

Does digital innovation satisfy citizens through service quality? Mediation evidence from civil registry and notary services in Timor-Leste, with global, regional and national implications

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Abstract

Purpose. Digital government reforms are frequently assumed to directly enhance citizen satisfaction; however, empirical evidence from small, low-income, and post-conflict administrations remains scarce. This study investigates whether the perceived effectiveness of digital innovation is associated with citizen satisfaction through perceived service quality, and whether perceived socio-political intervention conditions this pathway.

Design/methodology/approach. A cross-sectional survey was conducted among 96 citizens utilizing digital civil registry and notary services provided by the Directorate-General of Registry and Notary Services (DGSRN) in Dili, Timor-Leste. Four key constructs were measured using five-point Likert scales. Hypotheses were tested using ordinary least squares (OLS) path models, 10,000-sample bootstrap confidence intervals, HC3 heteroscedasticity-consistent standard errors, moderation analysis, and extensive sensitivity analyses.

Findings. The measurement instruments demonstrated good reliability ($\alpha = .81-.87$) and discriminant validity was supported ($HTMT \leq .70$). Perceived digital-innovation effectiveness was positively related to satisfaction (total effect = 0.52, $p < .001$), and about 37% of this association operated indirectly through service quality (indirect effect = 0.19, 95% CI [0.05, 0.42]). With perceived socio-political intervention added as a covariate, the indirect effect was smaller (0.08, 95% CI [-0.01, 0.25]) but excluded zero in three of four sensitivity specifications. Socio-political intervention did not moderate the pathway ($p = .54$).

Originality/value. The study offers a quantitative test of a mediated digital-innovation–satisfaction pathway in an early-digitizing post-conflict state and interprets it against global, Southeast Asian and national policy benchmarks. The results suggest that digital tools raise satisfaction mainly when they improve the quality of the service encounter, which implies that digital-government strategies should monitor citizen-perceived service quality alongside supply-side indicators.

Highlights

Digital innovation is related to citizen satisfaction partly through service quality.

About 37% of the total effect is transmitted indirectly (95% CI [0.05, 0.42]).

Perceived socio-political intervention does not moderate the pathway.

Findings are interpreted at global, ASEAN and national levels.

Transparent sensitivity analyses show where the evidence is fragile.

1. Introduction

Governments across the world have invested heavily in digital platforms with the expectation that automation, online access and data integration will make public services faster, more transparent and more satisfying for citizens (Dunleavy et al., 2006; Mergel et al., 2019; United Nations Department of Economic and Social Affairs [UN DESA], 2024). The expectation is intuitive, but the empirical record is mixed. Digital reforms in public administration frequently fall short of their promises because of mismatches between the design of systems and the realities of the organizations and users who must work with them (Heeks, 2002), and because technology does not by itself change how frontline staff and citizens interact (Bannister & Connolly, 2014; Fountain, 2001). Much of the research on e-government and citizen satisfaction has been carried out in high-income democracies and has concentrated on trust in government and on satisfaction with websites (Morgeson et al., 2011; Tolbert & Mossberger, 2006; Welch et al., 2005). Much less is known about how citizens in small, low-income and post-conflict states evaluate digital reforms that sit alongside long-standing weaknesses in administrative capacity (Goldfinch & DeRouen, 2014).

This gap matters for theory and for practice at three levels. Globally, the expectancy–disconfirmation model of citizen satisfaction implies that satisfaction depends on the gap between what citizens expect and what they perceive they receive (Van Ryzin, 2004, 2006). A digital system closes that gap only if citizens perceive it as improving the service they actually experience, that is, its reliability, responsiveness and empathy at the point of contact (Parasuraman et al., 1988; Zeithaml et al., 2002). Digital innovation may therefore influence satisfaction mostly indirectly, by improving perceived service quality. Regionally, Southeast Asian governments have committed to improving both the quality and the use of e-government services under the ASEAN Digital Masterplan 2025 (ASEAN, 2021), and Timor-Leste’s accession to ASEAN in October 2025 places its administrative reforms within this regional agenda. Nationally, Timor-Leste is pursuing a ten-year digital strategy, Timor Digital 2032, while its position in international e-government benchmarks has weakened since 2020 (UN DESA, n.d.). Public agencies that have invested in digital systems therefore need to know whether further gains in satisfaction require more technology or better service processes.

Timor-Leste offers a revealing setting. The country restored independence in 2002, rebuilt its public administration almost from the ground up, and is now digitizing core services (Goldfinch & DeRouen, 2014; Tanaka-Sakabe, 2021). The Directorate-General of Registry and Notary Services (DGSRN) delivers civil registration and notary services that nearly every citizen must use at some stage of life, which makes it a natural case for studying digital transformation in a service where citizen–state contact is frequent and consequential. Politics and organizational culture are also widely believed to shape the fate of administrative reforms in this context, so a complete account should consider whether the perceived socio-political environment alters how digital innovation is experienced.

This article therefore asks two research questions. RQ1: To what extent is the perceived effectiveness of digital innovation associated with citizen satisfaction, and does perceived service quality mediate this association? RQ2: Does perceived socio-political intervention condition the pathway from digital innovation to service quality? Using survey data from 96 citizens who used DGSRN services, we estimate

mediation and moderation models and subject the results to extensive sensitivity analysis. We then interpret the findings against global theory, Southeast Asian regional evidence and Timor-Leste's national policy context.

The study makes four contributions. First, it moves beyond the assumption that digital innovation has a direct effect on satisfaction by testing a mediation mechanism grounded in service-quality theory. Second, it extends the evidence to a post-conflict, early-digitizing administration that is underrepresented in digital-government research. Third, because small-sample survey results can be fragile, it demonstrates a transparent reporting strategy in which the main estimates are accompanied by bootstrap, heteroscedasticity-robust and influential-case analyses. Fourth, it links micro-level survey evidence to global, regional and national policy frameworks, and offers a proposition about digital-service decoupling in early-stage digital governments that can be tested in comparative work. The remainder of the article is organized as follows: Section 2 develops the theory and hypotheses, Section 3 describes the global, regional and national context, Section 4 presents the method, Section 5 reports the results, Section 6 discusses them at the global, regional, national and organizational levels, and Section 7 concludes.

2. Theoretical background and hypotheses

2.1 Citizen satisfaction as a perceived performance judgement

Satisfaction research in public administration borrows from consumer psychology the idea that satisfaction results from comparing expectations with perceived performance (Oliver, 1980). Van Ryzin (2004, 2006) applied this expectancy-disconfirmation logic to citizen evaluations of local services and showed that expectations and perceived performance jointly shape satisfaction. Morgeson (2013) extended the model to the federal level, and Kelly and Swindell (2002) linked service performance to citizen satisfaction across jurisdictions. This literature suggests that citizens judge public organizations through their lived service encounters. It also suggests that anything that improves, or is perceived to improve, those encounters should raise satisfaction, while anything that merely adds technology without changing the encounter should not.

The New Public Service perspective (Denhardt & Denhardt, 2000) reinforces this view by arguing that public organizations should serve citizens rather than merely steer them, which places the quality of the citizen-administrator interaction at the center of public value. Public service logic similarly emphasizes that value in public services is co-created in the interaction between users and providers (Osborne et al., 2013; Osborne, 2018).

