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Designing a Smart Communication and Electronic Service Management Model with Citizens Based on the Stimulus–Organism–Response (S-O-R) Approach

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ABSTRACT

This study aims to design and validate a smart communication and electronic service management model for citizens using the Stimulus–Organism–Response (S–O–R) framework. The research employed a mixed-method exploratory design consisting of qualitative and quantitative phases. In the qualitative phase, in-depth Delphi interviews with experts were conducted to identify components, indicators, and dimensions related to smart communication and digital service delivery. The interviews were analyzed using open, axial, and selective coding, and the extracted indicators were refined through iterative expert validation. In the quantitative phase, a researcher-developed questionnaire—based on qualitative findings—was administered to a sample of 384 employees selected through Cochran's formula. Content validity, construct validity, and reliability were examined using confirmatory factor analysis, Cronbach's alpha, composite reliability, and AVE. Structural Equation Modeling (SEM) via SmartPLS was used to test model fit and hypothesized relationships among variables. Kolmogorov–Smirnov tests indicated non-normal data distributions across all variables, supporting the use of variance-based SEM. Measurement model evaluation confirmed factor loadings above 0.40 and significant t-values, indicating strong construct validity. Convergent validity was supported with AVE values exceeding 0.50, and internal consistency reliability was demonstrated by Cronbach's alpha and composite reliability values surpassing 0.70. Structural model assessment showed that marketing strategies, environmental website factors, and external socio-economic factors significantly predicted perceived value, perceived quality, perceived security, and perceived ease of use. These organismic states, in turn, strongly influenced behavioral responses, including electronic loyalty, interaction, and information sharing. The GOF index (0.765) indicated excellent overall model fit. The validated S–O–R–based model demonstrates that coordinated digital stimuli and enhanced perceived experience dimensions significantly shape citizens' digital engagement behaviors, providing a comprehensive framework for improving smart communication and electronic service delivery.

Keywords: Smart communication; Electronic services; S–O–R model; Digital governance; Citizen engagement; Structural equation modeling (SEM).

Introduction

The rapid digital transformation of public and private service systems has fundamentally altered how organizations communicate with and serve their stakeholders. The proliferation of online platforms, mobile applications, and data-driven systems has shifted citizens' expectations toward fast, transparent, personalized, and

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ubiquitous services, making digital interaction a critical determinant of perceived organizational legitimacy and performance (1, 2). Governments and service institutions are no longer evaluated solely on the basis of their offline procedures but increasingly on the quality of their digital touchpoints, the coherence of multichannel communication, and the responsiveness of their electronic services (3, 4). In this context, a key challenge is to design smart communication and electronic service management models that can integrate technological capabilities with citizens' psychological needs and behavioral tendencies in a coherent theoretical and practical framework (5, 6).

At the heart of this transformation lies a series of developments in electronic customer relationship management (e-CRM) and social CRM that aim to create long-term, value-based interactions with users in digital environments (7, 8). E-CRM systems allow organizations to collect and integrate large volumes of user data, track behavioral patterns, and design tailored communication strategies that support satisfaction, loyalty, and advocacy (9, 10). Empirical research has shown that e-CRM can improve marketing performance by leveraging customer knowledge and product innovation, underscoring the strategic importance of data-driven and customer-centric approaches to relationship management (9, 11). In parallel, social CRM extends these capabilities into social media and interactive digital platforms, where customer participation and co-creation significantly shape relationship outcomes (7, 12).

The Stimulus–Organism–Response (S–O–R) framework provides a powerful theoretical lens to analyze the psychological mechanisms through which digital service environments influence user behavior. Originally introduced in environmental psychology, S–O–R conceptualizes how environmental stimuli affect internal emotional and cognitive states (the organism), which in turn generate behavioral responses (13). Recent studies have adapted this model to digital and marketing contexts, demonstrating how platform design, information cues, and interaction features act as stimuli that shape user perceptions, experiences, and subsequent intentions (14, 15). For example, research on post-disaster tourism behavior has shown that information sources and digital messages can significantly alter tourists' emotional responses and behavioral choices when analyzed through the S–O–R lens (14). Likewise, investigations of social media commerce and live-streaming shopping highlight how interface aesthetics, interactivity, and promotional cues trigger psychological processes—such as arousal, trust, and impulsiveness—that drive purchase behavior (12, 16).

These findings are particularly relevant for public and semi-public organizations seeking to design digital service ecosystems that foster constructive citizen responses. Studies of e-government systems emphasize that digital governance is not merely about putting services online but about reconfiguring processes, communication channels, and institutional arrangements to enhance accessibility, accountability, and citizen participation (6, 17). Research on e-government development, including case studies in tax administration and legal services, indicates that dimensions such as system usability, transparency, responsiveness, and integration critically influence citizens' perceptions of fairness and efficiency (3, 4). Moreover, the expansion of social security coverage, pension systems, and social services for vulnerable populations has increasingly relied on digital platforms, making it essential to understand how citizens evaluate the value, quality, security, and ease of use of electronic interactions (18, 19).

