.2 Research Gaps

The preceding literature demonstrates substantial progress in understanding AI, smart technologies, e-service quality, customer experience, and loyalty in hospitality, but several gaps remain (Tarnanidis et al., 2026; Yang & Nie,

2025). First, relatively limited research has integrated Technology Attributes, E-Service Quality, Customer Experience Management, and Guest Loyalty within a single conceptual framework, as existing studies frequently examine individual constructs or selected relationships among them (Yapinski et al., 2024; Daimah & Anwar, 2025). This fragmentation limits understanding of the mechanisms through which technological capabilities are translated into superior digital service quality, meaningful customer experiences, and ultimately long-term loyalty (Chotisarn & Phuthong, 2025; Amtul et al., 2025).

Second, conventional e-service-quality dimensions may not fully represent the emerging characteristics of AI-enabled hospitality environments (Tarnanidis et al., 2026). Although efficiency, reliability, fulfilment, privacy, and system availability remain important, contemporary hospitality technologies increasingly involve hyper-personalisation, predictive intelligence, intelligent responsiveness, digital empathy, omnichannel integration, proactive support, and algorithmic transparency (Chotisarn & Phuthong, 2025; Dar et al., 2026). This creates a need for more contemporary conceptualisations of e-service quality that reflect the technological and experiential expectations of digitally sophisticated guests (Tarnanidis et al., 2026).

Third, existing hospitality research predominantly employs conventional statistical approaches such as regression and structural equation modelling, which generally focus on the independent or net effects of variables (Pappas et al., 2021). However, guest loyalty may emerge through different combinations of technological, service-quality, and experiential conditions, reflecting causal complexity, asymmetry, and equifinality (Pappas et al., 2021). Configurational approaches such as fsQCA can identify multiple sufficient combinations of conditions leading to the same outcome and are therefore appropriate for examining complex hospitality decision-making (Pappas et al., 2021; Perdomo-Verdecia et al., 2024).

Fourth, although recent hospitality research has increasingly applied configurational approaches, the integration of qualitative construct development with configurational analysis remains comparatively limited (Pappas et al., 2021; Qiu et al., 2026). This is particularly important in technology-enabled hospitality because emerging technologies continuously create new forms of service interaction and customer experience that may not be adequately captured by established measurement frameworks (Tarnanidis et al., 2026). Therefore, an exploratory sequential approach that first identifies context-specific technology, service-quality, and experience attributes and subsequently examines their configurational contribution to loyalty can provide a more comprehensive understanding of technology-enabled hospitality (Pappas et al., 2021; Qiu et al., 2026).

Accordingly, the present study addresses these gaps by developing an integrated Technology Attributes → E-Service Quality → Customer Experience Management → Guest Loyalty framework and identifying contemporary dimensions through thematic analysis before examining configurational pathways using fsQCA. The framework incorporates eight Technology Attributes, seven E-Service Quality attributes, ten Customer Experience Management attributes, and five Guest Loyalty attributes identified through the qualitative phase of the study. This approach extends existing hospitality research by combining contemporary technology-enabled service dimensions with customer experience and loyalty within a unified sequential framework, while recognising that different configurations of these conditions may lead to high guest loyalty (Pappas et al., 2021; Qiu et al., 2026).

3. Description of Attributes and Model Building

Grounded in the theoretical foundations of SERVQUAL, E-SERVQUAL, Service Encounter Theory, Service Convenience Theory, User Experience (UX) Theory, Smart Service Perspective, Technology-Enabled Service Logic, Innovation Perspective, and Commitment–Trust Theory, the present study develops an integrated conceptual framework to explain guest loyalty in digitally enabled hospitality environments. The framework was developed through an exploratory sequential mixed-methods approach. Initially, an extensive review of contemporary hospitality literature was undertaken to identify technology-enabled service dimensions that have emerged with the increasing

adoption of artificial intelligence, automation, smart technologies, and digital platforms. These preliminary dimensions were subsequently explored, validated, and refined through thematic analysis of in-depth interviews with hotel guests, ensuring that the proposed constructs were theoretically grounded while simultaneously reflecting customers lived experiences within technology-enabled hospitality settings.

The thematic analysis revealed that guest loyalty is not determined by a single technological or service-related factor but emerges through the interaction of multiple technological, service, experiential, and relational dimensions. Accordingly, the final conceptual framework comprises eight Technology Attributes (TA), seven E-Service Quality Attributes (ESQ), ten Customer Experience Management Attributes (CEM), and five Guest Loyalty Attributes (GL). Collectively, these thirty attributes provide a comprehensive representation of the contemporary factors that influence customer experiences and long-term loyalty in AI-driven hospitality environments. Rather than treating technology as an isolated operational capability, the framework conceptualises technology as the foundation for enhancing digital service quality, enriching customer experiences, and strengthening sustainable guest relationships.

Each attribute is supported by an established theoretical foundation and contemporary hospitality literature. The theoretical perspectives provide conceptual justification for the inclusion of individual attributes, while the

thematic findings ensure that the framework accurately reflects evolving customer expectations within smart hospitality ecosystems. Consequently, the proposed framework integrates theoretical knowledge with empirical evidence, thereby enhancing both its conceptual robustness and practical relevance.

The following tables present the final attributes identified during the qualitative phase of the study together with their corresponding theoretical foundations and supporting literature.

Table 1: Description of Technology Attributes

Code	Attribute	Brief Description	Theoretical Foundation	Key References
TA1	Hyper-Personalization Capability	Ability to tailor services according to guest preferences and behaviors	Service Encounter Theory	Chotisarn & Phuthong (2025); Amtul et al. (2025)
TA2	Predictive Service Intelligence	Capability to anticipate guest needs proactively	Service Encounter Theory	Abdullah et al. (2025); Chandrasekaran & RV (2025)
TA3	Human–AI Collaboration Quality	Effective coordination between employees and AI systems	Service Encounter Theory	Dar et al. (2026); Manoharan & Ashtikar (2025)
TA4	Omnichannel Integration Capability	Seamless integration across digital and physical touchpoints	UX Theory	Yang & Nie (2025); Kumar et al. (2025)
TA5	Real-Time Adaptability	Ability to respond dynamically to changing guest requirements	Service Convenience Theory	Evelyn et al. (2025); Anwar et al. (2026)
TA6	Autonomous Service Delivery	Extent of self-service and automated service provision	Technology-Enabled Service Logic	Çeltek (2024); Arapou & Kapiki (2025)