2.2 Digital innovation and citizen satisfaction

Digital-era governance expects digitization to reintegrate fragmented functions, simplify processes and make services more responsive to needs (Dunleavy et al., 2006). Empirical studies find that citizens who

use government websites report higher e-government satisfaction, and that this satisfaction is linked with trust in government (Welch et al., 2005; Morgeson et al., 2011). Digital tools are also associated with transparency and openness (Bertot et al., 2010), and utilization depends on citizen trust and on innovation characteristics such as perceived usefulness and ease of use (Carter & Bélanger, 2005; Davis, 1989; Venkatesh et al., 2003). We therefore expect that citizens who perceive the DGSRN's digital innovation as effective will report higher satisfaction.

H1. Perceived effectiveness of digital innovation is positively associated with citizen satisfaction (total effect).

2.3 Service quality as the mechanism

Service-quality research distinguishes the technical delivery of a service from the way it is delivered and experienced, and identifies dimensions such as reliability, responsiveness, assurance, empathy and tangibles (Grönroos, 1984; Parasuraman et al., 1988). Quality perceptions have behavioral and evaluative consequences (Zeithaml et al., 1996), and performance-based measures of quality predict satisfaction well (Cronin & Taylor, 1992). For electronic channels, the E-S-QUAL framework emphasizes efficiency, system availability, fulfilment and privacy (Parasuraman et al., 2005; Zeithaml et al., 2002). Together, these frameworks imply a sequence in which a digital system raises satisfaction by first improving what citizens experience as service quality: faster, more reliable, more responsive and more considerate handling of their case.

The sequence is consistent with the design–reality gap argument (Heeks, 2002) and with the platform-governance view that technology yields value only when organizational processes are reconfigured around it (Janssen & Estevez, 2013). It is also consistent with the warning that states can adopt the forms of modern administration without acquiring its functions (Pritchett et al., 2013; Andrews et al., 2017). If digital tools do not alter the service encounter, they should have little effect on satisfaction; if they do, perceived service quality should carry the effect. We hypothesize:

- H2. Perceived effectiveness of digital innovation is positively associated with perceived service quality (path a).
- H3. Perceived service quality is positively associated with citizen satisfaction, controlling for digital innovation (path b).
- H4. Perceived service quality mediates the association between digital innovation and citizen satisfaction (indirect effect ab).

2.4 The perceived socio-political context

Reforms in public administration are embedded in political and organizational settings that can strengthen or undermine their effects. Politics, organizational culture and informal influence are recurrent explanations for why digital initiatives succeed or fail (Heeks, 2002; Fountain, 2001), and state capacity and bureaucratic professionalism remain contested in Timor-Leste (Goldfinch & DeRouen,

2014). Citizens who perceive more socio-political intervention in service delivery may interpret the same digital system differently, for example as less neutral or less reliable. Because the construct captures perceptions rather than objective conditions, and because the literature does not yield a firm prediction of direction, we treat the test as exploratory.

H5 (exploratory). Perceived socio-political intervention moderates the association between digital innovation and perceived service quality (path a), and thereby the indirect effect.

3. Research context: global, regional and national

3.1 The global context

Digital government is now a global policy priority, and the United Nations benchmarks it biennially through the E-Government Development Index (EGDI), which combines an online service index, a telecommunication infrastructure index and a human capital index (UN DESA, 2024). Such indices measure the supply side of digital government that is, what governments provide and what infrastructure and skills exist. They do not measure how citizens experience the resulting services, which is the focus of satisfaction research and of this study. The gap between supply-side readiness and demand-side experience is particularly relevant for countries in the early stages of digitization, where the risk that digital systems exist on paper but do not change the service encounter is greatest (Heeks, 2002; Pritchett et al., 2013). An OECD review of digital-government foundations in the Portuguese-speaking African countries and Timor-Leste, which used the OECD recommendation on digital government strategies as its reference frame, illustrates the policy attention given to this group of small administrations (OECD, 2018).

3.2 The regional context: Southeast Asia and ASEAN

Southeast Asia combines some of the world's most advanced digital governments with administrations at much earlier stages. In the 2024 survey, Singapore ranked third globally, while several other Southeast Asian states improved their positions (UN DESA, 2024). The region's common policy framework is the ASEAN Digital Masterplan 2025, which lists the improvement of the quality and use of e-government services among its desired outcomes (ASEAN, 2021). Timor-Leste was admitted as the bloc's eleventh member state on 26 October 2025 (Gusmão, 2025). Membership brings access to regional cooperation on digital government and, at the same time, exposes the country's digital-government performance to regional comparison.

Empirical research on citizen evaluations of e-government in the region is growing, but it is concentrated in Indonesia and in the higher-capacity systems. Studies of Indonesian public-service websites, for example, report that perceived e-service quality significantly affects user satisfaction and that satisfaction in turn partially mediates effects on loyalty (Noor, 2022), and information-systems success models have been applied to e-government from the perspective of public employees (Rahmatullah et al., 2025). Evidence from the smallest and newest ASEAN administrations remains scarce.

3.3 The national context: Timor-Leste

Timor-Leste is a lower-middle-income country of about 1.2 million people (UN DESA, n.d.). Its public administration was rebuilt after 1999 and remains in a phase of capacity development (Goldfinch & DeRouen, 2014; Tanaka-Sakabe, 2021). Digital government has been an explicit priority: a National Policy for ICT was approved in 2017 (OECD, 2018), TIC Timor, I.P. was established in 2017 as the lead agency for digital government (TIC Timor, n.d.), the Strategic Development Plan 2011–2030 provides the long-term framework (Government of Timor-Leste, 2011), and Timor Digital 2032 sets a ten-year strategy that includes e-government service delivery, administrative efficiency, transparency and inclusion (TIC Timor, n.d.). In April 2026 the Ministry of Transport and Communications held public consultations on a Digital Transformation Strategy for 2026–2036 (TATOLI, 2026).

International benchmarks, however, show a mixed picture. As Fig. 2 illustrates, Timor-Leste's EGDI rose from 0.382 (rank 142) in 2018 to 0.465 (rank 134) in 2020, then fell to 0.437 (rank 147) in 2022 and 0.402 (rank 159 of 193) in 2024 (UN DESA, n.d.). The country ranked 120th on the E-Participation Index in 2024, compared with 81st in 2022 (UN DESA, n.d.). Against this backdrop, the DGSRN is an informative case: it delivers high-contact services that are being digitised, and its users' perceptions provide a demand-side counterpart to the supply-side benchmark.

3.4 The organizational context: the DGSRN

The DGSRN is the national directorate responsible for civil registration and notary services. Its services, which include registration of births, marriages and deaths and notarial acts, are essential for legal identity and access to other public services. The directorate has been introducing digital systems to modernize registration processes. Service encounters are frequent and procedural, digital reforms are recent and visible to citizens, and a mismatch between technology and service experience, if present, would be expected to show up in citizen perceptions.

4. Method

4.1 Design and sample

We used a cross-sectional, quantitative survey design. The target population comprised citizens who had used DGSRN services in Dili. The target sample size of 96 was derived with Cochran's (1977) formula for a large population, using $z = 1.96$, $p = 0.5$ and a $\pm 10\%$ margin of error ($n = z^2pq/e^2 = 3.8416 \times 0.25 / 0.01 \approx 96$). The final sample was $N = 96$ with no missing item responses. [Authors to complete: fieldwork dates, sampling procedure as implemented, mode of administration, questionnaire language and response rate.] Because respondents were current users of the service, the sample is likely to over-represent citizens who have successfully accessed it; we return to this selection issue in Section 6.8.