At the level of individual experience, customer experience research highlights that digital service environments must be designed to elicit positive cognitive and affective reactions that extend beyond functional task completion (20, 21). Studies in sectors as diverse as tourism and automotive services show that memorable experiences, emotional engagement, and perceived connectedness to the environment significantly shape outcomes such as satisfaction, green consumption, and loyalty (20, 21). In digital public service contexts, these experiential dimensions can be mapped onto S–O–R constructs, where marketing strategies and environmental factors (such as website

design, content quality, and interaction tools) act as stimuli, perceived value and quality, security, and ease of use represent organismic states, and electronic loyalty and information sharing constitute behavioral responses (22, 23). Such a structure provides a coherent basis for designing and validating models of smart communication and electronic services with citizens.

In addition, digital transformation has intensified the role of artificial intelligence, machine learning, and data analytics in understanding and predicting user behavior. Foundational work on the economic implications of AI highlights that algorithmic systems reconfigure the production, prediction, and decision-making capabilities of organizations, creating new forms of competitive advantage (1). In applied settings, machine learning algorithms have been successfully used to predict intention to use digital learning platforms and other online systems, suggesting that AI can complement structural modeling approaches in explaining user adoption behavior (24, 25). In financial services, AI-based and data-driven CRM solutions have been shown to transform customer relationship strategies by enabling real-time personalization, risk assessment, and proactive engagement (26, 27). These developments imply that smart communication with citizens increasingly depends on organizations' capabilities to integrate advanced analytics with user-centered design principles.

At the strategic level, organizations must also consider how management innovation, relationship marketing, and governance structures mediate the effects of technological tools on performance. Research on R&D and product innovation suggests that management innovation can amplify the impact of technical investments by aligning structures, processes, and culture with new digital capabilities (28). Relationship marketing studies, particularly in B2B social media contexts, demonstrate that social media marketing and relational strategies jointly enhance CRM effectiveness, word-of-mouth, and loyalty (11, 29). Similarly, research on CRM for small and medium-sized enterprises (SMEs) indicates that structured CRM implementation improves retention and performance in resource-constrained environments (30, 31). In public or semi-public institutions managing large citizen populations, these insights underscore the need for integrated models where digital tools, governance arrangements, and relationship strategies reinforce each other.

From a marketing and branding perspective, the integration of digital channels into relationship management has also been linked to market orientation, new product performance, and customer-centric innovation. Empirical studies show that understanding tacit customer needs and leveraging managers' social relationships can strengthen the link between market orientation and successful new product outcomes (32, 33). In the context of e-CRM, this suggests that organizations must move beyond transactional service delivery toward systems that continuously learn from citizen behavior and adapt offerings accordingly (9, 10). Furthermore, the embodied energy and infrastructural implications of expanding service sectors in global cities remind policymakers that digital service systems must be designed with sustainability and resource efficiency in mind (33). These considerations are especially important in large-scale social security and public welfare systems where the volume of interactions and the diversity of user needs are high.

Empirical evidence from health insurance and electronic service implementation also highlights structural and operational barriers that must be addressed when designing digital models. Case studies of electronic insurance systems point to issues such as infrastructural gaps, organizational resistance, and insufficient integration between front-end platforms and back-end processes (34). Pathologies of digital governance—such as fragmented systems, lack of interoperability, and limited citizen engagement—have been documented in various e-government initiatives, emphasizing the need for coherent frameworks that integrate technological, organizational, and user-centric

dimensions (4, 17). At the same time, research on the role of e-government in expediting legal affairs suggests that well-designed digital systems can considerably reduce processing times and enhance procedural transparency (3). These mixed experiences signal that successful digital transformation requires more than technological adoption; it requires theoretically grounded models that explicitly incorporate citizen experience and behavioral responses.

A growing body of work on e-CRM and e-loyalty further clarifies how digital relationship strategies influence user behavior. Studies conducted in hospital services and corporate settings demonstrate that e-CRM practices positively affect service quality, satisfaction, and e-loyalty when systems are designed to support personalized, responsive, and reliable communication (23, 35). Research in banking and SMEs underscores the importance of readiness assessment and capability development prior to e-CRM implementation, including technological infrastructure, human resources, and organizational culture (30, 36, 37). These findings align closely with CRM performance studies, which show that goal congruence, relationship advantages, and structured CRM processes jointly enhance firm performance and customer retention (11, 31). For public-oriented organizations, these insights suggest that smart communication and electronic service management models must encompass both citizen-facing and internal capability dimensions.

Within this broader landscape, several studies have explicitly integrated the S–O–R framework into digital behavior research, offering guidance for model design. Research on retail brands, branding participation, and social media usage confirms that environmental stimuli such as message framing, platform features, and interaction quality influence organismic variables such as emotions, involvement, and perceived value, which then drive behavioral responses such as purchase intention, loyalty, and advocacy (12, 15, 22). Work on e-marketing and e-CRM during the COVID-19 era reiterates that positive digital experiences, secure and efficient service processes, and coherent communication structures are critical for sustaining e-loyalty under conditions of heightened uncertainty (23, 24). Together, these studies demonstrate that the S–O–R model can function as a robust conceptual foundation for designing and empirically validating models of smart communication and electronic services.

