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# Operationalizing Substantive Representation through Digital Performance Criteria for Local Accountability

**Makhsad Isabayev Bakhodirovich**
Associate Professor, Researcher at the Institute for the Study of Youth Problems and Training Prospective Personnel under Youth Affairs Agency of the Republic of Uzbekistan, Doctor of Philosophy in Political Science (PhD),
E-mail: Maksfind_22@mail.ru, +998944229925

**ABSTRACT**
This study examines how deputies' digital practices affect substantive representation at the local level. Using panel data from 55 deputies (2020-2025), citizen surveys, and expert interviews, it tests Digital Performance Criteria. Results show digital performance strongly predicts representation, with responsiveness most influential and transparency acting as a key mediating factor.

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digital governance; substantive representation; digital performance criteria; local accountability; democracy.

**Маҳаллий ҳисобдорликни таъминлашда рақамли самарадорлик мезонлари орқали самарали вакилликни операционаллаштириш**

**Мақсад Исабаев Баходирович**
*Ўзбекистон Республикаси Ёшлар ишлари агентлиги ҳузуридаги Ёшлар муаммоларини ўрганиш ва истиқболли кадрларни тайёрлаш институти тадқиқотчиси, сиёсий фанлар бўйича фалсафа доктори (PhD), доцент*

**Аннотация:** *Мазкур тадқиқот маҳаллий даражада депутатларнинг рақамли амалиётлари мазмунли вакилликка қандай таъсир кўрсатишини ўрганади. 2020-2025 йилларда 55 нафар депутат бўйича панел маълумотлари, фуқаролар сўровлари ва эксперт интервюларига асосланиб, "рақамли самарадорлик мезонлари" синовдан ўтказилди. Натижалар рақамли самарадорлик мазмунли вакилликни кучли даражада белгилашини, бунда жавобгарлик энг муҳим омил эканини, шаффофлик эса воситачи механизм сифатида хизмат қилишини кўрсатди.*

**Калит сўзлар:** *рақамли бошқарув, мазмунли вакиллик, рақамли самарадорлик мезонлари, маҳаллий ҳисобдорлик, демократия.*

**Операционализация содержательного представительства через критерии цифровой эффективности для обеспечения подотчётности на местном уровне**

**Максад Исабаев Баходирович**
*Исследователь Института изучения проблем молодежи и подготовки перспективных кадров при Агентстве по делам молодежи Республики Узбекистан, доктор философии (PhD) по политическим наукам, доцент*

**Аннотация**: *В данном исследовании анализируется влияние цифровых практик депутатов на содержательное представительство на местном уровне. На основе панельных данных по 55 депутатам за 2020–2025 годы, опросов граждан и экспертных интервью проведено эмпирическое*

*тестирование критериев цифровой эффективности. Результаты показывают, что цифровая эффективность является значимым предиктором содержательного представительства, при этом наибольшее влияние оказывает отзывчивость, а прозрачность выступает в качестве важного посреднического механизма.*
**Ключевые слова**: *цифровое управление, содержательное представительство, критерии цифровой эффективности, местная подотчётность, демократия.*

## Introduction

Digital transformation is reshaping governance and elevating expectations for transparency, accountability, and responsiveness (Dunleavy et al., 2006). While national administrations have widely adopted digital systems to streamline services and expand public engagement (Lindgren & van Veenstra, 2018), the implications for local representative institutions remain theoretically underdeveloped and empirically understudied (Mellouli et al., 2014). In emerging democracies such as Uzbekistan – where decentralization reforms have expanded the authority and visibility of local Kengash deputies (Schedler, 2006; Bernhard et al., 2020) – understanding how digital performance shapes substantive representation has become increasingly salient as citizens demand immediate, data-backed, and publicly verifiable action from elected officials (Welp & Wheatley, 2022; Vaccari & Valeriani, 2021).

