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Article

Loyalty and Perception of Reliability in E-Government Services: The Brazilian Case

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Abstract: This research provides an analytical exploration into digital transformation in public services, with a focus on Brazil's GOV.BR platform. It critically examines how citizens' trust and satisfaction influence their loyalty to e-government services. Supported by structural equation modeling (PLS-SEM), the study is based on established frameworks in e-government literature. Our analysis reveals that service quality significantly influences citizen loyalty, with an adjusted R2 value of 71.2%, highlighting its importance in the e-government domain. Contrary to expectations, trust in the government showed a non-significant direct impact on citizen satisfaction and loyalty. These findings provide critical insights for policymakers and practitioners in improving the efficacy and adoption of e-government services.

Keywords: e-government; digital transformation; structural equation modeling.

1. Introduction

The digital transformation revolution has been reconfiguring countless sectors of contemporary society, and public services are not immune to this wave of change. The digitalization of government services carries with it the promise of improving efficiency, broadening access and increasing citizen satisfaction. However, for these benefits to materialize, it is imperative that there is a relationship of perceived quality, trust and satisfaction between citizens and these digital services, culminating in loyalty and continued use.

In this landscape, the "GOV.BR" platform, an initiative of the Brazilian government, is emerging as a paradigm of innovation in the context of electronic government (e-gov). The

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platform was launched in 2019 as part of an effort to modernize the government and centralize and digitalize public services in a single channel. As of June 2023, 150 million citizens, or 94% of the population over the age of 18, had registered on the platform, which offers 4,200 digital services. As a result, in 2022, Brazil was ranked 2nd in the GovTech Maturity Index (GTMI), measured by the World Bank [10], which is made up of 4 digital government focus areas: (i) central government systems, (ii) public service delivery, (iii) citizen engagement and (iv) e-government enablers,

Despite its growing relevance, there is a lack of knowledge about how citizens' perception of trust and satisfaction in using the "GOV.BR" platform influences their loyalty to e-government services. This lack of studies prompted this research. This research investigates how citizens' perceptions of quality, trust, and satisfaction with the 'GOV.BR' platform affect their loyalty to e-government services. Specifically, to elucidate the dynamics of how the perceived quality of e-government services, trust and user satisfaction shape citizen loyalty.

The findings expected from this work have the potential to provide valuable insights for future improvements and user engagement strategies on the "GOV.BR" platform.

2. LITERATURE REVIEW AND HYPOTHESES

2.1.Literature Review

As described by [2], [3], and [4], loyalty transcends the mere intention to use or retain, encompassing favorable attitudes, commitment, recommendation to others, and an active engagement with the government entities responsible for the services. At government level, loyalty can be expressed through deeper commitment and proactive actions to support digital services, such as recommending these services to other citizens or participating in national evaluation surveys, generating brand-building benefits for citizens [5], participation in global rankings [1] and improved service delivery for users.

Loyalty is crucial even in monopolistic government services. It entails not only avoiding services that citizens reject but also promoting enhancements in design [6] and user experience [7]. These improvements should favor online over traditional methods, encourage greater interaction, and result in citizens recommending digital services [8]. This understanding broadens the perception of loyalty in the context of e-government, highlighting it as a lever for continuous improvement and citizen engagement.

About service quality, [9] laid the foundation for measurement by comparing customer expectations and perceptions with the actual service using a gap model commonly referred to as SERVQUAL. Investigating e-government quality, [10] identified the importance of perceived service value as a mediator between service quality and citizens' intention of continued use. [11] supported this perspective by presenting a model where system quality

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acts as a strong antecedent of perceived usefulness and citizens' trust in satisfaction with mandatory e-government services.

Citizen engagement with a new e-government service in Taiwan was analyzed by [2], linking innovation and citizen engagement to their loyalty intentions. This study highlighted the difference between willingness for initial adoption and continued loyalty to the service. On the other hand, [3] and [12] focused on the impact of service quality on citizen loyalty, confirming that better quality is associated with greater satisfaction and loyalty to the e-government self-service.

Another critical construct that has emerged in many e-government and e-commerce studies is Trust. [13] attributed the quality of service to a determining role in increasing trust and, consequently, customer loyalty. Research such as [14], [15] and [16] has explored trust in online services in detail, identifying its antecedents, such as information quality and citizen characteristics, and its effects on the adoption of e-government services.

Previous studies on the ability to generate feelings of citizen trust highlight 3 (three) fundamental pillars: i. the citizen's psychological disposition to trust [16][17][18]; ii. the citizen's trust in the enabling technologies used for the e-government website [8][19][20][21]; and iii. the citizen's trust in government in general [8][12][17][18][21].