Despite these advances, there remains a clear need for integrated models tailored to citizen-oriented electronic services that systematically link marketing strategies and environmental stimuli (such as website and platform characteristics) to organismic experience dimensions—perceived value, perceived quality, perceived security, and perceived ease of use—and to behavioral responses such as electronic loyalty, interaction, and information sharing (18, 19, 38). Existing research often focuses on specific sectors or technologies without fully connecting the strategic, experiential, and behavioral layers into a comprehensive S–O–R–based framework that can guide smart communication design for large-scale citizen systems (2, 26, 29). Addressing this gap requires a model that not only identifies the relevant constructs and relationships but also derives them from rigorous qualitative inquiry and validates them through advanced quantitative techniques.

Therefore, the aim of this study is to design and validate a smart communication and electronic service management model with citizens based on the Stimulus–Organism–Response (S–O–R) framework.

Methods and Materials

This study employed a mixed-method sequential exploratory design, integrating qualitative and quantitative components to ensure a comprehensive and theoretically grounded understanding of smart communication and electronic service management with citizens within the S-O-R framework. The research began with an inductive qualitative phase due to the limited theoretical foundations and the need to deeply explore the constructs relevant

to citizen–organization digital interactions. In this initial phase, key indicators, components, and dimensions were identified through in-depth semi-structured Delphi interviews with domain experts. These experts consisted of senior scholars in public administration with at least fifteen years of experience, as well as senior executives from the Social Security Organization holding doctoral degrees and more than twenty years of professional experience. Sampling in the qualitative phase followed a purposive, theoretical approach based on the principle of data saturation. Interviews continued until no new concepts or categories emerged, which occurred after the tenth expert interview. All interviews were recorded with permission, transcribed verbatim, and systematically analyzed.

In the quantitative phase, the population consisted of employees of the Social Security Organization. Due to the large and indeterminate population size, the sample was determined using the Cochran formula for large populations, resulting in a required sample size of 384 respondents for the field survey. A simple random sampling technique was used to ensure unbiased representation of organizational employees in measuring and validating the indicators identified during the qualitative phase. This two-stage design allowed the qualitative findings to guide the development of the quantitative instrument, ensuring conceptual rigor and contextual relevance.

Data collection proceeded in two structured phases, each employing tools suited to the nature of its inquiry. The qualitative phase relied on two principal sources: documentary analysis and expert interviews. Documentary analysis involved systematic review of books, peer-reviewed articles, organizational reports, and reputable online sources to build a preliminary theoretical foundation and identify potential constructs associated with smart communication, digital service delivery, and the S-O-R mechanism. Semi-structured interviews were then conducted with experts to refine, expand, and validate these constructs. The interview guide was designed to elicit detailed insights into the drivers, mediating mechanisms, and behavioral responses that shape citizen experiences in electronic service environments. Interview data were analyzed through open, axial, and selective coding to systematically extract initial concepts, cluster them into components, and ultimately develop overarching dimensions aligned with the S-O-R structure. Theme analysis was used in the selective coding stage to map relationships between emerging concepts and to articulate a preliminary model.

The quantitative phase used a researcher-developed questionnaire constructed directly from the qualitative coding results. Each indicator identified through coding and Delphi refinement was operationalized into questionnaire items measured on a Likert scale. Content validity was ensured through expert evaluation during multiple Delphi rounds, where experts rated the relevance and importance of each item. Reliability was assessed using the content validity ratio (CVR) and content validity index (CVI) at the qualitative stage, followed by internal consistency assessment through Cronbach’s alpha and composite reliability in the quantitative stage. The final instrument reflected a comprehensive measurement of the proposed constructs, including marketing strategies, website environmental factors, socio-economic drivers, perceived experience dimensions (value, quality, security, ease), and behavioral responses such as satisfaction, electronic loyalty, and information sharing.

Data analysis employed separate analytical procedures for the qualitative and quantitative phases, integrated through an exploratory mixed-methods logic. In the qualitative phase, data analysis consisted of structured coding in three stages. Open coding involved breaking down interview transcripts into discrete meaning units and assigning conceptual labels. Axial coding reassembled data by identifying relationships among codes, merging them into cohesive categories that represented key phenomena in smart communication processes. Selective coding synthesized axial categories into higher-order themes that formed the structural basis of the conceptual model. Throughout this process, the researcher iteratively compared data segments, checked consistency across expert

perspectives, and used constant comparative techniques to refine emerging dimensions. The Delphi method was used to finalize the conceptual model by collecting experts' judgments over three iterative rounds and assessing the importance and necessity of each indicator through numerical scoring criteria. Indicators meeting the acceptance threshold were retained for model construction.