Table 1 describes the respondents. Most were women (54.2%) and held a bachelor's degree (66.7%); 62.5% were aged 26–45. Just over one-third (37.5%) were using the digital service for the first time, and 21.9% had used it more than three times.

Table 1
Sample characteristics (N = 96)

Characteristic	Category	N	%
Gender	Female	52	54.2
	Male	44	45.8
Age (years)	18–25	22	22.9
	26–35	36	37.5
	36–45	24	25.0
	46 and above	14	14.6
Education	Basic	7	7.3
	Secondary	25	26.0
	Bachelor	64	66.7
Prior use of the digital service	First time	36	37.5
	2–3 times	39	40.6
	More than 3 times	21	21.9

4.2 Measures

All constructs were measured with five items on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), and composite scores were computed as the mean of the five items. Digital innovation effectiveness (X) captured perceived usefulness, ease of use and system integration. Service quality (M) captured reliability, responsiveness and empathy. Perceived socio-political intervention (W) captured citizens' perceptions of political and organizational influence on service delivery. Citizen satisfaction (Y) captured perceived performance relative to expectations and trust in the institution. Item wording is provided in Appendix A. [Authors to insert the translated item wording and the original-language items.]

4.3 Data preparation

Data were screened before analysis. All composite scores were recomputed from the item responses because two totals in the original spreadsheet were incorrect (one total had mistakenly included the respondent identification number, and one had been mis-entered). Inconsistent age-category labels were harmonized. One respondent gave the maximum rating to all 20 items (straight-lining), and several respondents gave contradictory extreme ratings within a construct; these cases were retained in the main analysis and examined in sensitivity analyses.

4.4 Measurement quality

Item validity was assessed with corrected item–total correlations (critical $r = .20$ for $N = 96$ at $\alpha = .05$). Reliability was assessed with Cronbach's alpha (Cronbach, 1951) and composite reliability (CR). Convergent validity was assessed with the average variance extracted (AVE), and discriminant validity with the heterotrait–monotrait ratio (HTMT; Henseler et al., 2015) and the Fornell–Larcker logic (Fornell & Larcker, 1981). CR and AVE were computed from the loadings of the first principal component of each construct's items, and should therefore be read as approximations that await confirmatory factor analysis. Common-method variance was screened with Harman's single-factor test, acknowledging its well-known limitations (Podsakoff et al., 2003).

4.5 Analytical strategy

Hypotheses were tested with path models estimated by ordinary least squares on composite scores, following the regression approach to mediation (Baron & Kenny, 1986), with inference on the indirect effect based on percentile bootstrap confidence intervals rather than normal-theory tests (Preacher & Hayes, 2008; Zhao et al., 2010; Hayes, 2022). Path a regressed M on X , path b and the direct effect c' regressed Y on X and M , and the total effect c regressed Y on X ; the indirect effect is $ab = c - c'$. We estimated two specifications: Model 1 without covariates, and Model 2, which added perceived socio-political intervention (W) as a covariate to address the concern that it is correlated with both M and Y . Indirect effects were bootstrapped with 10,000 resamples of cases. Moderation of path a by W was tested with a mean-centered interaction term, and conditional indirect effects and the index of moderated mediation (Hayes, 2022) were bootstrapped.

Because the data are small-sample and perceptual, we applied several safeguards. The distributions of the model residuals and tests for heteroscedasticity (Koenker's studentised Breusch–Pagan test) were examined, and HC3 heteroscedasticity-consistent standard errors were reported (Long & Ervin, 2000). Cook's distance and standardized residuals identified influential cases, and results were re-estimated after excluding respondents 28 and 29, excluding seven influential cases (respondents 5, 6, 9, 10, 28, 29 and 32), excluding the straight-liner (respondent 14), and using rank-transformed variables. Finally, because cross-sectional mediation models are statistically equivalent to alternative causal orderings (MacKinnon, 2008), we estimated the reversed model (service quality $\rightarrow$ digital innovation $\rightarrow$ satisfaction) for comparison. A sensitivity power analysis indicated that, with $N = 96$ and three predictors, a single coefficient with an effect size of Cohen's (1988) $f^2 \approx .085$ is detectable with 80% power at $\alpha = .05$; smaller effects, including small interactions, should be interpreted cautiously. Analyses were run in Python (NumPy, SciPy); a replication script is available on request.

4.6 Ethics

This study adhered to ethical standards for research involving human participants. The research protocol and survey instruments were reviewed and approved by the institutional ethics committee (details blinded for peer review), or alternatively, formal exemption was granted given the non-invasive nature of

the survey. Informed consent was obtained from all participants prior to their inclusion in the study, and participation was entirely voluntary. The confidentiality and anonymity of all respondents were strictly protected throughout data collection, analysis, and reporting.

5. Results

5.1 Measurement quality

All 20 items met the validity criterion, with corrected item–total correlations between .36 and .77. Table 2 shows that internal consistency was good ($\alpha = .81-.87$; CR = .87–.91) and AVE exceeded .50 for every construct (.57–.66). Weakest items were the fifth service-quality item (X2.5; $r = .36$) and the first socio-political item (X3.1; $r = .38$). Table 3 reports the correlations and HTMT values. All HTMT ratios were below .85 (the highest was .70, between service quality and socio-political intervention), supporting discriminant validity, although the relatively high overlap between those two constructs ($r = .58$) warrants attention.

Harman’s test indicated that the first unroasted factor accounted for 38.4% of the variance, below the 50% threshold, and five components had eigenvalues above one. These results do not suggest that a single method factor dominates, but the test is not conclusive. An exploratory four-component solution with varimax rotation explained 65.9% of the variance; most items loaded on the intended components, but X2.5, X3.1 and X3.5 showed weaker or cross-loading patterns, in line with their lower item–total correlations. We therefore regard the measurement model as adequate for exploratory path analysis, and recommend confirmatory validation in larger samples.

Table 2
Descriptive statistics, reliability and convergent validity

Construct	Items	M	SD	Skewness	A	CR	AVE
Digital innovation effectiveness (X)	5	3.81	0.77	−1.52	.809	.867	.568
Service quality (M)	5	3.46	0.77	−0.12	.823	.879	.599
Socio-political intervention (W)	5	3.62	0.79	−0.54	.812	.876	.591
Citizen satisfaction (Y)	5	3.73	0.80	−0.87	.870	.908	.664
Note. N = 96; scale means on the 1–5 metric. CR and AVE are based on first-principal-component loadings.							

Table 3
Pearson correlations (below diagonal) and HTMT ratios (above diagonal)

X Digital innovation	X	M	W	Y
	—	.518	.534	.606
M Service quality	.408	—	.702	.698
W Socio-political intervention	.422	.582	—	.592
Y Citizen satisfaction	.508	.591	.509	—
Note. All correlations $p < .001$ (two-tailed), $N = 96$.				

5.2 Descriptive findings

Respondents evaluated all four constructs favorably (Table 2). Digital innovation effectiveness received the highest mean (3.81), with 70.2% of item responses in the “agree” or “strongly agree” categories. Service quality received the lowest mean (3.46), with only 51.7% of responses in those categories, and satisfaction was in between (3.73; 61.9%). The ordering is notable: citizens rate the digital system more highly than the service encounter, which is consistent with the idea that technology and service quality are distinct components of experience. Digital-innovation scores were negatively skewed (-1.52), indicating a ceiling effect that restricts variance. Satisfaction did not differ significantly by gender, age, education or frequency of prior use (Mann–Whitney and Kruskal–Wallis tests, all $p > .05$).