The concept of citizen satisfaction with e-government services was analyzed in research carried out by [22] and [23], which investigated how satisfaction with the use of these services and citizens' trust in government institutions influence the success of e-government. This concept is essential to the success of e-government projects, since citizen dissatisfaction, derived from the relationship between them and e-government services, can negatively affect the efficiency of these initiatives, impacting citizen loyalty to the services [10][11] [23].

Although satisfaction is a relevant factor for measuring the success of information systems [24], [25] and [26], there is no consensus on the specific methods for measuring user satisfaction with e-government services, with studies using a single construct [27] and dividing satisfaction into attitudinal and behavioral factors [11], [16] and [22]. Current research explores the direct relationship between service quality and trust in citizen satisfaction, as well as the impact of satisfaction on citizen loyalty to e-government services [22] [24].

Finally, it is observed that loyalty, in the context of e-government services, is a multifaceted construct that encompasses the willingness of citizens to continue using the online services offered by the government, as well as to recommend them to others. [3] and [12] list factors such as service quality and citizen satisfaction as critical antecedents for fostering this loyalty, indicating that better service quality positively affects satisfaction and, consequently, leads to greater citizen loyalty.

Thus, effective implementation, focused on quality and reliability, together with a satisfactory user experience, is essential for loyalty in the field of government e-services,

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directly impacting on the intention of continued use and the positive promotion of these services by citizens.

2.1. Theoretical Model and Hypotheses

Drawing from a comprehensive literature review, our research model elucidates the relationships among service quality, trust, satisfaction, and their collective impact on citizen loyalty towards e-government services, as depicted in Fig. 1.

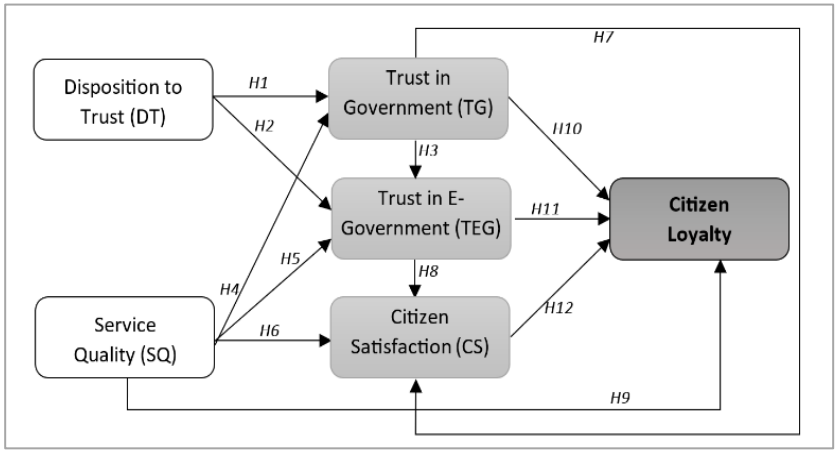

Figure 1 - Proposed Model and Hypotheses

In relation to the construct of trust, as observed in the literature review, the propensity to trust and trust in government are fundamental in building relationships of trust in e-government services, serving as essential pillars in this process [17]. Previous studies [16][18] have shown that a greater predisposition to trust on the part of citizens results in increased confidence in government institutions and their e-services. On the other hand, an untrustworthy government leads to greater suspicion on the part of citizens about the real transparency of digital services [17]. Therefore, the following hypotheses related to the trust construct were developed:

Service quality is a relevant antecedent of trust and is related to loyalty in various contexts [6] [10], including e-commerce. High-quality e-government services that meet citizens' expectations consistently tend to improve the relationship with the government [28] and e-government services [12][13][16]. Thus, the hypotheses were formulated:

H4: Service quality has a direct and positive influence on citizens' trust in government.

H5: Service quality has a direct and positive influence on citizen trust in e-government services.

In the area of satisfaction, the direct relationship between service quality, trust in government, trust in e-government and citizen satisfaction with the GOV.BR platform was explored. Previous studies reinforce the connection between service quality and satisfaction in the context of e-government, such as those by [19] and [29], suggesting that a high standard

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of service raises citizens' trust and overall satisfaction. We have therefore formulated the following hypothesis:

H6: Service quality has a direct and positive influence on citizen satisfaction with e-government services.

In addition, [17], [18], [24], [28] and [30] identified that positive prior trust in government directly influences citizen satisfaction with digital public services. Similarly, [20], [21], [31] and [32] showed that prior trust in e-government services boosts citizen satisfaction and engagement with new services, while a lack of trust reduces interaction and satisfaction with these services. Thus, it were tested:

H7: Trust in government directly and positively influences citizen satisfaction with e-government services.