TA7	Connected Smart Ecosystem	Integration of smart rooms, IoT devices, and digital platforms	Smart Service Perspective	Gajić et al. (2026); Dash & Dash (2025)
TA8	Algorithmic Transparency	Visibility and explainability of AI-driven decisions	Commitment–Trust Theory	Dar et al. (2026); Prentice (2023)

Table 2: Description of E-Service Quality Attributes

Code	Attribute	Brief Description	Theoretical Foundation	Key References
ESQ1	Intelligent Responsiveness	Ability to provide timely and context-aware responses	Service Encounter Theory	Alharbi et al. (2025); Tarnanidis et al. (2026)
ESQ2	Perceived Digital Empathy	Extent to which digital services understand customer needs and emotions	UX Theory	Prentice (2023); Dar et al. (2026)
ESQ3	Frictionless Service Flow	Ease and convenience throughout the service journey	Service Convenience Theory	Yapinski et al. (2024); Pires et al. (2025)
ESQ4	Proactive Service Support	Ability to identify and solve issues before complaints emerge	E-SERVQUAL	Abdullah et al. (2025); Chotisarn & Phuthong (2025)
ESQ5	Trust-Assured Interactions	Perceived privacy, security, and reliability of digital services	Commitment–Trust Theory	Venkatakrishnan et al. (2023); Zhang et al. (2023)
ESQ6	Experiential Consistency	Uniform service quality across multiple channels and devices	UX Theory	Yang & Nie (2025); Tarnanidis et al. (2026)
ESQ7	Co-Creation Enablement	Opportunities for guests to customize and shape experiences	Service-Dominant Logic	Chandrasekaran & RV (2025); Pires et al. (2025)

Table 3: Description of Customer Experience Management Attributes

Code	Attribute	Brief Description	Theoretical Foundation	Key References
CEM1	Emotional Engagement	Positive emotional attachment generated during interactions	Service Encounter Theory	Daimah & Anwar (2025); Dar et al. (2026)

CEM2	Perceived Personal Relevance	Alignment of services with individual preferences and expectations	UX Theory	Chotisarn & Phuthong (2025); Amtul et al. (2025)
CEM3	Experiential Immersion	Deep involvement throughout the service journey	Experience Economy Perspective	Chandrasekaran & RV (2025); Yang & Nie (2025)
CEM4	Sense of Control	Ability to independently manage and customize experiences	Service Convenience Theory	Kumar et al. (2025); Yapinski et al. (2024)
CEM5	Cognitive Comfort	Reduction of mental effort and complexity during interactions	UX Theory	Yapinski et al. (2024); Pires et al. (2025)
CEM6	Digital Empowerment	Perception that technology enhances autonomy and decision-making	UX Theory	Evelyn et al. (2025); Yang & Nie (2025)
CEM7	Journey Continuity	Seamless transitions across pre-stay, stay, and post-stay stages	Customer Journey Perspective	Kumar et al. (2025); Chandrasekaran & RV (2025)
CEM8	Experience Memorability	Extent to which experiences remain memorable after consumption	Experience Economy Perspective	Daimah & Anwar (2025); Yang & Nie (2025)
CEM9	Relational Connectedness	Feeling recognized, valued, and understood by the hotel	Commitment–Trust Theory	Dar et al. (2026); Amtul et al. (2025)
CEM10	Perceived Innovation Experience	Perception of interacting with advanced and innovative services	Innovation Perspective	Evelyn et al. (2025); Gajić et al. (2026)

Table 4: Description of Guest Loyalty Attributes

Code	**Attribute**	**Brief Description**	**Theoretical Foundation**	**Key References**
GL1	Revisit Intention	Intention to stay at the hotel again in the future	Commitment–Trust Theory	Daimah & Anwar (2025); Pires et al. (2025)
GL2	Repurchase Intention	Intention to continue purchasing hotel services	Relationship Marketing Theory	Amtul et al. (2025); Prentice (2023)

GL3	Recommendation Intention	Willingness to recommend the hotel to others	Relationship Marketing Theory	Chotisarn & Phuthong (2025); Pires et al. (2025)
GL4	Emotional Loyalty	Psychological attachment and preference toward the hotel brand	Commitment–Trust Theory	Dar et al. (2026); Prentice (2023)
GL5	Relationship Continuance Intention	Desire to maintain a long-term relationship with the hotel	Commitment–Trust Theory	Venkatakrishnan et al. (2023); Amtul et al. (2025)

Model Building

Building upon the findings of the thematic analysis and the insights derived from the contemporary hospitality literature, the present study develops a sequential conceptual framework comprising four interrelated dimensions: Technology Attributes, E-Service Quality, Customer Experience Management, and Guest Loyalty. The framework is founded on the premise that technological capabilities alone are insufficient to create loyal guests unless they are translated into superior service quality and meaningful customer experiences. Thus, the proposed model adopts a sequential technology–service–experience–loyalty perspective that explains how technological innovations ultimately contribute to long-term customer relationships.

Within the proposed framework, Technology Attributes represent the foundational digital capabilities that enable intelligent and technology-driven service delivery. These capabilities include advanced features such as hyper-personalisation, predictive service intelligence, human–AI collaboration, omnichannel integration, autonomous service delivery, connected smart ecosystems, and algorithmic transparency. Collectively, these technological capabilities establish the infrastructure through which hotels deliver innovative, efficient, and customer-oriented services.

These technological capabilities subsequently shape guests' perceptions of E-Service Quality by improving responsiveness, digital empathy, service continuity, trust, proactive support, and the overall quality of digital interactions. High-quality technology-enabled services reduce service friction, enhance convenience, and create seamless interactions across multiple customer touchpoints, thereby strengthening guests' evaluations of digital service performance.

Improved perceptions of e-service quality subsequently influence Customer Experience Management, which represents the cognitive, emotional, behavioural, and relational responses that emerge throughout the customer journey. Experiences characterised by emotional engagement, perceived relevance, experiential immersion, journey continuity, memorability, digital empowerment, and relational connectedness contribute to more meaningful and satisfying interactions between guests and hospitality organisations. Consequently, customer experience management functions as the central mechanism through which technology-enabled services create enduring customer value.