5.3 Diagnostics

Residuals from the equation for service quality were approximately normal (Shapiro–Wilk $p = .47$) and homoscedastic (Koenker $p = .07$), while residuals from the satisfaction equation departed mildly from normality ($p = .02$) and showed mild heteroscedasticity (Koenker $p = .03$). Variance inflation factors in the equation containing all three predictors ranged from 1.28 to 1.61. The most influential observations were respondents 28 and 29, who reported the lowest satisfaction (scale mean 1.2) while rating service quality or the socio-political context as moderate to high, and respondents 5, 6, 9, 10 and 32, who combined contradictory extreme ratings. These diagnostics motivated the use of bootstrap and HC3 inference and the sensitivity analyses reported below.

5.4 Mediation analysis

Model 1 (no covariates). Perceived effectiveness of digital innovation was positively related to service quality ($a = 0.41$, $SE = 0.09$, $p < .001$; $R^2 = .17$), supporting H2. Service quality was positively related to satisfaction controlling for digital innovation ($b = 0.48$, $SE = 0.09$, $p < .001$), supporting H3. The total effect of digital innovation on satisfaction was $c = 0.52$ ($SE = 0.09$, $p < .001$), supporting H1, and the direct effect remained significant ($c' = 0.33$, $SE = 0.09$, $p < .001$; R^2 of the outcome equation = .44). The indirect effect was $ab = 0.19$, with a 95% bootstrap CI of $[0.05, 0.42]$ that excluded zero, so the indirect pathway through service quality accounted for approximately 37% of the total effect, indicating partial

mediation (H4; Fig. 3). In standardized terms, the paths were $a = .41$, $b = .46$, $c' = .32$ and $c = .51$, and the indirect effect was .19. Using HC3 standard errors, paths a ($p = .009$), b ($p = .004$) and c ($p < .001$) remained significant, whereas c' did not ($p = .12$).

Model 2 (socio-political intervention as covariate). After controlling for perceived socio-political intervention, which was strongly related to service quality (0.49 , $p < .001$) and weakly to satisfaction (0.17 , $p = .09$), the a path fell to 0.20 ($SE = 0.09$, $p = .03$) while the b path remained 0.39 ($SE = 0.10$, $p < .001$), the direct effect was 0.29 ($SE = 0.09$, $p = .002$) and the total effect was 0.37 ($SE = 0.09$, $p < .001$). The indirect effect was 0.08 , 95% CI $[-0.01, 0.25]$, representing 21% of the total effect; the confidence interval narrowly included zero. With HC3 errors the a and b paths were not significant at the .05 level ($p = .12$ and $p = .07$). Thus, once the shared variance with the socio-political context is partialled out, the mediation evidence in the full sample is weaker and more tentative (Table 4).

Table 4
Path estimates for the mediation models (unstandardized coefficients, $N = 96$)

Path	Model 1: b (SE)	P	HC3 p	Model 2: b (SE)	p	HC3 p
$X \rightarrow M$ (a)	0.41 (0.09)	< .001	.009	0.20 (0.09)	.032	.119
$M \rightarrow Y$ (b)	0.48 (0.09)	< .001	.004	0.39 (0.10)	< .001	.067
$X \rightarrow Y$, direct (c')	0.33 (0.09)	< .001	.116	0.29 (0.09)	.002	.212
$X \rightarrow Y$, total (c)	0.52 (0.09)	< .001	< .001	0.37 (0.09)	< .001	.035
$W \rightarrow M$	—	—	—	0.49 (0.09)	< .001	< .001
$W \rightarrow Y$	—	—	—	0.17 (0.10)	.086	.315
Indirect effect (ab)	0.19	95% CI [0.05, 0.42]		0.08	95% CI [- 0.01, 0.25]	
Proportion mediated	.37			.21		
R^2 (M; Y)	.17; .44			.37; .45		
Note. Model 1 includes no covariates; Model 2 adds socio-political intervention (W) as a covariate. Indirect-effect confidence intervals are percentile bootstrap intervals (10,000 resamples). Variables are scale means (1–5).						

5.5 Sensitivity analyses

Table 5 and Fig. 4 show how the indirect effect behaves across specifications. In Model 1, the indirect effect was positive with a CI excluding zero in all specifications and was larger when influential cases were removed (0.28 and 0.29), at which point the direct effect shrank ($c' = 0.20$ and 0.22 , $p = .03$ and $.01$). In Model 2, the CI of the indirect effect excluded zero when respondents 28 and 29 were excluded (0.10 , 95% CI $[0.01, 0.22]$), when seven influential cases were excluded (0.06 , $[0.003, 0.12]$) and with rank-

transformed variables (0.09, [0.006, 0.20]), but included zero in the full sample and when only the straight-liner was removed. In three of the four sensitivity specifications the direct effect was no longer significant, suggesting that in cleaner data the effect of digital innovation operates largely through service quality. In summary, the direction of the indirect effect was consistent in every specification, its size was modest and sensitive to a small number of respondents, and the conclusion of mediation is robust in Model 1 and conditionally supported in Model 2.

Table 5
Sensitivity of the mediation results

Specification	n	a	B	c' (p)	c	Indirect effect [95% CI]
Model 1 (no covariate)						
Full sample	96	0.41	0.48	0.33 (< .001)	0.52	0.19 [0.05, 0.42]
Excluding cases 28, 29	94	0.54	0.52	0.20 (.026)	0.48	0.28 [0.16, 0.40]
Excluding 7 influential cases	89	0.56	0.52	0.22 (.015)	0.50	0.29 [0.16, 0.41]
Model 2 (X3 covariate)						
Full sample	96	0.20	0.39	0.29 (.002)	0.37	0.08 [- 0.01, 0.25]
Excluding cases 28, 29	94	0.30	0.35	0.12 (.158)	0.23	0.10 [0.01, 0.22]
Excluding 7 influential cases	89	0.24	0.25	0.11 (.166)	0.17	0.06 [0.003, 0.12]
Excluding straight-liner	95	0.19	0.39	0.29 (.002)	0.36	0.07 [- 0.01, 0.24]
Rank-transformed variables	96	0.25	0.34	0.07 (.454)	0.15	0.09 [0.006, 0.20]
Note. Coefficients are unstandardized; those for the rank-transformed specification are on the rank metric. Confidence intervals are percentile bootstrap intervals (5,000 resamples, except 10,000 for the full-sample specifications).						

The reversed model (service quality → digital innovation → satisfaction, controlling for W) produced an indirect effect of 0.07, 95% CI [- 0.02, 0.16], similar in magnitude to the forward Model 2 estimate, with a significant direct effect of service quality on satisfaction (0.39, $p < .001$). As expected for cross-sectional data, the models are statistically equivalent in fit, and the data cannot adjudicate the causal ordering. The forward ordering is justified on theoretical grounds (Section 2.3) rather than on the data.