Classic theories frame representation as accountability-based interaction, but they were developed in pre-digital, offline contexts (Pitkin, 1972; Wayne et al., 2010). et these frameworks emerged in contexts defined by slow, asymmetrical, and offline communication. Digitalization reshapes representative interaction and generates observable behavioral data for systematic performance assessment (Dunleavy et al., 2006). This shift requires revisiting substantive representation in settings where citizens increasingly expect immediate, transparent, and evidence-based engagement (Lavi et al., 2024; Vaccari & Valeriani, 2021).

Although research on parliamentary digital adaptation, mediatisation, and digital participation is expanding (Leston-Bandeira & Siefken, 2023; Serra-Silva, 2022; Noviawati et al., 2025; Welp & Wheatley, 2022), local representative institutions remain understudied. Few models link digital behavior directly to representative outcomes, and decentralization research has focused more on institutional design than on behavioral mechanisms of effective representation.

This article introduces and validates the Digital Performance Criteria (DPC), which links observable digital actions to substantive representation (Dunleavy et al., 2006; Leston-Bandeira & Siefken, 2023).

Empirically, the study draws on a mixed-methods dataset consisting of a representative citizen survey (n = 350), structured assessments of 55 deputies' digital performance, and interviews with 17 decentralization and public administration experts. A panel-data design with fixed-effects and mediation analysis identifies causal pathways while addressing endogeneity. Findings show that the DPC Index strongly predicts substantive representation, with responsiveness emerging as the most influential component and transparency serving as a significant mediating mechanism (Baron & Kenny, 1986; Sobel, 1982; Mechkova et al., 2019; Neihouser & Ouellet, 2024).

Overall, the study advances representation theory by providing a digital-era operationalization of substantive representation suitable for decentralized and hybrid governance contexts. It also introduces a scalable performance measurement tool and offers practical insights for strengthening local accountability, transparency, and democratic functioning in transitioning governance systems (Mechkova et al., 2019; Christensen et al., 2020; Dunleavy et al., 2006).

## Theoretical framework

Rethinking Substantive Representation in the Digital Era

Political representation is a core concept in democratic theory, traditionally understood as a performed relationship grounded in accountability, justification, and responsiveness rather than mere formal delegation (Pitkin, 1972). Subsequent scholarship expanded these foundations. For example, (Wayne et al., 2010), proposed a multidimensional view of representation – anticipatory, gyroscopic, surrogate, and promissory – highlighting the differing logics through which representatives interpret citizen interests.

However, these classical frameworks emerged in an era of limited, delayed, and asymmetrical communication. Digital technologies now reshape the micro-foundations of representation by creating expectations of visibility, evidence-based justification, and instantaneous response. Parliaments increasingly operate under a "public engagement mandate," where online activity constitutes part of their institutional legitimacy (Leston-

Bandeira & Siefken, 2023), and research on mediatization shows that digital platforms shape how representatives construct public personas and political authority (Neihouser & Ouellet, 2024).

Yet this scholarship remains centered on national legislatures, leaving local representative institutions comparatively under-theorized. This gap is particularly relevant in transitioning political systems such as Uzbekistan, where decentralization reforms have expanded the roles and responsibilities of local Kengash deputies. In such contexts, digital behavior may not simply complement representation but function as one of its central mechanisms, shaping how accountability and responsiveness are enacted in everyday governance.

Digital Performance as a Mechanism of Local Accountability

Digitalization broadens the channels through which representatives communicate, justify decisions, and address citizen concerns. Increasingly, scholars treat digital activity as political performance that produces observable behavioral traces – such as transparent decision posting, evidence-based justification, and timely responses to public inquiries – which serve as powerful indicators of democratic accountability (Stier, 2020; Vaccari & Valeriani, 2021; Mechkova et al., 2019).

Public administration research typically examines digital performance through concepts of openness, digital responsiveness, and participatory platforms (Welp & Wheatley, 2022; Noviawati et al., 2025). Yet theoretical perspectives remain fragmented: some view digital governance as structural transformation, others as administrative coordination, and still others argue that ICT tools are used selectively, emphasizing information disclosure over meaningful engagement (Dunleavy et al., 2006; Christensen et al., 2020; Serra-Silva, 2022).