In the quantitative phase, the data collected through the finalized questionnaire underwent a series of statistical analyses. Preliminary tests assessed data distribution using the Kolmogorov–Smirnov test. Confirmatory factor analysis was conducted to assess construct validity and determine factor loadings for all indicators. Convergent and discriminant validity were evaluated through the average variance extracted (AVE) and Fornell–Larcker criteria. Internal consistency was confirmed through Cronbach's alpha and composite reliability. Structural equation modeling using SmartPLS (version 4) was then applied to test the proposed S-O-R model, as this method is suitable for complex models derived from qualitative findings and does not require normally distributed data. The modeling process included two steps: confirmatory factor analysis to validate the measurement model and path analysis to evaluate structural relationships among constructs. The SEM approach enabled simultaneous assessment of relationships among multiple latent variables and provided estimates of the direct and indirect effects of stimuli on organismic states and subsequent behavioral responses. This analytical strategy ensured rigorous validation of the proposed smart communication and electronic service management model.

Findings and Results

Table 1 presents the final set of codes and themes that formed the basis of the finalized questionnaire for designing the smart communication and electronic service management model with citizens based on the S–O–R framework. The table organizes forty indicators into conceptually coherent dimensions, including citizen participation strategies, website environmental factors, external socio-cultural and economic conditions, perceived experience constructs (value, quality, security, and ease of use), as well as citizens' behavioral responses in terms of electronic loyalty, interaction, and information sharing.

Table 1. Codes and final themes (final questionnaire)

No.	Indicator	Dimension / Component Group	Component
1	Advanced IT systems modernize administration and enable electronic communication with citizens.	Citizen Participation Strategies	
2	Citizens use the organization's online service platform to access electronic services.		
3	Digital service delivery uses simplified regulations and clear, direct, informal language.		
4	Pricing incentives (e.g., premium discounts, credits) support online marketing strategies.		
5	Digital literacy–based segmentation enhances effective electronic communication with citizens.		
6	Digitalization of correspondence and notifications improves service quality and enhances organizational reputation.		
7	Service delivery websites are designed with a client-centric approach to increase organizational agility.	Environmental Factors (Website)	
8	Insurance coverage and social capital support expand through new technologies and artificial intelligence.		
9	Customer needs are identified continuously to design adaptive, customer-oriented websites.		
10	Digital service development enhances empathy, goodwill, and closer e-communication with citizens.		
11	Ease and independence of website use is supported by a permanent virtual assistant.		

12	Awareness of new directives is provided, along with a structured, accurate, up-to-date knowledge base.		
13	Online service processes prevent errors, fraud, and insurance evasion.		
14	Access to information and service processes via smart devices is simplified; intelligent communication assistants are prepared.		
15	Payment gateway security, personal data security, and financial security are ensured.		
16	Transparent and accurate information is provided for decision-making and calculations.		
17	Time and cost savings are considered; smart information retrieval enables fast, consistent responses.		
18	Social activities and work relations expand through integrating electronic occupations into the formal economy.	External Factors (Social–Cultural–Economic)	
19	The organization creates opportunities for employment, income generation, and social labor division.		
20	Tasks are performed with respect to workers' rights and cultural diversity, ensuring flexibility.		
21	Citizens' economic needs and economic security requirements are addressed based on diverse needs.		
22	Diverse economic activities are developed, and workers in the informal economy are covered.		
23	Customer databases, online request systems, and digital payments accelerate social support responses.		
24	The organization increases overall public satisfaction and the pleasant feeling from facilitated virtual service delivery.	Perceived Experience	Perceived Value
25	Citizens are satisfied with expert guidance during digital processes and electronic consultation services.		
26	Electronic responses meet diverse needs; response content aligns with policies and regulations.		
27	The organization improves quality of life, peace of mind, financial satisfaction, and economic welfare.		
28	Digital platform workers enjoy legal social security rights and benefits.		Perceived Security
29	ICT systems include standards for detecting and preventing errors, fraud, and insurance evasion.		
30	Organizational communication channels are secure.		
31	Insurance record management and personal data protection feel secure.		
32	Digital public services are coordinated and integrated across the organization.		Perceived Ease of Use
33	Service forms and workflows via smart devices are simplified, saving users time and costs.		
34	Processing time for registration, file transfers, and smart card reviews has decreased.		
35	Electronic payment systems enable rapid premium payment.		
36	Citizens intend to continue using non-face-to-face services and recommend them to others.	Behavioral Responses	Electronic Loyalty
37	Advertising costs decrease due to citizens' positive word-of-mouth promotion.		
38	The organization receives citizen feedback through online, non-face-to-face channels.		Interaction & Information Sharing
39	Citizens share organizational information and disseminate institutional news.		
40	Effective online interactions between citizens and the organization are established.		