5.6 Moderation by socio-political intervention

The interaction between digital innovation and socio-political intervention in predicting service quality was not significant ($b = 0.05$, $SE = 0.08$, $t(92) = 0.61$, $p = .54$; $HC3\ p = .72$; $\Delta R^2 = .003$). Conditional effects of digital innovation on service quality were 0.18 ($SE = 0.10$, $p = .07$) at one standard deviation below the

mean of W, 0.22 (SE = 0.10, $p = .03$) at the mean and 0.25 (SE = 0.13, $p = .05$) one standard deviation above. The conditional indirect effects were 0.07 [– 0.03, 0.24], 0.08 [– 0.005, 0.30] and 0.10 [– 0.01, 0.38], respectively, and the index of moderated mediation was 0.02, 95% CI [– 0.05, 0.16]. Moderation of path b (interaction = – 0.07, $p = .42$) and of the direct effect (0.004, $p = .96$) was also non-significant. H5 was therefore not supported. Given the minimum detectable effect size ($f^2 \approx .085$), the study could not rule out small moderation effects.

5.7 Summary of hypothesis tests

Table 6
Summary of hypothesis tests

Hypothesis	Evidence	Conclusion
H1: $X \rightarrow Y$ (total effect)	$c = 0.52, p < .001$ (Model 1); $c = 0.37, p < .001$ (Model 2); positive in all specifications	Supported
H2: $X \rightarrow M$	$a = 0.41, p < .001$ (Model 1); $0.20, p = .03$ (Model 2); robust to exclusions	Supported
H3: $M \rightarrow Y$	$b = 0.48$ and $0.39, p < .001$; borderline under HC3 in Model 2	Supported
H4: M mediates $X \rightarrow Y$	Model 1: CI excludes zero; Model 2: CI includes zero in the full sample, excludes zero in 3 of 4 sensitivity specifications	Partially / conditionally supported
H5: W moderates path a	$b = 0.05, p = .54$; index = $0.02 [-0.05, 0.16]$	Not supported

6. Discussion

6.1 Main findings

This study asked whether the perceived effectiveness of digital innovation is related to citizen satisfaction through service quality, and whether the perceived socio-political context conditions that pathway. Three findings stand out. First, perceived digital-innovation effectiveness was positively associated with satisfaction, but a substantial share of this association, roughly 37% in the parsimonious model, was transmitted through perceived service quality. Second, service quality was the most consistent correlate of satisfaction across specifications, and its association remained significant when digital innovation was controlled. Third, we found no evidence that perceived socio-political intervention changes the strength of the pathway, although the construct itself overlapped considerably with service quality.

6.2 Theoretical implications

The results support a view of digital government in which technology is an enabler rather than an end. They are consistent with the expectancy–disconfirmation logic: citizens’ satisfaction depends on their

perception of the service they receive (Van Ryzin, 2004, 2006), and digital tools matter to the extent that they alter that perception. The mediation pattern parallels the e-government literature that links electronic service experiences to satisfaction and trust (Welch et al., 2005; Morgeson et al., 2011), but it shifts attention to the intermediate construct of service quality, which has been emphasized in service-quality theory (Parasuraman et al., 1988, 2005; Zeithaml et al., 2002) but less often modelled explicitly in public-sector digitalization studies.

The comparatively high rating of digital innovation (3.81) versus service quality (3.46) suggests a decoupling between the technical system and the service encounter. Citizens appear to appreciate the digital tools, yet their satisfaction is more closely tied to how they are served. Where digital innovation is evaluated favorably but does not translate fully into the encounter, the direct association with satisfaction may reflect other channels, for example convenience, a sense of modernity or perceived fairness, which our data cannot separate. The weak and unstable direct effect in the cleaner samples is consistent with the interpretation that these other channels are less important than service quality, but it should not be over-read given the sample size.

The null moderation result is informative. Despite arguments that politics and organizational culture condition reform outcomes (Fountain, 2001; Heeks, 2002), perceived socio-political intervention did not alter the digital-innovation–service-quality relation. One interpretation is that citizens' experience of digital services is relatively insulated from the perceived political environment because transactions are procedural and routine. Another is that the high correlation between the socio-political construct and service quality ($r = .58$; HTMT = .70) means that the construct partly captures service experience itself, which weakens its ability to act as an independent boundary condition. The reduction of the indirect effect when the construct was added as a covariate is consistent with that overlap, and highlights the need for better measurement of political and organizational influence in this setting.

6.3 The global perspective

At the global level, the findings suggest that mechanisms established in high-income settings travel to a small, low-income and post-conflict administration. Service quality is the proximate driver of satisfaction in expectancy–disconfirmation research on local and federal services (Van Ryzin, 2004, 2006; Morgeson, 2013), and the mediated pattern found here is consistent with the claim of digital-era governance that digitization improves responsiveness (Dunleavy et al., 2006), provided that the improvement is experienced in the encounter.

The results also speak to the development-administration literature. The warning that states may adopt the forms of modern administration without its functions (Pritchett et al., 2013; Andrews et al., 2017), and the design–reality gaps documented in developing-country e-government (Heeks, 2002), predict that citizens will reward visible functional improvement more than the mere presence of a system. The finding that satisfaction tracks service quality more consistently than digital effectiveness is compatible with this prediction, although a single survey cannot test it directly. It also complements supply-side benchmarks such as the EGDI (UN DESA, 2024): readiness indicators describe what a government

offers, whereas satisfaction surveys describe whether the offer becomes experience. We therefore propose:

Proposition 1

(digital–service decoupling). In early-stage digital governments, perceived digital effectiveness is higher and more homogeneous than perceived service quality, and citizen satisfaction is more strongly associated with the latter, so that digital effects on satisfaction operate largely through service quality.

Proposition 1

can be tested in comparative designs that measure the same constructs in agencies at different stages of digitization. The present data are consistent with it in one case, but cannot establish it.

6.4 The regional perspective: Southeast Asia and ASEAN

Regionally, the evidence base and the policy framework both point in the same direction as our results. Studies from Indonesia, the largest ASEAN system, report that perceived e-service quality significantly affects user satisfaction with public-service websites (Noor, 2022), and information-systems success models that include service quality and user satisfaction have been applied to Indonesian e-government (Rahmatullah et al., 2025). The constructs, samples and methods differ from ours, so these studies are not direct replications, but they share the view that service quality is a central determinant of satisfaction with digital government and that satisfaction is shaped by a chain of perceptions rather than by technology alone. Our citizen-side evidence complements employee-side evidence such as that of Rahmatullah et al. (2025), and the DGSRN would be a natural site for combining both perspectives.

The ASEAN Digital Masterplan 2025 lists the improvement of the quality and use of e-government services among its desired outcomes (ASEAN, 2021). Our findings suggest that quality and use should be monitored together with citizen-perceived service quality, because use alone may not translate into satisfaction when the service encounter is weak. This is particularly relevant for Timor-Leste, which became ASEAN's eleventh member on 26 October 2025 (Gusmão, 2025) and whose EGDI position fell from 147th to 159th between 2022 and 2024, while several other Southeast Asian states improved theirs (UN DESA, 2024, n.d.). Peer learning within ASEAN could therefore usefully focus on service-delivery practices (service charters, front-office training, case-tracking), not only on platforms and infrastructure. Regional heterogeneity also warrants caution in generalizing: systems with high digital maturity may show different mechanisms, for example more homogeneous quality perceptions, and our data from one directorate in one city cannot speak to rural–urban differences within Timor-Leste or to differences between ASEAN members.