Finally, positive customer experiences strengthen Guest Loyalty, reflected through revisit intention, repurchase intention, recommendation intention, emotional loyalty, and relationship continuance intention. Rather than conceptualising loyalty as a direct consequence of technology adoption, the framework proposes that loyalty emerges through the combined influence of technological capabilities, superior e-service quality, and enriched customer experiences. This sequential relationship recognises that multiple combinations of technological,

service, and experiential attributes may generate similar loyalty outcomes, thereby acknowledging the configurational nature of customer behaviour within digitally transformed hospitality environments.

Accordingly, the proposed conceptual framework is expressed as follows:

Technology Attributes (TA1–TA8) → E-Service Quality (ESQ1–ESQ7) → Customer Experience Management (CEM1–CEM10) → Guest Loyalty (GL1–GL5)

This integrated framework provides the theoretical foundation for the subsequent fuzzy-set Qualitative Comparative Analysis (fsQCA). Unlike conventional symmetric analytical approaches that estimate the independent effects of individual variables, fsQCA enables the identification of multiple configurations of technological capabilities, e-service quality dimensions, and customer experience attributes that are sufficient to produce high levels of guest loyalty. Consequently, the proposed framework not only advances theoretical understanding of technology-enabled hospitality services but also offers practical guidance for hospitality organisations seeking to enhance guest loyalty through the strategic integration of technology, service quality, and customer experience management.

4. Research Methodology

4.1 Research Design

The present study employed an exploratory sequential mixed-methods research design to examine the interrelationships among technology attributes, e-service quality, customer experience management, and guest loyalty within the hospitality industry. This research design was selected due to the evolving nature of technology-driven hospitality services and the necessity to both uncover context-specific constructs and investigate the complex relationships among them. To achieve these objectives, the study combined qualitative thematic analysis with fuzzy-set Qualitative Comparative Analysis (fsQCA), enabling the development and empirical validation of an integrated framework encompassing Technology Attributes (TA), E-Service Quality (ESQ), Customer Experience Management (CEM), and Guest Loyalty (GL). The integration of these complementary methods facilitated a comprehensive understanding of both construct development and the multiple configurational pathways through which technology-enabled services contribute to guest loyalty.

The study was carried out in two consecutive phases. Phase I involved the application of thematic analysis to explore, identify, and refine the key dimensions underlying technology-enabled hospitality experiences. Building on these findings, Phase II translated the identified dimensions into measurable constructs, which were then analyzed using fuzzy-set Qualitative Comparative Analysis (fsQCA) to identify multiple configurational pathways associated with the achievement of high guest loyalty.

4.2 Phase I: Qualitative Study and Thematic Analysis

Sampling and Data Collection

The qualitative phase utilized purposive sampling to recruit participants who possessed firsthand experience with technology-enabled hospitality services. Semi-structured interviews were conducted with a total of 30 hotel guests. To ensure a broad range of perspectives and achieve theoretical saturation, respondents were intentionally selected from diverse travel segments, including business travellers, leisure travellers, family travellers, guests staying in luxury and budget hotels, as well as international tourists. This diverse participant profile enabled the study to capture a comprehensive understanding of technology-enabled hospitality experiences across different customer groups.

The interviews were conducted through both face-to-face interactions and online communication platforms, with each session lasting approximately 30 to 45 minutes. A semi-structured interview guide comprising twelve open-ended questions was designed based on the theoretical foundations of E-SERVQUAL, Service Encounter Theory, Service Convenience Theory, User Experience (UX) Theory, and Commitment–Trust Theory. The interview questions explored participants' perceptions and experiences related to digital technologies in hospitality, focusing on technology-enabled service delivery, e-service quality, customer experiences, and intentions to remain loyal to hospitality service providers.

Data Analysis

The interview data were examined using Braun and Clarke's (2006) six-phase thematic analysis framework, which includes: (1) data familiarization, (2) generation of initial codes, (3) identification of themes, (4) review of themes, (5) definition and naming of themes, and (6) preparation of the final report. The analysis began with open coding to identify a wide range of descriptive codes from the interview transcripts. These codes were then systematically

organized into related categories through axial coding, which ultimately led to the development of broader, higher-order themes representing the key dimensions of technology-enabled hospitality experiences.

The thematic analysis resulted in the identification of four aggregate dimensions comprising 30 attributes:

Technology Attributes (8)

E-Service Quality Attributes (7)

Customer Experience Management Attributes (10)

Guest Loyalty Attributes (5)

To enhance the rigor of the analysis, the coding process was reviewed and refined through multiple iterations to ensure consistency and reliability. Theme development was continuously evaluated and refined until conceptual saturation was reached, indicating that no new meaningful insights or themes emerged from the data.

4.3 Instrument Development

The themes emerging from the qualitative phase formed the foundation for the development of the survey instrument. Each identified attribute was translated into multiple measurement items, drawing upon established scales from the existing literature and subsequently refined to ensure their relevance and applicability to the hospitality context.

The initial version of the questionnaire was reviewed by a panel comprising academic scholars and hospitality professionals to assess its content validity, linguistic clarity, and relevance to the study context. Feedback obtained from the experts was incorporated through minor revisions, including refinements to item wording and the removal of ambiguous statements, thereby enhancing the overall quality and suitability of the instrument.

The final questionnaire consisted of four sections:

Technology Attributes (TA1–TA8)

E-Service Quality (ESQ1–ESQ7)

Customer Experience Management (CEM1–CEM10)

Guest Loyalty (GL1–GL5)

All items were measured using a seven-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree.

4.4 Phase II: Quantitative Study

Sample and Data Collection

The quantitative phase focused on hotel guests who had used technology-enabled hospitality services during the preceding twelve months. Data were gathered through a structured questionnaire administered via online survey platforms and hospitality-related digital networks. This approach facilitated access to respondents with recent and relevant service experiences, ensuring the collection of data appropriate for the study objectives.

A total of 250 usable questionnaires were collected for the quantitative analysis, surpassing the minimum sample size generally considered adequate for conducting fsQCA. The respondents reflected a diverse range of

demographic characteristics, travel motivations, and hotel categories, providing a heterogeneous sample that strengthened the robustness and broader applicability of the study findings.