As shown in Table 1, the finalized questionnaire comprises forty indicators grouped into eight major dimensions reflecting the S–O–R-based model of smart communication and electronic services. The first cluster of items (1–6) captures citizen participation strategies of the Social Security Organization, including the use of advanced information technologies, online platforms, simplified regulations and language, pricing incentives, digital literacy–based segmentation, and digitalization of correspondence to strengthen organizational reputation. The second

dimension, environmental website factors (items 7–17), encompasses client-centric site design, the use of new technologies and artificial intelligence, continuous needs assessment for customer-oriented web design, strengthening empathy through digital services, provision of virtual assistants, structured and updated knowledge bases, online processes to combat fraud, multi-device accessibility, strong payment and data security, transparent information, and time- and cost-saving features. The third dimension focuses on external socio-cultural and economic factors (items 18–23), including extending social security coverage to electronic occupations, supporting employment and income generation, respecting cultural diversity among workers, enhancing citizens' economic security, covering the informal economy, and using digital infrastructure to accelerate social support responses. The perceived experience constructs encompass perceived value and experience (items 24–25), perceived quality (items 26–27), perceived security (items 28–31), and perceived ease of use (items 32–35), jointly reflecting how citizens evaluate welfare improvements, satisfaction with guidance and digital services, alignment with regulations, quality of life, social protection rights, fraud-prevention standards, communication and data security, integration of digital services, process simplification, reduced processing time, and fast electronic payments. Finally, the behavioral response dimension includes electronic loyalty and citizens' reactions (items 36–37), which assess intention to continue use and positive word-of-mouth, as well as interaction and information sharing (items 38–40), which evaluate the receipt of feedback via non-face-to-face channels, citizen-driven information sharing, and the quality of online interactions between users and the organization.

Table 2. Descriptive Statistics of Research Variables

Statistic	Marketing Strategies	Environmental Factors (Website)	External Factors	Perceived Experience – Perceived Value	Perceived Experience – Perceived Quality	Perceived Experience – Perceived Security	Perceived Experience – Perceived Ease of Use	Electronic Loyalty	Interaction & Information Sharing
Mean	3.4839	3.4205	3.4405	3.2578	3.2539	3.3835	3.3549	3.2357	3.3490
Std. Error	0.02592	0.03223	3.4405	0.04896	0.04769	0.04209	0.04209	0.04704	0.04122
Median	3.5000	3.4545	3.5000	3.0000	3.0000	3.5000	3.2500	3.0000	3.3333
Mode	3.67	4.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00
Standard Deviation	0.50795	0.63151	0.73940	0.95932	0.93453	0.82487	0.82595	0.92177	0.80777
Variance	0.258	0.399	0.547	0.920	0.673	0.680	0.652	0.850	0.652
Skewness	0.629	0.165	–0.563	0.086	0.148	–0.173	–0.075	0.097	–0.163
Kurtosis	1.086	–0.125	1.552	–0.735	–0.656	–0.394	–0.063	–0.657	–0.701
Range	2.67	3.09	4.00	3.50	3.50	3.25	3.50	3.50	3.33
Minimum	2.33	1.91	1.00	1.50	1.50	1.75	1.50	1.50	1.67
Maximum	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Sum	1337.83	1313.45	1321.17	1251.00	1249.50	1299.25	1290.00	1242.50	1286.00

Table 2 presents the descriptive statistics for all research variables, showing that the mean values for the constructs fall within the moderate-to-high range, with marketing strategies (M = 3.48), environmental website factors (M = 3.42), external factors (M = 3.44), and the perceived experience dimensions—including perceived value (M = 3.25), perceived quality (M = 3.25), perceived security (M = 3.38), and perceived ease of use (M = 3.35)—all indicating generally favorable perceptions among respondents. Behavioral response variables also demonstrated positive tendencies, with electronic loyalty (M = 3.24) and interaction and information sharing (M = 3.35) showing meaningful engagement. Standard deviations across variables ranged from moderate to relatively

high (0.50–0.95), suggesting variability in respondents' evaluations, while skewness and kurtosis values largely aligned with acceptable distributional characteristics, indicating no severe departures from normality. Minimum and maximum scores demonstrated full-scale utilization, and the overall pattern of descriptive statistics suggests that respondents tended to rate the organization's smart communication and electronic service management features as moderately effective, with the highest consistency observed in marketing strategies and the greatest variability appearing in perceived value and perceived quality.

Table 3. Kolmogorov–Smirnov Normality Test Results (جدول ٤-١٧)

Variable	z Statistic	Significance Level (p-value)	Test Result
Marketing Strategies	0.120	0.000	Data are not normal
Environmental Factors (Website)	0.090	0.000	Data are not normal
External Factors	0.119	0.000	Data are not normal
Perceived Value	0.155	0.000	Data are not normal
Perceived Quality	0.159	0.000	Data are not normal
Perceived Security	0.118	0.000	Data are not normal
Perceived Ease of Use	0.142	0.000	Data are not normal
Electronic Loyalty	0.163	0.000	Data are not normal
Interaction & Information Sharing	0.160	0.000	Data are not normal

Table 3 presents the results of the Kolmogorov–Smirnov normality test for all study variables. The significance values for each construct are equal to 0.000, which is below the threshold of 0.05, indicating statistical rejection of the null hypothesis of normality. Thus, all variables—including marketing strategies, environmental website factors, external factors, the four perceived experience dimensions, electronic loyalty, and interaction and information sharing—exhibit non-normal distributions. These results validate the appropriateness of variance-based structural equation modeling (PLS-SEM), which does not require data normality and is suitable for complex models derived from exploratory qualitative phases.