Despite these insights, scholarship lacks a unified, behavior-based model explaining how specific digital actions translate into substantive representation – particularly in subnational governance, where deputies' online behavior strongly shapes public perceptions of openness and accountability.

The DPC addresses this gap by conceptualizing digital activity as a structured set of representative practices that operationalize substantive representation. Rather than treating online visibility as a superficial output, DPC frames digital actions as normatively grounded mechanisms linking everyday representative behavior to democratic legitimacy.

Dimensions of the Digital Performance Criteria (DPC)

The DPC model extends public administration and political communication scholarship by integrating four behavioral dimensions that collectively operationalize substantive representation.

(1) Transparency

Transparency refers to timely, accurate disclosure that enables citizens to monitor representative activity. While long recognized as a cornerstone of accountability (Mechkova et al., 2019), digital platforms broaden this function by providing real-time access to decisions, budgets, meeting records, and policy justifications. Such visibility reduces information asymmetry and limits opportunities for opaque governance.

(2) Responsiveness

Responsiveness – one of the central behavioral markers of substantive representation (Pitkin, 1972) – acquires heightened importance in digital environments. Deputies are now expected to respond to emails, social-media messages, online consultations, and feedback mechanisms. Empirical research consistently identifies responsiveness as the strongest predictor of perceived representative legitimacy, particularly in local settings where citizens expect rapid, practical solutions.

(3) Citizen Engagement

Digital engagement involves two-way interaction, including soliciting public input, enabling participatory processes, and integrating citizen feedback into decision-making (Noviawati et al., 2025; Serra-Silva, 2022). Comparative studies show that while many parliaments employ ICT for information-sharing, far fewer use digital tools to facilitate substantive participation. In decentralized systems, engagement can reshape policymaking by incorporating local knowledge and enhancing vertical accountability.

(4) Evidence-Based Decision-making

Digital governance expands access to administrative data, analytical tools, and citizen input. Policymakers increasingly justify policy choices with empirical evidence rather than rhetoric (Welp & Wheatley, 2022). At the local level, data-driven decision-making improves resource allocation, service delivery, and responsiveness to community needs.

Together, these four dimensions form a cohesive framework that captures the behavioral, communicative, and procedural components of digital-era representational performance.

Theoretical Expectations: Digital Performance as a Driver of Substantive Representation

Building on prior research, the DPC model advances three core expectations.

First, digital performance strengthens substantive representation, as transparency, responsiveness, and engagement help representatives articulate citizen interests and justify decisions (Pitkin, 1972; Wayne et al., 2010).

Second, responsiveness constitutes the strongest determinant of perceived representation, since citizens value timely and concrete action (Stier, 2020).

Third, transparency mediates the influence of digital performance by reducing information asymmetry and enabling real-time monitoring (Mechkova et al., 2019; Christensen et al., 2020). Together, these expectations provide the conceptual basis for the empirical analysis.

The model rests on a sequential logic: Digitalization → Four Components of DPC → Substantive Representation → Enhanced Accountability. Expanding digital infrastructure generates observable performance indicators—transparency, responsiveness, citizen engagement, and evidence-based decision-making—that collectively improve substantive representation. Stronger representation, in turn, reinforces accountability through citizen monitoring and evaluation.

This logic draws on four theoretical traditions. Representation theory highlights responsiveness and justification as core behavioral elements (Pitkin, 1972; Wayne et al., 2010). Digital governance scholarship emphasizes the transformative role of ICT in promoting transparency and administrative performance (Christensen et al., 2020; Dunleavy et al., 2006). Mediatization research shows how digital environments reshape visibility and communication strategies of elected officials (Neihouser & Ouellet, 2024). Multi-level governance theory explains how local accountability emerges within evolving subnational arrangements (Zaznaev, 2024). Each tradition underpins elements of the DPC framework and clarifies how digital behavior enhances representational quality (Table 1).