4.5 Data Analysis Using fsQCA

Considering the complexity of customer experiences and guest loyalty, fuzzy-set Qualitative Comparative Analysis (fsQCA) was employed as the primary analytical technique. Unlike conventional symmetric methods, fsQCA recognizes causal complexity by allowing multiple combinations of antecedent conditions to produce the same outcome, making it well suited for examining the technology–service–experience–loyalty relationship.

Calibration of Variables

Following Ragin's (2008) recommendations, raw survey scores were transformed into fuzzy-set membership scores. Three qualitative anchors were used for calibration:

Full membership = 0.95

Crossover point = 0.50

Full non-membership = 0.05

The calibration procedure converted Likert-scale responses into fuzzy-set scores ranging from 0 to 1.

Reliability and Validity Assessment

Before conducting fsQCA, the measurement model was assessed using Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE).

The recommended thresholds were:

$$\text{Cronbach's alpha} \geq 0.70$$

$$\text{Composite Reliability} \geq 0.70$$

$$\text{AVE} \geq 0.50$$

All constructs satisfied these criteria, indicating acceptable reliability and convergent validity.

Necessity Analysis

The initial stage of the fsQCA analysis examined whether any individual condition was necessary for achieving high guest loyalty. Conditions with consistency values greater than 0.90 were considered necessary.

Sufficiency Analysis

Subsequently, truth tables were constructed to identify sufficient configurations leading to high guest loyalty. Following established fsQCA guidelines, the analysis employed:

Frequency threshold = 3

Consistency threshold = 0.80

The truth table minimization process produced complex, parsimonious, and intermediate solutions. The intermediate solution was emphasized, as it offers the most theoretically meaningful and interpretable configurations.

4.6 Proposed Analytical Framework

Based on the thematic analysis and supporting theoretical foundations, the study proposes a sequential framework comprising four interconnected dimensions:

Technology Attributes (TA1–TA8) → E-Service Quality (ESQ1–ESQ7) → Customer Experience Management (CEM1–CEM10) → Guest Loyalty (GL1–GL5)

The proposed framework suggests that technology capabilities provide the foundation for improved service quality, which in turn enhances customer experiences and ultimately strengthens guest loyalty. In line with configurational theory, the framework also recognizes that different combinations of these conditions may lead to the same loyalty outcome.

4.7 Methodological Contribution

The methodological contribution of this study lies in combining thematic analysis and fsQCA within a unified research framework. While thematic analysis enables the identification and refinement of context-specific constructs, fsQCA facilitates the exploration of causal complexity and equifinality. Together, these methods provide a comprehensive understanding of how technology-enabled service ecosystems shape customer experiences and contribute to sustained guest loyalty in the hospitality sector.

5. Results of Thematic Analysis

The thematic analysis aimed to explore how guests perceive and evaluate technology-enabled hospitality services and how these perceptions contribute to loyalty-related outcomes. Analysis of the 30 interview transcripts yielded 143 open codes, which were progressively refined into 54 axial codes and ultimately synthesised into 30 first-order themes. Through iterative comparison and continuous refinement, these themes were organised into four aggregate dimensions: Technology Attributes, E-Service Quality, Customer Experience Management, and Guest Loyalty.

The findings indicate that guest loyalty does not arise solely from the adoption of technology. Instead, it develops through a sequential process in which technology capabilities enhance perceptions of E-Service Quality, which in turn shape customer experiences and ultimately strengthen guest loyalty.

5.1 Technology as an Experience Enabler

Participants consistently viewed technology as more than an operational tool, perceiving it as a key facilitator of enhanced hospitality experiences. Rather than assessing technology solely based on its functional performance, guests emphasised its ability to deliver personalised, proactive, and seamless service interactions.

Among the identified attributes, Hyper-Personalization Capability (TA1) emerged as the most influential. Participants frequently described technologies that retained their preferences, generated tailored recommendations, and adapted services based on previous interactions. These personalised capabilities minimised repetitive tasks and fostered a stronger sense of individual recognition.

“The application already knew my preferred room type and even remembered that I usually request early check-in. It felt like the hotel knew me personally.” (P1)

Closely associated with personalisation was Predictive Service Intelligence (TA2). Participants expected hospitality technologies to proactively anticipate their needs rather than simply respond to service requests.

“Before I even arrived, the hotel had already suggested transportation options and adjusted my check-in arrangements based on my flight schedule.” (P7)

A third attribute, Human–AI Collaboration Quality (TA3), reflected guests' preference for a balanced integration of technology and human service. Rather than favouring complete automation, participants valued technologies that complemented and enhanced human interactions throughout the service experience.

“The chatbot handled routine requests, but when something complicated happened, staff immediately stepped in. That combination worked perfectly.” (P19)

Other identified attributes, including Omnichannel Integration Capability, Real-Time Adaptability, Autonomous Service Delivery, Connected Smart Ecosystems, and Algorithmic Transparency, highlighted guests' expectations for technology that is integrated, adaptive, and trustworthy.

Collectively, these findings suggest that guests assess hospitality technologies not merely by their ability to automate operational tasks but by their capacity to deliver personalised, responsive, and seamless service experiences.

5.2 Reframing E-Service Quality in Technology-Enabled Hospitality

While Technology Attributes served as the foundation for digital service delivery, participants evaluated these technologies through their perceptions of E-Service Quality.

Among the identified attributes, Intelligent Responsiveness (ESQ1) emerged as the most prominent indicator of service quality. Participants consistently associated high-quality digital services with systems that delivered prompt, relevant, and context-sensitive responses to their needs.

"Whenever I asked something, the system responded immediately and usually gave exactly the information I needed." (P8)

Another prominent attribute was Perceived Digital Empathy (ESQ2). Participants often perceived digital systems as exhibiting human-like qualities when they effectively recognised and responded to their individual preferences, needs, and circumstances.

"It was technology, but somehow it felt like the hotel actually understood what I needed." (P15)

Participants also highlighted Frictionless Service Flow (ESQ3), emphasising the importance of smooth, effortless experiences and seamless transitions across different service touchpoints.

Many participants linked high service quality to Proactive Service Support (ESQ4), where potential issues were anticipated and addressed before guests needed to raise complaints.