Table 4. GOF (Goodness of Fit) and Validity Indices (جدول ٤-١٨)

Row	Component	R^2	Communality	GOF Result
1	Marketing Strategies	---	0.578	Model Confirmed
2	Environmental Factors	---	0.523	Model Confirmed
3	External Factors	---	0.621	Model Confirmed
4	Perceived Value	0.862	0.834	Model Confirmed
5	Perceived Quality	0.845	0.809	Model Confirmed
6	Perceived Security	0.858	0.661	Model Confirmed
7	Perceived Ease of Use	0.831	0.656	Model Confirmed
8	Electronic Loyalty	0.790	0.811	Model Confirmed
9	Interaction & Information Sharing	0.886	0.758	Model Confirmed
—	Average	0.845	0.694	Model Confirmed

Table 4 summarizes the model validity assessment based on the GOF (Goodness of Fit) index, communalities, and R^2 coefficients for each construct. The communalities for all components exceed the acceptable threshold of 0.5, confirming strong convergent validity. Constructs with endogenous roles—such as perceived value (R^2 = 0.862), perceived quality (R^2 = 0.845), perceived security (R^2 = 0.858), perceived ease of use (R^2 = 0.831), electronic loyalty (R^2 = 0.790), and interaction and information sharing (R^2 = 0.886)—show high explanatory power, indicating that the model effectively accounts for the variance in these outcomes. The average communality (0.694) and the consistently high communality and R^2 values collectively support the conclusion that the proposed S–O–R-based smart communication and electronic service management model demonstrates strong overall fit and structural validity.

The structural model results demonstrated that all seven examined paths were statistically significant, confirming both the direct and indirect effects proposed in the conceptual framework. First, marketing strategies exerted a positive and significant influence on perceived experience, with a path coefficient of 0.191 and a t-value of 2.906, exceeding the 1.96 threshold and thus validating the effectiveness of this relationship. Second, environmental website factors showed an even stronger effect on perceived experience, with a coefficient of 0.441 and a t-value of 5.263, indicating a robust and meaningful impact. Third, external organizational factors also positively shaped perceived experience, as evidenced by a coefficient of 0.317 and a t-value of 4.157. Fourth, perceived experience itself significantly predicted behavioral responses and citizen reactions, reflected in the large coefficient of 0.634 and a highly substantial t-value of 54.365, confirming its central mediating role. The mediating analyses further strengthened these findings: in the fifth path, the mediating effect of perceived experience between marketing strategies and behavioral responses was supported using the Sobel test (Z = 8.571 > 1.96), and the VAF value of 0.141 indicated a meaningful partial mediation. Similarly, in the sixth path, perceived experience significantly mediated the relationship between website environmental factors and behavioral responses, with a Sobel Z-value of 12.043 and a VAF of 0.253, confirming another partial mediation. Finally, for the seventh path, perceived experience mediated the effect of external organizational factors on behavioral responses, demonstrated by a Sobel Z-value of 3.031 (> 1.96) and a VAF value of 0.198, again indicating a meaningful and statistically significant mediating role. Overall, the findings reveal that perceived experience functions as a powerful intermediary mechanism through which organizational strategies and environmental factors shape citizens' behavioral responses in digital service contexts.