These global theoretical perspectives intersect with the institutional realities of transitioning systems such as Uzbekistan. Digital transparency has expanded rapidly through national e-government reforms; participation mechanisms remain weakly institutionalized, prompting citizens to rely on informal channels; data-driven policymaking is developing gradually; and accountability increasingly emerges through unstructured online monitoring.

The DPC model incorporates these dynamics by transforming fragmented digital interactions into coherent indicators of representative performance. By integrating international theory with context-specific institutional conditions, the framework offers a rigorous and adaptable tool for evaluating local representation in a system shaped by centralized legacies and accelerating reforms.

Hypotheses

Building on the preceding theoretical discussion, this study formulates testable hypotheses linking digital performance to substantive representation in local governance. The DPC framework posits that the four dimensions of digital behavior – transparency, responsiveness, citizen engagement, and evidence-based decision-making – should enhance deputies' capacity to articulate, justify, and act on citizen interests.

Classical theories emphasize that responsiveness and justification constitute the behavioural core of substantive representation (Pitkin, 1972; Wayne et al., 2010). Digital governance research further shows that online activity enhances perceived legitimacy and trust by making representative behaviour more visible and measurable (Stier, 2020). Taken together, this literature suggests that stronger digital performance should be positively associated with higher levels of substantive representation.

*H1. Higher levels of digital performance (DPC) are associated with greater substantive representation among local deputies.*

A substantial body of research shows that digital transformation expands the behavioural channels through which representatives perform accountability, justification, and responsiveness – core elements of substantive representation. Classical theorists argue that representation becomes meaningful only when elected officials actively interpret and advance citizen interests (Pitkin, 1972; Wayne et al., 2010). Digital governance scholarship adds that online platforms enhance these behaviours by increasing visibility, measurability, and interaction (Christensen et al., 2020; Dunleavy et al., 2006). Digital performance improves transparency, accelerates communication, and strengthens public oversight, which are particularly consequential in local governance contexts where proximity to constituents raises expectations for timely responses. Therefore, higher levels of digital performance should translate into stronger substantive representation.

*H2. Among the DPC components, digital responsiveness will have the strongest positive effect on substantive representation.*

Responsiveness holds a uniquely central role within digital performance because it represents the behavioural core of substantive representation (Pitkin, 1972; Wayne et al., 2010). Empirical studies show that timely and meaningful digital replies are the strongest predictors of citizens' trust and perceived representative effectiveness (Stier, 2020; Vaccari & Valeriani, 2021). By lowering communication barriers and enabling immediate feedback, digital responsiveness signals attentiveness to public needs. In contexts with limited formal participation channels, such as Uzbekistan, it often becomes the primary indicator through which citizens assess their deputies. Therefore, responsiveness is expected to have the strongest positive effect among all DPC components.

*H3. Transparency mediates the relationship between digital performance and substantive representation.*

Transparency is widely viewed as a core mechanism linking representative behaviour to citizen trust and accountability. By reducing information asymmetry, transparency allows citizens to monitor deputies and assess policy decisions more accurately (Mechkova et al., 2019). Digital transparency strengthens this function by offering real-time access to decisions, reports, and justifications, enabling citizens to evaluate the quality and consistency of representative actions (Christensen et al., 2020). As a mediating factor, transparency provides the informational context through which citizens interpret digital behaviours such as responsiveness, engagement, and data-based decision-making. In transitioning governance systems with weaker formal accountability structures, this role becomes even more critical. Thus, transparency is expected to mediate the relationship between digital performance and substantive representation.