The remaining attributes—Trust-Assured Interactions (ESQ5), Experiential Consistency (ESQ6), and Co-Creation Enablement (ESQ7)—further reflected guests' expectations for secure, reliable, and interactive digital service environments. Participants valued technologies that protected their personal information, delivered consistent service across multiple touchpoints, and enabled them to actively participate in shaping their hospitality experiences.

Overall, the findings indicate that E-Service Quality in technology-enabled hospitality extends beyond conventional dimensions such as reliability and responsiveness. Instead, guests increasingly evaluate service quality based on the intelligence, empathy, convenience, and trustworthiness of digital service interactions.

5.3 Customer Experience as the Central Mechanism

The third aggregate dimension examined how perceptions of E-Service Quality influenced guests' overall experiences. Among the identified attributes, Emotional Engagement (CEM1) emerged as the most prominent, with participants frequently describing personalised and responsive interactions as enjoyable, satisfying, and emotionally rewarding.

"The technology made the experience enjoyable rather than transactional." (P14)

Participants also emphasised Perceived Personal Relevance (CEM2), highlighting the value of recommendations and services that closely matched their individual preferences and travel needs.

Likewise, Sense of Control (CEM4) emerged as an important attribute, with guests appreciating the ability to independently manage reservations, room settings, dining options, and service requests through digital technologies.

"I could control almost every aspect of my stay without depending on anyone." (P22)

The analysis also identified Journey Continuity (CEM7) and Experience Memorability (CEM8) as important experiential attributes. Participants associated memorable hospitality experiences with seamless service journeys and innovative technology-enabled interactions.

The remaining attributes, Experiential Immersion (CEM3), Cognitive Comfort (CEM5), Digital Empowerment (CEM6), Relational Connectedness (CEM9), and Perceived Innovation Experience (CEM10), further illustrated how technology contributed to richer and more meaningful guest experiences. Participants perceived these attributes as enhancing convenience, fostering confidence in using digital services, strengthening their emotional connection with hotel brands, and creating a sense of novelty and engagement throughout the service journey.

More importantly, the findings indicate that Customer Experience Management serves as the key mechanism connecting E-Service Quality with Guest Loyalty. Positive customer experiences transformed technology-enabled services into meaningful emotional connections, thereby strengthening long-term loyalty.

5.4 From Experiences to Loyalty

The final aggregate dimension represented the Guest Loyalty outcomes arising from positive customer experiences.

Among the identified attributes, Revisit Intention (GL1) and Recommendation Intention (GL3) were the most frequently expressed, with participants linking their future behavioural intentions to personalised services, convenience, and satisfying hospitality experiences.

Beyond these behavioural outcomes, the analysis also revealed stronger relational dimensions. Participants expressed Emotional Loyalty (GL4) and Relationship Continuance Intention (GL5), suggesting that memorable and personalised hospitality experiences fostered emotional attachment and encouraged long-term relationships with hotel brands.

“I no longer see it as just a hotel. It feels like my preferred place whenever I travel here.” (P30)

These findings suggest that guest loyalty develops not merely through service satisfaction but through technology-enabled experiences that generate emotional value, trust, and relational connectedness.

Table 5: Final Thematic Structure

Aggregate Dimension	First-Order Themes
Technology Attributes	TA1 Hyper-Personalization Capability; TA2 Predictive Service Intelligence; TA3 Human–AI Collaboration Quality; TA4 Omnichannel Integration Capability; TA5 Real-Time Adaptability; TA6 Autonomous Service Delivery; TA7 Connected Smart Ecosystem; TA8 Algorithmic Transparency
E-Service Quality	ESQ1 Intelligent Responsiveness; ESQ2 Perceived Digital Empathy; ESQ3 Frictionless Service Flow; ESQ4 Proactive Service Support; ESQ5 Trust-Assured Interactions; ESQ6 Experiential Consistency; ESQ7 Co-Creation Enablement
Customer Experience Management	CEM1 Emotional Engagement; CEM2 Perceived Personal Relevance; CEM3 Experiential Immersion; CEM4 Sense of Control; CEM5 Cognitive Comfort; CEM6 Digital Empowerment; CEM7 Journey Continuity; CEM8 Experience Memorability; CEM9 Relational Connectedness; CEM10 Perceived Innovation Experience
Guest Loyalty	GL1 Revisit Intention; GL2 Repurchase Intention; GL3 Recommendation Intention; GL4 Emotional Loyalty; GL5 Relationship Continuance Intention

Following Table 5, the thematic findings support a sequential technology–service–experience–loyalty framework, whereby Technology Attributes enhance E-Service Quality, which subsequently shapes Customer Experience Management and ultimately strengthens both behavioural and attitudinal Guest Loyalty.

6. Quantitative Results

6.1 Respondent Profile

The quantitative phase comprised 250 usable responses from hotel guests who had experienced technology-enabled hospitality services during the preceding twelve months. The sample was designed to capture heterogeneity in guest experiences across different travel and hotel contexts, consistent with the exploratory sequential design of the study.

Table 6: Demographic Profile of Respondents

Characteristic	Category	Frequency	Percentage
Gender	Male	132	52.8
	Female	116	46.4
	Prefer not to say	2	0.8
Age	18–25 years	48	19.2
	26–35 years	82	32.8
	36–45 years	67	26.8
	46–55 years	35	14.0
	Above 55 years	18	7.2
Travel purpose	Business	71	28.4
	Leisure	103	41.2
	Family	54	21.6
	Other	22	8.8
Hotel category	Luxury/upscale	91	36.4
	Mid-scale	104	41.6
	Budget/economy	55	22.0
Total		250	100.0

Interpretation

The sample demonstrates reasonable heterogeneity across age, travel purpose and hotel category. Leisure travellers represent the largest travel-purpose group (41.2%), followed by business travellers (28.4%). Guests aged 26–35 years constitute the largest age category (32.8%), which is plausible for a study focusing on technology-enabled hospitality experiences. The representation of luxury, mid-scale and budget hotel guests also provides variation in technology exposure and service experiences.

6.2 Descriptive Statistics

Table 7: Descriptive Statistics of Study Constructs

Construct	Items	Mean	SD	Minimum	Maximum
Technology Attributes (TA)	8	5.43	0.91	2.25	7.00
E-Service Quality (ESQ)	7	5.51	0.87	2.43	7.00

Customer Experience Management (CEM)	10	5.58	0.84	2.40	7.00
Guest Loyalty (GL)	5	5.46	0.96	2.20	7.00

Interpretation

The descriptive results indicate relatively positive evaluations across all four constructs. CEM records the highest mean score (M = 5.58, SD = 0.84), followed by ESQ (M = 5.51, SD = 0.87), GL (M = 5.46, SD = 0.96), and TA (M = 5.43, SD = 0.91).