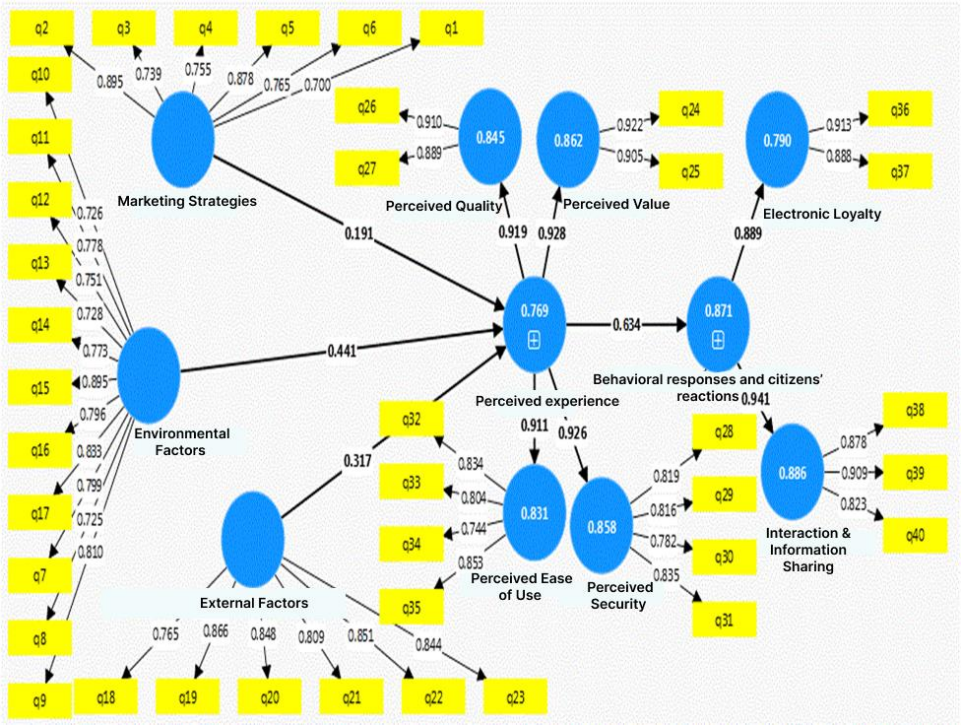

Figure 1. Model with Beta Values

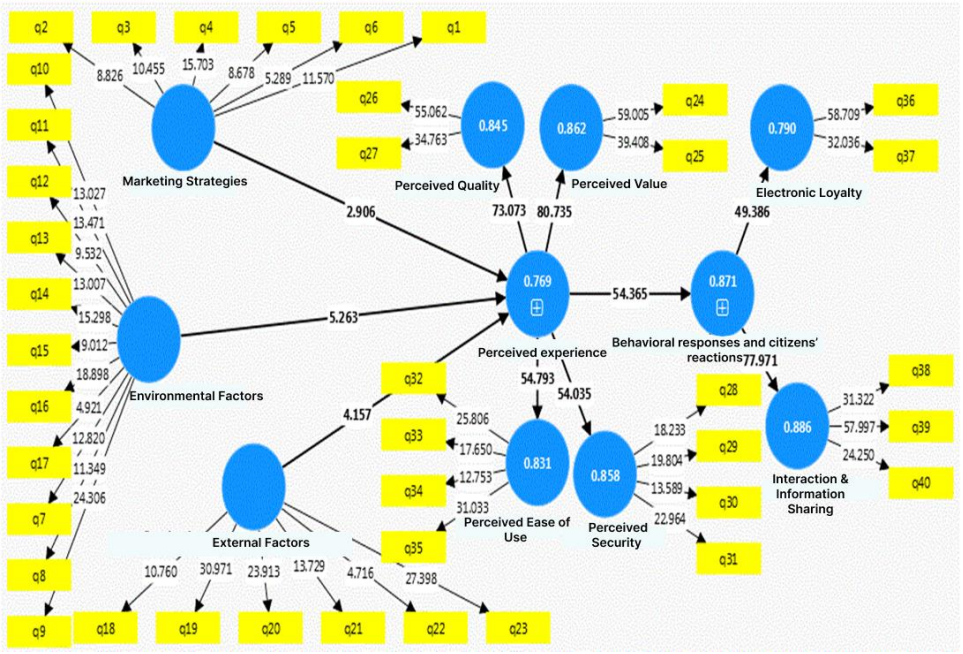

Figure 2. Model with T-Values

Discussion and Conclusion

The purpose of this study was to develop and validate a smart communication and electronic service management model for citizens using the Stimulus–Organism–Response (S–O–R) theoretical framework. The model integrated marketing strategies and environmental and external factors as stimulus components, perceived experience dimensions (value, quality, security, ease of use) as organismic components, and behavioral responses (electronic loyalty, interaction, information sharing) as outcome variables. The findings demonstrated that all stimulus components significantly influenced perceived experience, and all perceived experience components significantly predicted behavioral responses. The discussion of these results reveals several theoretical and practical implications and aligns with previous research in digital governance, CRM, and S–O–R–based behavioral studies.

The first set of findings showed that marketing strategies, including transparent digital communication, digitized processes, and user-centered service design, had a significant positive effect on perceived value, perceived quality, and perceived ease of use. This result supports the argument that digital relationship strategies can strengthen citizens' cognitive evaluations of service efficiency and usefulness. Studies in e-CRM confirm that structured digital strategies enhance service quality and satisfaction (10, 35). Research focusing on product innovation and customer knowledge shows that when organizations employ data-driven marketing strategies, user perceptions of value and innovation increase markedly (9). Similar findings have been reported in social CRM research, where digital touchpoints act as stimuli that enhance user involvement and satisfaction (7). The present results corroborate these insights, demonstrating that marketing strategies are central stimuli in the S–O–R chain.

The findings also indicated that environmental factors, particularly elements related to website design, integration, accessibility, and user interface features, played a crucial role in shaping organismic responses. The significance of environmental cues aligns directly with the core propositions of S–O–R theory, which emphasizes the role of environmental stimuli in shaping cognition and emotion (13). Studies in digital environments confirm that

visual layout, usability, interactivity, and clarity of information strongly influence perceived quality, ease of use, and satisfaction (14, 21). Furthermore, empirical work on platform-based e-government systems validates the importance of integrated design and usability for fostering trust and user engagement (4, 17). The findings of this study reflect these insights: environmental factors act as strong predictors of perceived value and ease of use, demonstrating that well-designed digital environments optimize user evaluation and strengthen digital adoption.