6.5 The national perspective: Timor-Leste

Nationally, the results provide micro-level evidence relevant to the implementation of Timor Digital 2032 and the forthcoming Digital Transformation Strategy 2026–2036 (TIC Timor, n.d.; TATOLI, 2026). Timor

Digital 2032 emphasizes e-government service delivery, administrative efficiency, transparency and inclusion, and the draft 2026–2036 strategy aims, among other things, to strengthen governance and to build a secure and inclusive digital environment. Our findings indicate that the realization of these goals at the point of citizen contact depends on the quality of service delivery: citizens at the DGSRN rate the digital system highly (3.81) but give lower ratings to the service encounter (3.46), and it is the latter that is most consistently associated with satisfaction. Strategy monitoring that relies only on supply-side outputs, such as the number of services online, would therefore not capture whether digitization is improving citizens' experience.

The juxtaposition with the national benchmark trajectory requires care. Timor-Leste's EGDI declined between 2020 and 2024 (Fig. 2), while the DGSRN users we surveyed evaluated digital innovation favorably. The two are not contradictory. The EGDI is a national supply-side composite and our data are perceptions of one agency's users, who are by construction the citizens who have accessed the service and may therefore be more positive than non-users. The contrast does suggest that agency-level progress and national benchmarks can diverge, and that national monitoring would benefit from user-experience data from flagship agencies such as the DGSRN.

At the institutional level, the findings are relevant to the capacity-building agenda for the Timorese civil service (Goldfinch & DeRouen, 2014). Because service quality is the stronger correlate of satisfaction, investments in staff responsiveness, standard operating procedures and complaint handling are likely to complement digital investment. The null moderation result suggests that, in the eyes of DGSRN users, the perceived socio-political environment did not alter how digital innovation relates to service quality. That is reassuring but should not be taken as evidence that politics is irrelevant to reform: the measure was perceptual, it overlapped with service quality, and the study was underpowered for small interactions. Finally, because the satisfaction construct includes trust in the institution, and TIC Timor reports having drafted data-protection, cybercrime and cyber-security instruments (TIC Timor, n.d.), future work should examine whether digital registration affects trust through perceptions of data security and legal safeguards.

6.6 Multi-level synthesis

Table 7 summarizes how the findings relate to the global, regional, national and organizational levels, and what each implies for policy and research.

Table 7
Synthesis of the findings across levels

Level	Context	What the findings add	Implication
Global	UN EGDI benchmarks measure supply-side digital readiness (UN DESA, 2024); development-administration research warns of form without function (Pritchett et al., 2013)	Satisfaction is most consistently associated with perceived service quality, and about 37% of the digital-innovation association operates through it	Complement readiness indices with citizen-experience measures; test the digital-service decoupling proposition comparatively
Regional (Southeast Asia, ASEAN)	ASEAN Digital Masterplan 2025 targets the quality and use of e-government (ASEAN, 2021); Timor-Leste joined ASEAN in October 2025; Indonesian studies link e-service quality to satisfaction (Noor, 2022)	First citizen-side evidence from the newest ASEAN member; consistent with the centrality of service quality	Use ASEAN peer learning on service-delivery practices as well as platforms; extend to rural and cross-country comparisons
National (Timor-Leste)	Timor Digital 2032 and the 2026–2036 strategy under consultation; EGDI rank 159 in 2024 (TIC Timor, n.d.; TATOLI, 2026; UN DESA, n.d.)	Digital system rated highest (3.81), service encounter lowest (3.46) among DGSRN users	Embed periodic satisfaction and service-quality tracking in national strategy monitoring
Organizational (DGSRN)	Frequent, procedural civil-registry and notary encounters; recent digital rollout	Service quality had the strongest and most robust association with satisfaction	Priorities responsiveness, reliability and empathy in the front office and in case follow-up
Note. The table summarizes interpretive links; the survey itself covers one agency in one city.			

6.7 Practical implications for the DGSRN

For managers of the DGSRN and similar agencies, the findings suggest that investment in digital platforms should be accompanied by investment in the quality of the service encounter. Service quality received the lowest ratings, with only about half of the responses positive, and it was the strongest correlate of satisfaction. Priorities could include staff training in responsiveness and empathy, clear service standards and feedback channels, reliable follow-up on cases submitted online, and attention to the weakest items of the service-quality scale. Because digital innovation was already evaluated favorably, additional technical features are unlikely to produce large gains unless they visibly improve reliability and responsiveness. Monitoring should combine perception surveys with administrative indicators such as processing time and error rates, which we could not observe.

6.8 Limitations and future research

Several limitations qualify the conclusions. First, the cross-sectional design supports associations, not causal claims, and the reversed model fits equally well. Second, the sample is small, drawn from a single directorate in one city, and the confidence intervals of the indirect effect are wide, so the estimates should be treated as exploratory and not generalized to other agencies, countries or ASEAN members. Third, respondents were current users of the service, which raises the possibility of selection toward positive evaluations, and all variables are self-reported perceptions collected in the same survey, so common-method bias cannot be excluded despite favorable Harman results; ceiling effects were present for digital innovation. Fourth, composite scores and an exploratory factor structure were used instead of a latent-variable model, and three items (X2.5, X3.1, X3.5) behaved less well than the others, so the measurement model needs confirmatory testing in a larger sample. Fifth, the main findings depend partly on a handful of influential respondents, which is why we report sensitivity analyses; future work should pre-register exclusion rules and use independent samples. Sixth, we did not observe objective service-performance data, rural–urban differences or the views of staff, and the global, regional and national interpretations in Sections 6.3–6.5 are interpretive links to secondary evidence rather than tests.

Future research could use longitudinal or panel designs around the introduction of digital features, combine perception data with administrative records (waiting time, error rates), test latent-variable mediation with partial least squares or covariance-based structural equation modelling in larger multi-site samples, and examine rural–urban digital divides. Cross-national designs across ASEAN members at different stages of digitization could test Proposition 1 directly, and mixed methods could explain why citizens rate technology above service.

7. Conclusion

In a post-conflict, early-digitizing public administration, citizens who perceive digital innovation as effective are more satisfied with public services, and a substantial portion of this association appears to run through the perceived quality of service. The mediation evidence is consistent in direction across specifications, but its size is modest and sensitive to a small number of respondents, and perceived socio-political intervention did not moderate the pathway. The findings carry a common message at several levels: globally, supply-side readiness indices should be complemented by citizen-experience measures; regionally, ASEAN's emphasis on the quality and use of e-government is best served by attention to service delivery; nationally, Timor-Leste's digital strategies should track whether digitization improves the service encounter; and organizationally, the DGSRN should pair its digital systems with investment in responsive, reliable and empathetic service. For scholars, the study demonstrates how to report small-sample mediation analysis with transparent sensitivity checks, and it offers a proposition on digital–service decoupling for comparative testing.

Declarations

- **Ethics approval and consent:** The research protocol and survey instruments received institutional ethics approval (details blinded for peer review), or formal exemption was granted given the non-

invasive nature of the survey. Informed consent was obtained from all individual participants included in the study.

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- **Competing interests:** The authors have no relevant financial or non-financial interests to disclose.
- **Data availability:** The anonymized dataset and analysis script are available from the corresponding author on reasonable request.