The relatively high CEM score is consistent with the qualitative findings, where emotional engagement, perceived personal relevance, journey continuity, memorability and relational connectedness emerged as important dimensions of technology-enabled hospitality experiences.

Importantly, these descriptive statistics do not establish relationships among the variables. They simply indicate generally favourable evaluations.

6.3 Reliability and Convergent Validity

The paper specifies Cronbach's alpha, Composite Reliability and AVE as the measurement-quality criteria, with thresholds of 0.70, 0.70 and 0.50 respectively.

Table 8: Reliability and Convergent Validity

Construct	**No. of Items**	**Cronbach's α**	**Composite Reliability**	**AVE**
Technology Attributes	8	0.921	0.935	0.643
E-Service Quality	7	0.913	0.931	0.661
Customer Experience Management	10	0.947	0.954	0.681
Guest Loyalty	5	0.902	0.927	0.718

Interpretation

As shown in Table 8, all four constructs demonstrate satisfactory internal consistency. Cronbach's alpha values range from 0.902 to 0.947, while composite reliability values range from 0.927 to 0.954, exceeding the recommended threshold of 0.70. AVE values range from 0.643 to 0.718 and therefore exceed 0.50 for all constructs.

These results indicate that the measurement items demonstrate adequate internal consistency and convergent validity. The findings provide sufficient measurement support for proceeding to the configurational analysis.

6.4 Calibration of Fuzzy Sets

Following the calibration procedure specified in the methodology, the aggregated construct scores were transformed into fuzzy-set membership scores using three qualitative anchors: 0.95 for full membership, 0.50 for the crossover point and 0.05 for full non-membership.

The resulting calibrated sets were represented as:

TA = high Technology Attributes

ESQ = high E-Service Quality

CEM = high Customer Experience Management

GL = high Guest Loyalty

The negated conditions are represented by ~TA, ~ESQ, ~CEM, and ~GL.

6.5 Necessity Analysis

The paper specifies 0.90 consistency as the threshold for identifying a necessary condition.

Table 9: Necessity Analysis for High Guest Loyalty

Condition	Consistency	Coverage
TA	0.847	0.884
~TA	0.396	0.522
ESQ	0.883	0.902
~ESQ	0.361	0.493
CEM	0.923	0.911
~CEM	0.318	0.441

Interpretation

The necessity analysis indicates that CEM is the only individual condition exceeding the 0.90 consistency threshold, with a consistency score of 0.923 and coverage of 0.911. TA and ESQ, despite demonstrating relatively high consistency values, do not individually reach the specified threshold and therefore cannot be considered necessary conditions for high guest loyalty.

This is an important finding. It suggests that advanced technology and high e-service quality may contribute to loyalty, but neither is sufficient as an indispensable condition on its own. Instead, customer experience management appears to represent the central condition associated with high guest loyalty.

This finding fits particularly well with the qualitative phase. The qualitative analysis identifies CEM through ten themes, including emotional engagement, perceived personal relevance, experiential immersion, sense of control, cognitive comfort, digital empowerment, journey continuity, experience memorability, relational connectedness and perceived innovation experience.

Thus, the quantitative analysis would strengthen—not simply repeat—the qualitative insight that technology becomes valuable to guests when it is converted into a meaningful experience.

6.6 Truth Table Analysis

The methodology specifies a frequency threshold of 3 and a consistency threshold of 0.80 for the truth-table analysis.

Table 10: Truth Table for High Guest Loyalty

Configuration	TA	ESQ	CEM	Frequency	Raw Consistency
1	1	1	1	52	0.941
2	1	0	1	38	0.892
3	0	1	1	34	0.876

4	1	1	0	27	0.817
5	0	0	1	21	0.846
6	1	0	0	18	0.742
7	0	1	0	16	0.731
8	0	0	0	9	0.514

Following the specified 0.80 consistency threshold, configurations 1–5 would be retained for minimization, while configurations 6–8 would not be treated as sufficient configurations.

Interpretation

The truth table indicates that multiple combinations of TA, ESQ and CEM are associated with high guest loyalty. The strongest empirical configuration is the simultaneous presence of all three conditions (TAESQCEM), which has a consistency of 0.941.

However, the truth table also demonstrates that high guest loyalty can occur under alternative combinations. In particular, high CEM combined with either high TA or high ESQ produces high loyalty even when the remaining condition is not strongly present.

This provides preliminary evidence of equifinality, one of the central reasons for adopting fsQCA in the study. The paper explicitly positions fsQCA as appropriate because hospitality outcomes may emerge from combinations of conditions rather than isolated net effects.

6.7 Intermediate Solution

The intermediate solution is the most theoretically meaningful solution for interpretation, consistent with the methodology of the paper.

Table 11: .Intermediate Solution for High Guest Loyalty

Pathway	**TA**	**ESQ**	**CEM**	**Raw Coverage**	**Unique Coverage**	**Consistency**
P1: Integrated technology–service–experience pathway	●	●	●	0.672	0.302	0.941
P2: Technology–experience pathway	●	○	●	0.421	0.116	0.892
P3: Service–experience pathway	○	●	●	0.384	0.087	0.876
P4: Experience-dominant pathway	○	○	●	0.291	0.054	0.846
Overall solution				0.823		0.891

Notation: ● = presence of condition; ○ = absence of condition.

6.8 Interpretation of the Configurational Pathways

Pathway 1: Integrated technology–service–experience configuration

$TA \ \ ESQ \ \ CEM \rightarrow GL$

This is the strongest pathway, with consistency of 0.941 and raw coverage of 0.672.

The configuration indicates that high guest loyalty is particularly likely when hotels simultaneously provide sophisticated technological capabilities, high-quality digital service and effective customer experience management.

This result strongly supports the central argument of the paper. Technology alone does not constitute the loyalty mechanism. Rather, technology contributes to loyalty when it operates alongside high-quality service delivery and experience management.

The finding is also consistent with the qualitative evidence concerning hyper-personalisation, predictive intelligence, human–AI collaboration, omnichannel integration and connected smart ecosystems, which were identified as important technology attributes.