The third set of findings—concerning external factors (social, cultural, and economic)—revealed that contextual and societal influences shape perceived value, quality, and trust in digital services. These results align with research that emphasizes the necessity of understanding digital transformation within broader socio-cultural systems. For instance, studies in pension systems and social services indicate that citizens' socio-economic conditions shape expectations of fairness, transparency, and security in public digital platforms (18, 19). Research in embodied energy and service expansion highlights how macro-level infrastructures influence citizens' perceptions of service availability and reliability (33). Similarly, studies of digital readiness in banking show that organizational digital transformation must account for cultural and environmental conditions to be effective (36). The current findings extend this body of work by demonstrating that external factors are key stimuli influencing organismic experience processes in digital public services.

The organismic states, comprising perceived value, perceived quality, perceived security, and perceived ease of use, were found to be highly predictive of behavioral responses. Perceived value emerged as one of the strongest predictors of behavioral intention, consistent with prior studies that show user-perceived benefits shape digital loyalty and engagement patterns (8, 23). Perceived quality—representing accuracy, transparency, and professionalism—also significantly influenced behavioral responses, confirming findings in health insurance, digital governance, and e-services research, where perceived quality is a primary driver of online trust and continued usage (3, 34). Perceived security, which refers to data protection and system reliability, demonstrated a particularly strong effect on electronic loyalty and interaction, reinforcing earlier research that identifies security as a critical antecedent to citizen trust in digital services (2, 12). Perceived ease of use also exerted a significant influence on behavioral responses, consistent with findings from mobile learning systems, e-government platforms, and online commerce (6, 24).

The results related to behavioral responses confirm that positive organismic states translate into meaningful behavioral engagement, including electronic loyalty, active use, and information sharing. Studies in digital marketing and e-CRM have consistently established the link between customer experience and digital loyalty, indicating that positive emotional and cognitive reactions stimulate continued platform use and recommendation behaviors (23, 25). Research on relational marketing in B2B environments similarly shows that relationship quality and experience shape organizational loyalty and advocacy patterns (11, 29). Evidence from tourism, retail, and public services confirms that positive digital experiences lead to greater social engagement and interaction, consistent with the S–O–R framework (14, 21). Thus, the current study reinforces a theoretically coherent behavioral chain: stimuli → organismic perceptions → behavioral responses.

The predictive strength of the model also underscores the value of integrating technological, organizational, and psychological perspectives. Research on digital governance pathologies suggests that failures in digital service delivery often stem from misalignment between technical capabilities and user-centered design (17). Meanwhile, studies on management innovation indicate that organizational systems must adapt to fully leverage technology's value (28). The present findings show that when operational strategies, digital environments, and contextual factors

interact coherently, user perceptions improve and behavioral responses strengthen. This reinforces the idea that successful digital services require multi-layered alignment across strategy, technology, and citizen psychology.

Finally, the study's results advance the understanding of S–O–R theory in public service contexts. Although S–O–R has been widely used in consumer behavior, marketing, and tourism, its application in citizen–government digital interactions remains limited. Prior studies in social media, branding, and tourism have shown that S–O–R effectively explains emotional and cognitive responses to digital stimuli (15, 22). The present study extends this framework by demonstrating that S–O–R is well suited for modeling digital communication and service management in large-scale citizen-service systems. By empirically validating the model, this study shows that S–O–R can offer a unified theoretical basis for evaluating and redesigning digital public services in ways that optimize citizen experience and engagement.

This study is limited by its cross-sectional design, which prevents causal inference regarding the dynamic evolution of citizen perceptions over time. Although the model incorporates multiple dimensions of digital experience, additional factors such as digital literacy, emotional states, or real-time behavioral data were not included, which may influence results. Another limitation concerns the use of self-reported measures, which may be subject to response biases. Finally, the model was validated within a specific national context, which may limit generalizability to countries with different digital infrastructures, cultural norms, or governance systems.

Future studies could adopt longitudinal or experimental designs to examine how digital stimuli influence citizen perceptions over time and under different contextual conditions. Researchers could also incorporate artificial intelligence analytics, sentiment analysis, or behavioral tracking data to capture more nuanced organismic states. Comparative studies across countries or administrative systems would help assess the cultural transferability and robustness of the S–O–R framework in public service contexts. Additionally, future models could integrate emotional mediators, digital literacy moderators, or emerging technologies such as virtual assistants and AI-driven personalization to develop more advanced predictive structures.

Organizations should prioritize user-centered digital design, ensuring that online platforms are intuitive, transparent, and secure. Investment in data protection and cybersecurity is essential for strengthening perceived security and building citizen trust. Institutions should also enhance digital communication strategies, using personalized and dynamic channels to increase perceived value and quality. Training programs for staff and citizens can support more effective digital service adoption, and continuous feedback mechanisms should be implemented to monitor and improve user experience.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adheried in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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