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Figures

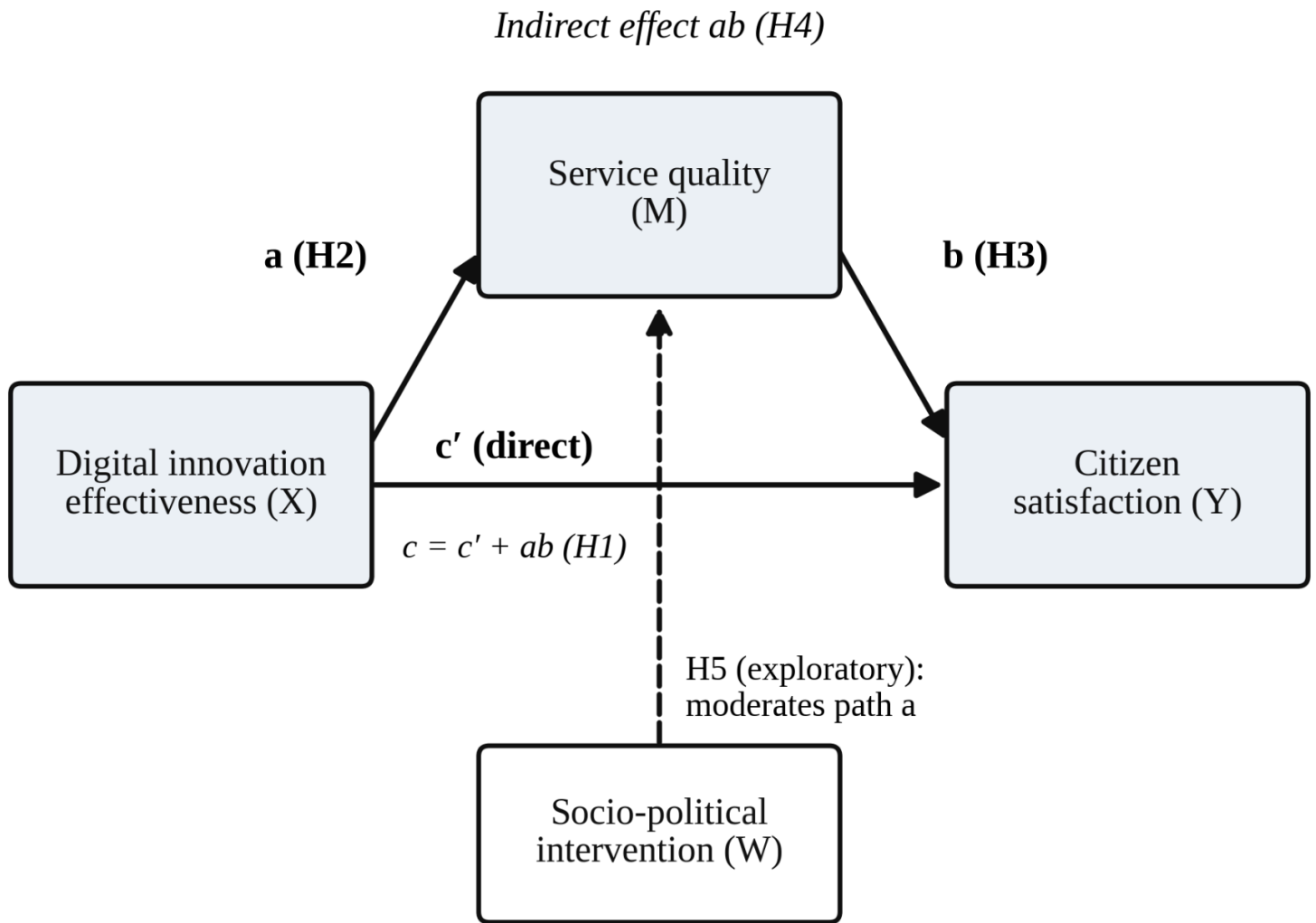


Figure 1

Conceptual model.

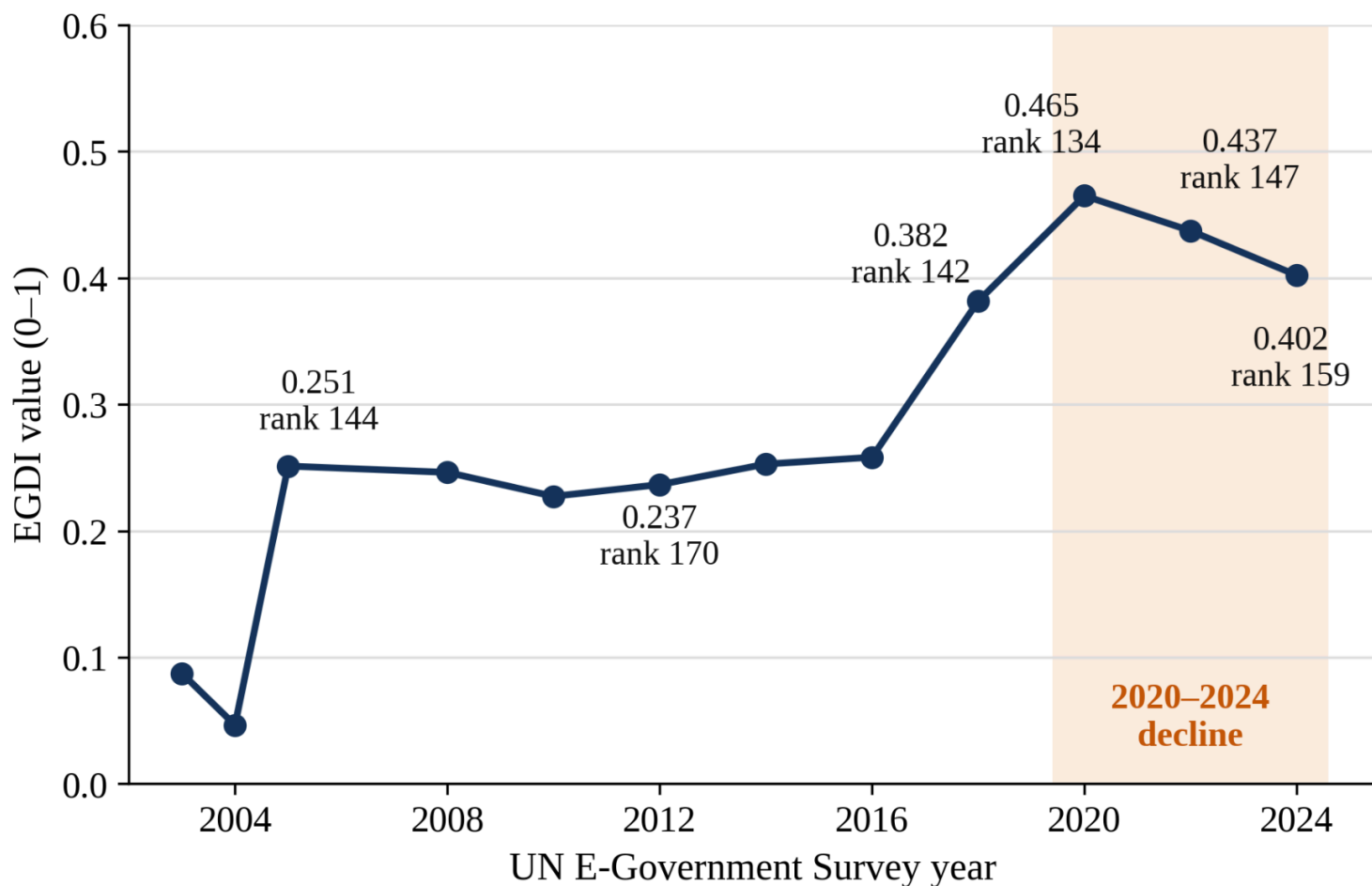
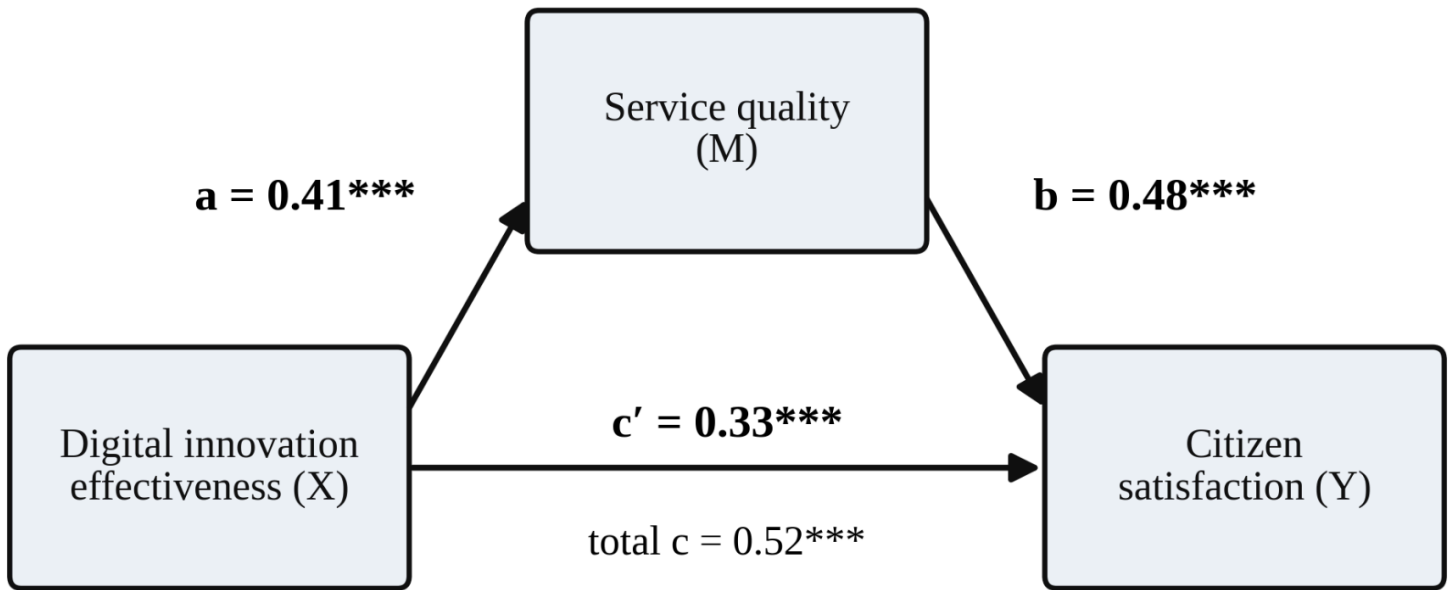