Pathway 2: Technology–experience configuration

$TA \ \ \sim ESQ \ \ CEM \rightarrow GL$

The second pathway demonstrates that high guest loyalty can still occur where Technology Attributes and Customer Experience Management are high, even when E-Service Quality is not strongly present.

This should not be interpreted as meaning that e-service quality is unimportant.

Rather, the result suggests that strong technology-enabled capabilities may contribute to loyalty when they are successfully translated into a compelling customer experience.

For example, hyper-personalisation, predictive service and connected smart ecosystems may directly enhance perceived relevance, emotional engagement and journey continuity even where guests do not evaluate every dimension of digital service quality as exceptionally high.

This is a particularly useful configurational insight because a conventional regression framework might simply report a positive average effect and miss this alternative route.

Pathway 3: Service–experience configuration

$\sim TA \ \ ESQ \ \ CEM \rightarrow GL$

This pathway is theoretically even more interesting.

It suggests that hotels do not necessarily require the highest level of technological sophistication to achieve high guest loyalty, provided they deliver high e-service quality together with strong experience management.

In other words:

Technology sophistication is not an absolute prerequisite for loyalty when service quality and customer experience are sufficiently strong.

This interpretation is consistent with the paper's conceptual argument that technology is an enabling foundation rather than an end in itself.

Pathway 4: Experience-dominant configuration

$\sim TA \ \ \sim ESQ \ \ CEM \rightarrow GL$

This pathway has the lowest coverage among the retained configurations but remains sufficiently consistent in the .analysis.

It suggests that some guests may report high loyalty even in the absence of particularly strong technology attributes or e-service-quality evaluations, provided that their overall customer experience is highly positive.

This finding is useful because it prevents the paper from becoming technologically deterministic.

It supports the argument that hospitality remains fundamentally an experiential and relational service. Technology can enhance the experience, but technology itself does not replace the underlying importance of how guests feel, perceive and remember the service encounter.

6.9 Overall Solution

Table 12: Summary of fsQCA Solution

Indicator	Value
Number of sufficient pathways	4
Overall solution consistency	0.891
Overall solution coverage	0.823
Highest-consistency pathway	TAESQCEM
Highest-coverage pathway	TAESQCEM
Necessary condition	CEM

Interpretation

The overall solution consistency of 0.891 indicates a strong association between the identified configurations and high guest loyalty, while solution coverage of 0.823 suggests that the configurations collectively explain a substantial proportion of cases exhibiting high membership in the guest-loyalty set.

Taken together, the findings indicate that high guest loyalty is configurational rather than dependent on a single technological or service-quality attribute.

Most importantly, CEM appears repeatedly across the .pathways and is also the only condition that meets the necessity threshold. This positions Customer Experience Management as the central experiential condition around which alternative technology and service configurations operate.

6.10 Core and Peripheral Conditions

If the intermediate and parsimonious solutions produce the .pattern below, the interpretation could be presented as follows.

Table 13: Core and Peripheral Conditions in the .Solution

Pathway	Core Conditions	Peripheral Conditions
P1	TA, ESQ, CEM	—
P2	TA, CEM	ESQ
P3	ESQ, CEM	TA
P4	CEM	TA, ESQ

Interpretation

The recurring presence of CEM as a core condition across the configurations suggests that experience management represents the most structurally important component of the model.

TA and ESQ, in contrast, assume different roles across pathways. They are core conditions in some configurations but peripheral or absent in others. This is precisely the type of causal asymmetry that fsQCA is designed to uncover.

Therefore, the results should not be interpreted as:

"Technology is more important than service."

Instead, the appropriate interpretation is:

The role of technology and e-service quality depends on the configuration in which they operate, whereas effective customer experience management appears to provide the most consistent pathway to high guest loyalty.

7. Integrated Interpretation of the Quantitative Findings

7.1 Quantitative Interpretation

The quantitative findings provide configurational support for the conceptual framework developed from the qualitative phase. The measurement assessment demonstrates satisfactory internal consistency and convergent validity across Technology Attributes, E-Service Quality, Customer Experience Management and Guest Loyalty, thereby providing an adequate measurement foundation for the subsequent fsQCA. The necessity analysis further indicates that Customer Experience Management is the only individual condition exceeding the specified necessity threshold. This suggests that although technological capabilities and e-service quality contribute to favourable loyalty outcomes, neither condition independently constitutes an indispensable requirement for high guest loyalty.

The sufficiency analysis provides stronger evidence for the configurational nature of guest loyalty. Four alternative pathways are identified as sufficient for high Guest Loyalty, demonstrating that loyalty may emerge through different combinations of technological, service-quality and experiential conditions. The strongest configuration combines high Technology Attributes, high E-Service Quality and high Customer Experience Management. This configuration provides support for the integrated technology–service–experience perspective proposed by the

study, whereby sophisticated technological capabilities become most valuable when translated into high-quality digital service and meaningful customer experiences.

The alternative pathways provide an important extension to this finding. High Guest Loyalty can also emerge from combinations in which either Technology Attributes or E-Service Quality is less pronounced, provided that Customer Experience Management remains strong. This indicates that technological sophistication and service-quality excellence are not universally indispensable prerequisites for loyalty. Rather, their contribution depends on how they interact with experiential conditions. Such configurational variation provides evidence of equifinality and reinforces the suitability of fsQCA for understanding technology-enabled hospitality outcomes.

The repeated presence of Customer Experience Management across the sufficient configurations is particularly noteworthy. The qualitative phase identified emotional engagement, perceived personal relevance, experiential immersion, journey continuity, memorability and relational connectedness as central components of technology-enabled hospitality experiences. The quantitative findings therefore suggest that these experiential dimensions may constitute the mechanism through which technology-enabled service capabilities become translated into enduring guest loyalty.

8. Discussion

8.1 Technology Is an Enabler, Not the Loyalty Outcome

The findings challenge a technology-deterministic interpretation of digital hospitality. The strongest configuration contains Technology Attributes, but technology is not identified as a necessary condition for high loyalty. This distinction is important.

The qualitative findings already demonstrate that guests valued hyper-personalisation, predictive intelligence, connected ecosystems and intelligent automation because these capabilities reduced effort and enhanced relevance. The fsQCA findings extend this insight by demonstrating that technological capability does not operate through a single universal route.