H8: Trust in e-government services has a direct and positive influence on citizen satisfaction with e-government services.

Finally, concerning loyalty, the influence of service quality, as highlighted by [13], trust in government, as evidenced by [11],[17] and [18], trust in e-government and citizen satisfaction, as indicated by [10], were found to be direct antecedents of citizen loyalty. Service quality is essential for strengthening citizen loyalty to digital public services, since perceived quality is a precursor to satisfaction and, in turn, loyalty. Thus, a loyal citizen tends to use the services more and more.

H9: Service quality directly and positively influences citizen loyalty to e-government services.

H10: Trust in government directly and positively influences citizen loyalty to e-government services.

H11: Trust in e-government services has a direct and positive influence on citizen loyalty to e-government services.

H12: Citizen satisfaction has a direct and positive influence on citizen loyalty to e-government services.

By exploring these hypotheses, our study aims to deepen the understanding of the drivers behind user loyalty to the GOV.BR platform, thereby informing strategies to enhance e-government services in Brazil.

3. Metodology

The Partial Least Squares - Structural Equation Modeling (PLS-SEM) method [33][34] was used to analyze the data. This method was chosen because of its effectiveness in dealing with complex structural equation models and its suitability for exploratory research such as this.

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Data was collected using an online questionnaire, revised and adapted for the Brazilian cultural context. The items were operationalized using a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5).

The survey sample was calculated using G-power based on the effect size [35]. For an average effect size (0.15), with a predictive power of 0.85 and alpha (margin of error) of 0.05 and with five predictors, a sample requirement of 95 respondents was generated. A total of 108 records were obtained. Removing those with a very low standard deviation (< 0.3) and those who do not use the GOV.BR platform, the final sample was 100 respondents. As seen in Table I, the characteristics of the respondents, such as gender, age group and region, were collected and organized to provide a detailed profile of the participants.

Table I. Demographic Profile

Category	**Frequency**	**%**
Gender		
Male	41	41%
Female	58	58%
Non-binary	1	1%
Region		
North	18	18%
Northeast	18	18%
Midwest	40	40%
South	7	7%
Southeast	17	17%
Annual Household Income (Brazilian Real $)		
≤ 31,680.00	6	6%
31,680.01—79,200.00	18	18%
79,200.01—158,400.01	38	38%
158,400.01— 237,600.00	17	17%
237,600.01—316,800.00	16	16%
≥ 316,800.00	13	13%
Education Level		
High School	6	5%
Bachelor's Degree	48	32%
Master's Degree	54	50%

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The survey was able to cover the various regions of Brazil, showing a representative sample of the population that uses e-government services. The data collection process was carried out over a period of one month, with a previously defined start and end date.

4. Results

Given the study's use of a reflective model [33], where the construct indicators stem from the latent variable, we validated both the measurement and structural models.