Figure 2

Timor-Leste's E-Government Development Index, 2003–2024. Source: UN DESA E-Government Knowledgebase (country data).

Indirect effect $ab = 0.19$, 95% CI [0.05, 0.42]



*Unstandardised coefficients; scale means (1–5); $N = 96$;
10,000 bootstrap resamples. *** $p < .001$*

Figure 3

Estimated mediation model (Model 1).

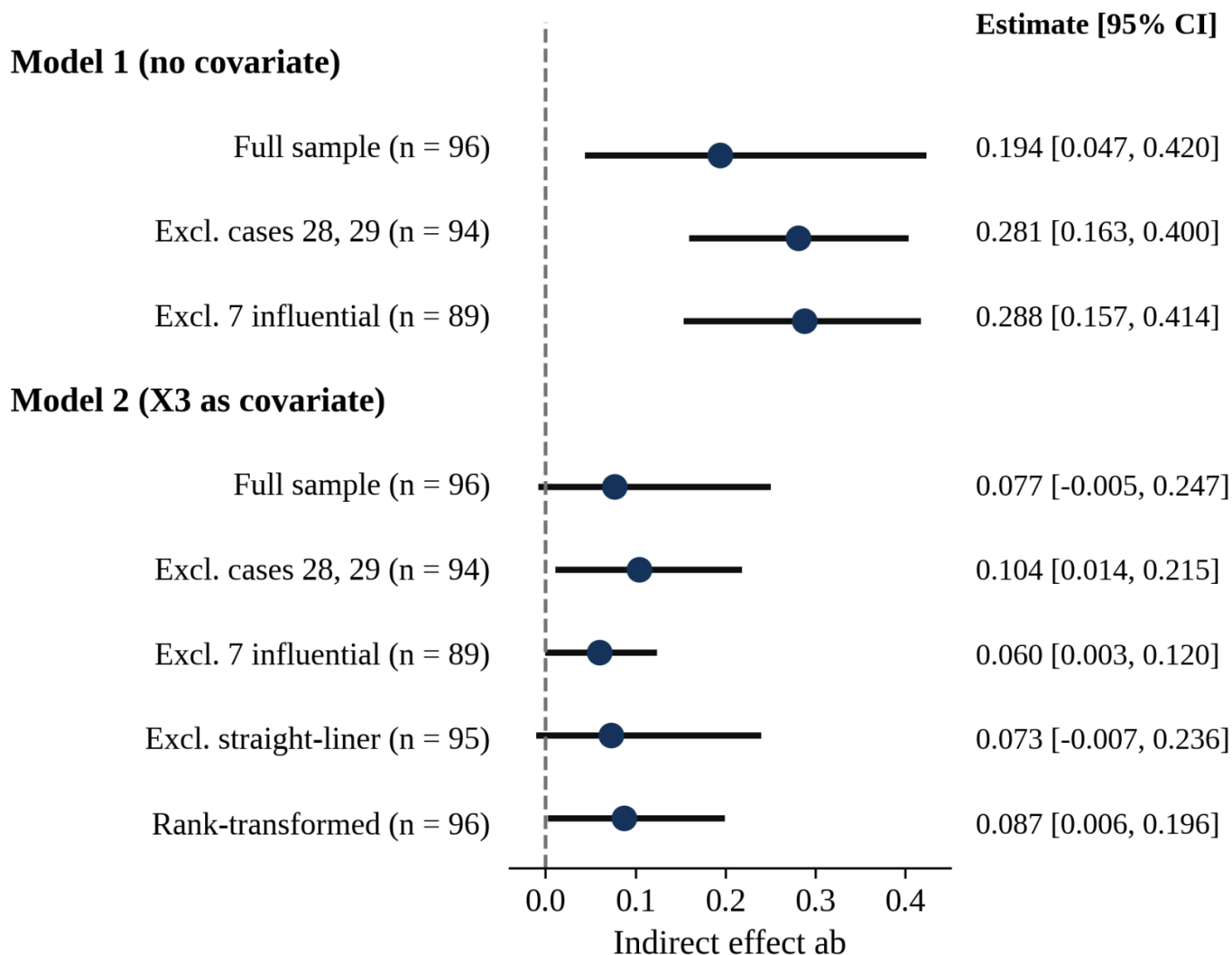


Figure 4

Indirect effects (ab) across specifications with 95% bootstrap confidence intervals.