*H4. Citizen engagement is positively associated with substantive representation.*

Citizen engagement – through consultations, participatory platforms, and digital feedback mechanisms – is widely seen as enhancing democratic representation by integrating diverse local preferences into decision-making. Participatory governance research shows that soliciting citizen input strengthens expectations of accountability and increases pressure on representatives to justify and adjust their actions (Welp & Wheatley, 2022). Digital participation studies likewise demonstrate that online engagement broadens the informational basis of policymaking, particularly where formal participation channels are weak or inaccessible (Serra-Silva, 2022; Noviawati et. al., 2025). In emerging governance systems such as Uzbekistan, digital engagement often becomes the primary avenue through which citizens express needs and grievances. Accordingly, deputies who more actively facilitate and respond to citizen engagement are expected to exhibit higher levels of substantive representation by incorporating public input and aligning their actions more closely with community interests.

*H5. Evidence-based decision-making is positively associated with substantive representation.*

Evidence-based decision-making has become a defining feature of modern governance, as data-driven policymaking improves the precision, consistency, and justification of representative actions (Dunleavy et al., 2006). When deputies rely on empirical information – such as needs assessments, budget analyses, or performance indicators – they are more likely to adopt policy positions aligned with constituent interests, consistent with normative expectations of substantive representation. Digital tools further facilitate this process by expanding access to reliable information and enabling more systematic analysis. In emerging governance systems with uneven analytical capacity, representatives who integrate data into decision-making are therefore expected to demonstrate stronger substantive alignment with citizen needs, though these effects may develop more gradually than responsiveness.

Building on this theoretical foundation and addressing the gap in measuring substantive representation in digitally evolving local governance settings, this study formulates empirically testable hypotheses derived from the DPC framework. These hypotheses translate the model's core mechanisms into measurable expectations linking digital performance to substantive representation among local deputies (Table 2).

Together, these hypotheses (H1-H5) connect the theoretical framework to the empirical analysis by specifying how each dimension of digital performance is expected to shape substantive representation in decentralized governance settings. H1–H4 isolate the individual effects of transparency, responsiveness, engagement, and evidence-based decision-making, while H5 evaluates the composite DPC index as an integrated measure of digital performance. Collectively, they operationalize how digital behaviors translate Pitkin's conceptual understanding of substantive representation into measurable empirical indicators.

**Methodology**

Conceptual Operationalization

This study adopts a positivist, mixed-methods research design in which quantitative panel analysis constitutes the primary analytical strategy, complemented by a qualitative contextual examination. The aim is to empirically test Hypotheses H1–H5 by evaluating the effect of the Digital Performance Criteria (DPC) on substantive representation and local accountability.

Uzbekistan serves as a suitable empirical setting given its ongoing digital-decentralization reforms, which create an opportunity to assess whether digital performance metrics can address accountability gaps in a transitioning governance system (Zaznaev, 2024; Leston-Bandeira & Siefken, 2023). The context allows for examining whether DPC indicators meaningfully predict representative behavior.

Two core variables are operationalized as follows:

A. Substantive Representation (Dependent Variable, $Y_{it}$)

Drawing on Pitkin's (1967) concept of "acting for" constituents, substantive representation is measured through observable political and budgetary outcomes that reflect documented citizen needs. This approach emphasizes transparency-driven responsiveness as a key component of institutional trust and accountability (Alessandro et al., 2019). The measure captures the extent to which deputies translate constituent priorities into concrete decisions and problem-solving actions.

B. Digital Performance Criteria (DPC) (Independent Variable, $DPC_{it}$)

The DPC framework is operationalized as a composite index built from four dimensions – transparency (T), responsiveness (R), citizen engagement (E), and data-driven decision-making (D). Across these dimensions, 12 specific indicators convert digital behaviors into measurable units such as publication frequency, response time, citizen request processing rates, and demonstrated use of evidence in decision-making (Figure 1).

The measurement flow in Figure 1 illustrates how the DPC framework translates abstract theoretical concepts into quantifiable indicators. It provides a structured bridge from Pitkin's normative notion of substantive representation to its empirical evaluation through the four DPC dimensions and 12 indicators. This operationalization ensures the internal coherence of the DPC Index and establishes a transparent foundation for the econometric models applied in the following sections.