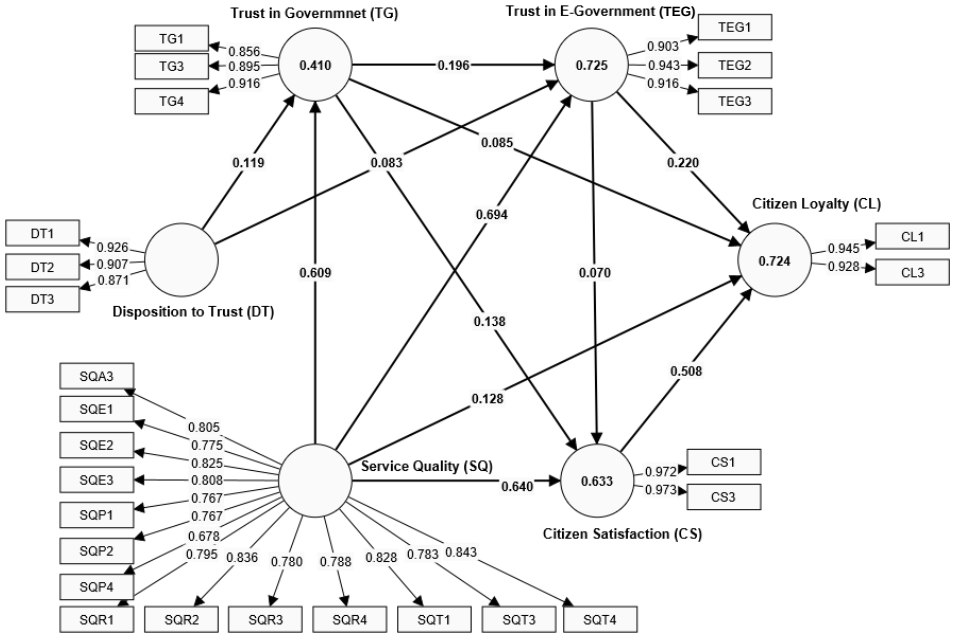

Figure 2 - Results of the PLS analysis of the data collected

In evaluating the measurement and structural models, we found that composite reliability values (rho_c) for all constructs were high, matching or surpassing Cronbach's alpha values. This indicates strong internal consistency across the utilized scales. Convergent validity was confirmed, with all constructs displaying an Average Variance Extracted (AVE) above the recommended threshold of 0.5 and factor loadings exceeding 0.7 [33][34]. This demonstrates a positive correlation between the indicators and their respective constructs.

Discriminant validity was achieved, with heterotrait-monotrait (HTMT) ratios falling below the 0.9 threshold across all construct comparisons [33][34]. This indicates that the constructs are sufficiently distinct from each other. In the initial measurement of the HTMT test, indicators CS2 and CL2 were excluded as they did not meet the acceptable threshold in the HTMT assessment and SQA1, SQA2, SQT2, SQP3 and TG2 as they had a Variance Inflation Factor (VIF). Indicator SQP4 had a factor loading of less than 0.7, but was not excluded as it did not affect progress. After adjustments, the HTMT(<0.9) and VIF(<0.5) limits were met, indicating that the constructs are sufficiently distinct from each other and the indicators are independent of each other, i.e. there is no multicollinearity.

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The validation of the structural model through PLS-SEM is particularly evident in the adjusted R^2 values which reflect the variance explained in the endogenous constructs. For example, the adjusted R^2 for citizen loyalty (CL) is 0.712, indicating that approximately 71.2% of the variance in citizen loyalty is explained by the model's constructs. Similarly, the adjusted R^2 for trust in e-government (TEG) is 0.717, suggesting that the predictors explain around 71.7% of its variance.

We tested the study's hypotheses concerning the GOV.BR platform by analyzing empirical evidence from path coefficients and p-values, assessing their validity within the Brazilian e-government context. The results can be seen in Table II.

Table II. PLS structural results

Hypotheses	**R^2 Adjusted**	***Path* coefficient**	**Confidence Level**		***p-value***
			2.5%	**97.5%**	
H1: DT→ TG	0.398	0.119	-0.104	0.289	0.219
H2: DT→ TEG	0.717	0.083	-0.036	0.192	0.158
H3: TG→ TEG	0.717	0.196	0.035	0.341	**0.010****
H4: SQ→ TG	0.398	0.609	0.468	0.720	**0.000*****
H5: SQ→ TEG	0.717	0.694	0.580	0.803	**0.000*****
H6: SQ→ CS	0.622	0.640	0.384	0.854	**0.000*****
H7: TG→ CS	0.622	0.138	-0.021	0.293	0.083
H8: TEG→ CS	0.622	0.070	-0.218	0.364	0.634
H9: SQ→ CL	0.712	0.128	-0.065	0.310	0.172
H10: TG→ CL	0.712	0.085	-0.064	0.224	0.245
H11: TEG→ CL	0.712	0.220	-0.031	0.471	0.083
H12: CS→ CL	0.712	0.508	0.286	0.695	**0.000*****

1. Citizen Satisfaction(CS). 2. Citizen Loyalty(CL). 3. Disposition to Trust(DT). 4. Trust in Government (TG). 5. Trust in E-Government services. 6. Service Quality; *** p<0.001; ** p< 0.01; * p< 0.05.

Thus, considering the context applied to Brazil, the results obtained show that:

H1 and H2: Citizens' willingness to trust in the Brazilian government was not confirmed (p=0.219), indicating that there is not enough evidence to affirm that willingness to trust has a direct and positive influence on trust in the government. Similarly, the hypothesis that willingness to trust influences trust in e-government services in Brazil was not confirmed (p=0.158).

H3: A previous trust in government was validated as a factor that positively affects trust in e-government services (p=0.010), corroborating that greater trust in the government leads to a higher propensity to trust in the digital services that will be made available to citizens.

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H4, H5 and H6: Service quality was confirmed as a factor that exerts a direct and positive influence on trust in government (p=0.000), E-government (p=0.000) and citizen satisfaction (p=0.000), with a high path coefficient, highlighting its critical importance as a precedent for loyalty in other constructs.