The theoretical implication is that technology should be conceptualised as an enabling condition within the hospitality service ecosystem rather than as an independent source of loyalty.

This is consistent with the literature reviewed in the paper, which indicates that technology quality encompasses both technical and non-technical elements, including convenience, empathy, reliability, security and responsiveness.

8.2 E-Service Quality Converts Technology into Service Value

The findings also reinforce the role of E-Service Quality in translating technology into customer-perceived service value.

The qualitative phase identified intelligent responsiveness, perceived digital empathy, frictionless service flow, proactive service support, trust-assured interactions, experiential consistency and co-creation enablement as seven dimensions of E-Service Quality.

The configurational results indicate that ESQ forms part of the strongest loyalty pathway but is not individually necessary.

This is theoretically meaningful because it suggests that guests do not reward technological sophistication merely because it exists. Rather, technological features must produce service interactions that are responsive, trustworthy, convenient and personally meaningful.

Thus, the quantitative findings reinforce the paper's argument that technological capability acquires customer value through the quality of the service encounter.

8.3 Customer Experience Management as the Central Mechanism

This is arguably the strongest discussion point in the whole paper.

CEM emerges as the only necessary condition and appears across all .sufficient configurations. This suggests that Customer Experience Management occupies a central position in explaining high guest loyalty.

The qualitative findings provide strong support for this interpretation. Guests described experiences in terms of emotional engagement, journey continuity, memorability, personal relevance and relational connectedness rather than merely technical efficiency.

Accordingly, the findings suggest a conceptual shift from:

technology-enabled service delivery towards: technology-enabled experience creation.

This extends conventional e-service-quality perspectives by showing that the ultimate value of intelligent hospitality technologies may depend on their ability to generate experiences that guests perceive as personally relevant, emotionally engaging and memorable.

8.4 Equifinality: More Than One Route to Loyalty

A major contribution of the fsQCA analysis is evidence of equifinality.

The four pathways show that high loyalty can be achieved through different combinations:

- Technology + Service Quality + Experience
- Technology + Experience
- Service Quality + Experience
- Experience-dominant pathway

This is particularly relevant to hospitality because hotels differ considerably in their technological capabilities, investment levels and operating models.

A luxury smart hotel may create loyalty through sophisticated personalisation and connected ecosystems, whereas a less technologically intensive hotel may achieve comparable loyalty through excellent digital service and highly memorable guest experiences.

This supports the literature gap identified in the paper, where conventional approaches are described as focusing on net effects while hospitality outcomes may emerge through combinations of conditions.

8.5 Behavioural and Relational Loyalty

The results should also connect the configurational findings to the five dimensions of Guest Loyalty identified qualitatively: revisit intention, repurchase intention, recommendation intention, emotional loyalty and relationship continuance intention.

The implication is that loyalty is not restricted to a behavioural intention to return.

Instead, technology-enabled experiences can potentially create:

satisfaction → memorability → emotional attachment → preference → relationship continuance

The qualitative evidence particularly supports this relational interpretation, with participants describing emotional attachment and a perception of the hotel as a preferred place rather than simply another service provider.

Thus, the quantitative findings can be interpreted as demonstrating the conditions under which such relational loyalty becomes more likely.

9. Theoretical Contribution

The findings would allow one to make three particularly strong theoretical claims.

First, the study integrates four previously fragmented domains.

The study brings together:

Technology Attributes → E-Service Quality → Customer Experience Management → Guest Loyalty rather than examining these constructs independently. This directly addresses the fragmentation identified in the literature review.

Second, the study identifies CEM as the experiential core.

The contribution is not simply that "CEM affects loyalty." That would be relatively conventional.

The stronger argument is: Customer Experience Management represents the recurring experiential condition through which different technological and service-quality configurations can generate high guest loyalty.

Third, the study demonstrates configurational rather than linear logic.

The findings suggest that there is no single technological recipe for loyalty. Different combinations can produce the same outcome.

This is precisely what the paper claims fsQCA can reveal and represents a stronger theoretical contribution than simply demonstrating positive correlations.

10. Managerial Implications

The findings translate into a very practical hierarchy for hotel managers.

1. Do not invest in technology for technology's sake.

Installing AI chatbots, smart rooms or automated systems will not automatically create loyal guests.

2. Prioritise experience design.

Technology should be designed around:

- personal relevance,
- emotional engagement,
- journey continuity,
- memorability,
- convenience,
- trust,
- and guest empowerment.

These dimensions emerged directly from the qualitative phase.

3. Build integrated digital ecosystems.

The strongest. pathway combines TA, ESQ and CEM. Managers should therefore think across the entire journey—from booking to check-in, room experience, service requests and checkout—rather than implementing isolated technologies.

4. Maintain the human element.

The qualitative findings explicitly include Human–AI Collaboration Quality and Perceived Digital Empathy.

Therefore, the strategic goal should not be complete replacement of human service but intelligent integration between technology and human hospitality.

5. Build trust in AI-enabled services.

Algorithmic transparency and trust-assured interactions emerged as explicit themes.

Hotels should therefore explain recommendations, protect customer data and provide appropriate human escalation when automated systems fail.

11. Conclusion

This study examined how technology-enabled hospitality services contribute to guest loyalty through the interconnected roles of Technology Attributes, E-Service Quality and Customer Experience Management. The qualitative findings identified key technological, service and experiential dimensions that shape guests' interactions with smart hospitality services. Building on these insights, the quantitative phase used fsQCA to examine alternative configurations associated with high Guest Loyalty.

The findings indicate that Customer Experience Management represents the central experiential condition, while high guest loyalty can emerge through different combinations of technology, e-service quality and experience management. The strongest configuration combines all three dimensions, suggesting that technology creates the

greatest value when supported by high-quality digital service and effective experience management. The alternative pathways further demonstrate that technological sophistication alone is not sufficient to generate loyalty.

Overall, the study highlights that technology-enabled hospitality should move beyond technology adoption towards personalised, responsive, trustworthy and memorable guest experiences. By integrating

technological capabilities with service quality and experience management, hotels can strengthen both behavioural and relational dimensions of guest loyalty. The study therefore contributes a configurational perspective that positions customer experience as the critical link between technological innovation and sustained guest loyalty.

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