Data collection and sources

The empirical analysis relies on a longitudinal panel dataset covering 2020-2025, a period marked by intensive decentralization and digital transformation reforms in Uzbekistan. This timeframe captures the expansion of e-government systems and the institutional strengthening of local representative bodies. To operationalize the DPC, data were compiled from four complementary sources that together provide administrative, behavioral, and contextual information.

(1) Administrative and Financial Records.

These include Kengash resolutions, budget monitoring reports, program implementation protocols, and official replies to citizen petitions. Such documentation offers objective evidence of deputies' formal activities and forms the basis for measuring substantive representation outcomes.

(2) Digital Interaction Data (E-Portal statistics).

Behavioral trace data were extracted from national platforms such as My Deputy, E-Decisions, and the My Opinion petitions registry. Indicators include response times, communication frequency, engagement levels, and petition-resolution rates – core measures for the Responsiveness (DPC-R) and Engagement (DPC-E) dimensions. Because these records originate from authenticated government systems, they reduce reporting bias and allow comparable measurement across districts.

(3) Official Statistical Indicators.

Socioeconomic and infrastructural characteristics of districts were collected from the Open Data Portal to construct control variables. These contextual factors are widely recognized as influencing representation and accountability and help isolate the independent effect of digital performance.

(4) Qualitative Validation Data.

Expert interviews with government officials, local administrators, civil society actors, and digital-governance specialists were used to strengthen construct validity. Interviews supported (a) the conceptual interpretation of DPC indicators and (b) triangulation of quantitative trends with institutional practice.

The final dataset forms a balanced panel of 15 local councils, allowing the study to trace temporal changes in digital performance and substantive representation. The panel structure improves causal inference by capturing within-unit variation over time and minimizing omitted-variable bias through fixed-effects estimation.

Variable Specification and Measurement

The analytical model tests the relationship between the Digital Performance Criteria and substantive representation while accounting for contextual and regional confounders. All variables are operationalized in line with the conceptual framework.

A. Dependent Variable ($Y_{it}$): Substantive Representation Index

The dependent variable is a composite Substantive Representation Index reflecting the degree to which deputies "act for" constituents (Pitkin, 1967). The index aggregates three standardized components:

1. Policy Outcome Alignment – the share of policy decisions and budget allocations corresponding to citizen-identified priorities (petitions, complaints, community feedback).
2. Legislative Responsiveness Quality – the number and significance of policy adjustments or initiatives derived from documented public input.
3. Transparency Compliance – adherence to required disclosure practices, including publication of decisions, financial reports, and performance updates.

Combined through a weighted aggregation approach, the index provides a continuous district-level measure of substantive representation suited to local institutional settings.

B. Independent Variable ($DPC_{it}$): Digital Performance Criteria

The key explanatory variable is the DPC Composite Index, based on 12 indicators across four components: Transparency (DPC–T), Responsiveness (DPC–R), Engagement (DPC–E), and Data-driven Decision-making (DPC–D).

Indicators capture deputies' digital behavior, including publication frequency, response timeliness, petition-processing rates, participatory platform usage, and documented reliance on evidence.

This composite index measures both institutional digital capacity and performance.

C. Control Variables ($X_{it}$)

Several controls are included to address endogeneity and omitted-variable concerns:

1. Socioeconomic and demographic factors – district-level variables such as urbanization, GDP per capita, and population characteristics, capturing contextual heterogeneity influencing both digital performance and representation.
2. Digital Infrastructure Index ($Infra_{it}$) – measuring broadband coverage, mobile network density, and internet penetration. Although correlated with DPC, digital infrastructure is not theoretically expected to affect substantive representation directly. Therefore, it is used as a control in baseline models and as a diagnostic instrument for probing endogeneity.
3. Fixed Effects ($\mu_i$, $\lambda_t$) – district fixed effects account for unobserved, time-invariant characteristics, while year fixed effects capture national-level reforms and external shocks.