H7 and H8: The direct positive impact of trust in the government on citizen satisfaction (p=0.083), and the relationship between trust in e-government services and citizen satisfaction (p=0.634), were not statistically significant. This indicates that additional factors may play a more substantial role in influencing citizen satisfaction.

H9, H10 and H11: Service quality (p=0.172), trust in government and e-government services (p=0.245 and p=0.083 respectively) had no statistically significant relationship with citizen loyalty.

H12: Finally, citizen satisfaction was confirmed as a direct and positive influencer of citizen loyalty (p=0.000), emphasizing satisfaction as an essential component for long-term loyalty.

In sum, the evidence from the study indicates that while service quality, trust in e-government services and citizen satisfaction are significant antecedents of citizen loyalty, trust in government did not show a significant direct impact on citizen satisfaction or loyalty. These findings offer valuable insights for government authorities to focus on specific improvements that can strengthen the effectiveness and adoption of e-government services.

5. Practical Implications

To enrich the research and establish criteria for practical implications, an importance-performance analysis (IPMA) was conducted. This analytical tool evaluates the mean values of latent variables alongside their indicators, offering a nuanced understanding of each variable's impact. Thus, by combining the importance analysis with the performance analysis, it is possible to reach additional conclusions and identify more essential areas for improvement [36].

The IPMA generates a graph positioning variables based on their importance and the corresponding performance level, offering a visual representation of priority areas for improvement. The x-axis shows the importance of each factor, while the y-axis shows its performance. As a result, Variables located in the graph's lower right quadrant are prioritized for action due to their high importance yet low performance metrics.

In the context of citizen loyalty to e-government services, the IPMA analysis (fig. 3) highlights the critical importance of Quality of Service. With a total effect of 0.508 on Citizen Loyalty, it becomes clear that understanding which pillars of service quality matter most to citizens can generate more effective results, highlighting as the most important indicators in this construct the perception of security (SQA3) and the perception of the government looking out for the citizen's interests first (QSE2).

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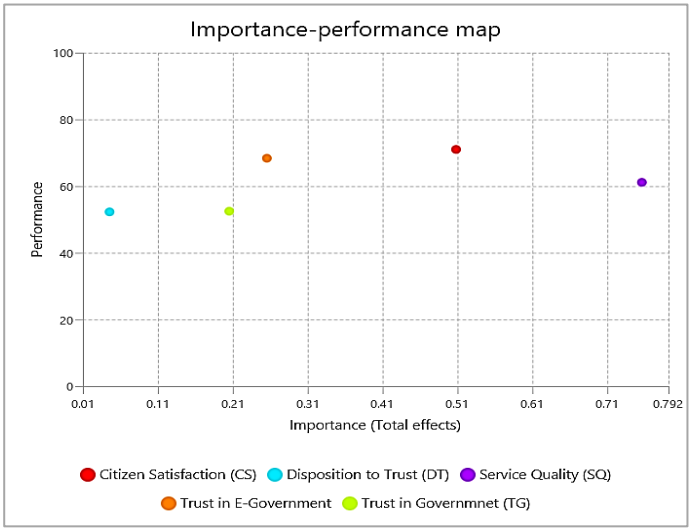

Figure 3 - IPMA analysis results

In the analysis at indicator level alone, the indicators TG4, TEG2, and TG3, related to the reliability and perceived security of the GOV.BR platform, rank in the top 80th percentile for importance. However, their performance falls below the 70th percentile, signaling a critical area for intervention. In this context, improving the User Experience (UX), highlighting that the direction of care for the citizen and an environment that increases the security perceived by users would act directly to improve Citizen Loyalty.

Leveraging insights from the IPMA enabled pinpointing specific factors for improvement, directly enhancing citizen loyalty with the platform. Then, based on these insights, we delineated functional requirements tailored to service management capabilities, aimed at optimizing the GOV.BR platform's functionality.

5. Conclusions

This study sought to enrich the understanding of customer/citizen loyalty within the realm of electronic public services, specifically focusing on e-government platforms. By empirically examining how service quality, trust in government, trust in e-government services, and citizen satisfaction influence citizen loyalty to e-government services, this research utilized the GOV.BR platform in Brazil as a pivotal case study.

Anticipated to enrich the theoretical framework on citizen loyalty to digital services, the findings of this study aim to offer e-government practitioners actionable insights for refining managerial strategies. These strategies are geared towards the development of impactful citizen loyalty programs..

Furthermore, this research sheds light on the GOV.BR platform and underscores the critical importance of sustained collaboration between the government and its citizens in service enhancement. Such a partnership is particularly vital in Brazil, where bolstering citizen-government relations is key to ensuring the persistent uptake and triumph of e-government endeavors.

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