Together, they isolate within-unit variation and strengthen causal inference consistent with best practices in panel-data public administration research.

3.4. Methods

This study uses panel data from 15 regions of Uzbekistan for 2020–2025 to evaluate the effect of digital performance on substantive representation. The panel structure enables analysis of temporal dynamics and allows identification of within-region changes while controlling for persistent institutional differences across local councils.

The main estimation strategy relies on the following panel regression model:

$$Y_{it}=\beta_1 DPC_{it}+\beta_2 X_{it}+\mu_i+\lambda_t+\varepsilon_{it},$$

where $Y_{it}$ is the substantive representation index, $DPC_{it}$ the Digital Performance Criteria score, $X_{it}$ a vector of controls, $\mu_i$ region fixed effects, $\lambda_t$ year fixed effects, and $\varepsilon_{it}$ denotes the idiosyncratic error term. This specification isolates the net effect of digital performance by accounting for both observed and unobserved heterogeneity.

Given substantial unobservable regional characteristics – administrative culture, governance traditions, and elite stability – the fixed-effects estimator is preferred. A Hausman test confirms the superiority of the fixed-effects model, which is therefore used in all baseline analyses.

Because digital transformation may influence representation indirectly, a mediation analysis is conducted to assess whether improvements in digital infrastructure operate through enhanced digital performance. The mediation framework is specified as:

$DPC_{it}=\alpha_1 Infra_{it}+\alpha_2 X_{it}+\mu_i+\lambda_t+v_{it}$,

$Y_{it}=\gamma_1 DPC_{it}+\gamma_2 Infra_{it}+\gamma_3 X_{it}+\mu_i+\lambda_t+\xi_{it}$,

where $Infra_{it}$ denotes the digital infrastructure index. The mediation effect is evaluated following the Baron and Kenny procedure, with significance assessed using the Sobel test (Baron & Kenny, 1986; Sobel, 1982).

Several robustness checks were conducted to ensure the stability of the findings. First, the models were re-estimated using alternative normalization schemes for the DPC index to test whether the results were sensitive to measurement choices. Second, observations from 2020-2021 were excluded to account for potential distortions associated with the COVID-19 period. Third, separate estimations for urban and rural districts were carried out to verify that structural differences across settlement types did not drive the results. Finally, an instrumental-variables specification was employed using regional digital infrastructure growth as an instrument – an indicator strongly correlated with DPC but theoretically unrelated to substantive representation – to address potential endogeneity concerns.

Together, the combination of panel regression, fixed-effects estimation, mediation analysis, and multiple robustness tests provides a solid methodological basis for causal inference and strengthens the internal validity of the study's findings on how digital governance shapes substantive representation in a rapidly evolving administrative environment.

**Results**

Main Relationship Between Digital Performance Criteria (DPC) and Substantive Representation

The fixed-effects panel regressions show a clear and statistically significant positive relationship between the Digital Performance Criteria (DPC) and substantive representation. As reported in Table 3, a one-unit increase in the DPC Index corresponds to a 0.31-0.34 rise in the Substantive Representation Index ($\beta \approx 0.27\text{-}0.34$). This indicates that higher levels of digital transparency, responsiveness, and reporting practices translate into substantially stronger representative performance aligned with citizen priorities.

Control variables behave as theoretically expected. Economic development and local budget revenues positively influence representation, while population density has a small negative effect, suggesting that more crowded regions may face greater representational constraints. Digital infrastructure also shows a significant positive impact, confirming the enabling role of technological capacity.

Model diagnostics support the robustness of these findings. The within-$R^2$ of 0.472 indicates solid explanatory power, the model F-test is significant at $p < 0.001$, and the Hausman test $(X^2=14.62,\ p=0.004)$ confirms the suitability of the fixed-effects specification (Table 3).

Taken together, these results provide strong empirical support for the hypotheses and demonstrate that digital performance is a substantive driver of representation in decentralized governance. Improvements in transparency, responsiveness, and engagement produce measurable gains in representative behavior, while socioeconomic and infrastructural conditions shape the magnitude of these effects. Overall, the findings affirm that digitalization enhances – not merely facilitates – the quality of substantive representation.

Responsiveness as the Strongest Determinant of Substantive Representation

Disaggregated analyses of the DPC components show that digital responsiveness is the strongest predictor of substantive representation. Across fixed-effects models, responsiveness yields the largest coefficient ($\beta \approx 0.41$, $p < 0.01$), indicating that deputies who reply promptly and substantively to digital inquiries perform significantly better in representing citizen interests.

This result is consistent with international findings. Scholars argue that responsiveness – especially in digital environments – is a core behavioural mechanism through which representatives demonstrate attentiveness and accountability (Leston-Bandeira & Siefken, 2023). Comparative analyses of parliamentary platforms likewise show that reply timeliness and quality are among the most visible indicators of representative engagement (Serra-Silva, 2022). Research from emerging digital democracies also demonstrates that citizens increasingly rely on online channels to communicate needs, making digital responsiveness a key determinant of perceived legitimacy and representational integrity (Noviawati et. al., 2025).

In Uzbekistan, this pattern is amplified by the rapid growth of digital communication platforms. Online petitions, comments, and inquiries have become central mechanisms through which citizens monitor their deputies. Consequently, deputies who respond actively and consistently through these channels are more likely to convert constituent concerns into concrete policy actions, resulting in higher and more measurable levels of substantive representation (Figure 2).

Responsiveness exhibits the strongest positive effect among the four DPC components, indicating that timely and substantive digital interactions are the most influential driver of substantive representation.

Mediation Through Transparency: The Indirect Effect of Digitalization

The mediation analysis demonstrates that digital transparency serves as a significant conduit through which digital infrastructure enhances substantive representation. The effect of digital infrastructure is not exclusively direct; rather, it operates partly through transparency-enhancing practices embedded in the DPC framework (Baron & Kenny, 1986; Sobel, 1982).

First, digital infrastructure strongly predicts transparency ($\alpha_1 > 0$, $p < 0.01$), indicating that improvements in broadband access and platform availability encourage more consistent disclosure of decisions, reports, and citizen-facing information. Second, transparency itself significantly increases substantive representation ($\gamma_1 > 0$, $p<0.01$), confirming that when deputies publish decisions and provide accessible justifications, citizens obtain the informational basis required for performance evaluation. Importantly, introducing transparency into the model reduces – but does not eliminate – the direct effect of infrastructure on representation, indicating partial mediation.

The Sobel test ($Z\approx 3.45$, $p < 0.001$) confirms that the indirect pathway is statistically meaningful. These findings align with recent research showing that transparency and digital visibility have become central pillars of contemporary legislative behaviour (Zaznaev, 2024). The results of this study extend that insight to the subnational level: digital transparency now constitutes the primary mechanism through which citizens monitor and evaluate their elected deputies (Figure 3).

Paths represent estimated coefficients from the mediation analysis. The significant indirect effect (Sobel test: $Z \approx 3.45$, $p < 0.001$) indicates that improvements in the broader digital performance environment increase transparency, which subsequently enhances substantive representation – confirming a partial mediation structure.

Robustness and Sensitivity Analyses

To assess the reliability of the empirical results, several robustness and sensitivity checks were performed. Across all specifications, the estimated effect of the DPC Composite Index on substantive representation remains positive, statistically significant, and substantively stable.

Alternative normalization procedures for the DPC Index (z-scores, percentile scaling) produce coefficient estimates that closely mirror the baseline model, indicating that results are not driven by measurement choices. Excluding the pandemic-affected years 2020-2021 yields effect sizes within a narrow range of the main estimates, suggesting temporal stability.

Subsample analyses reveal theoretically consistent heterogeneity: responsiveness shows a stronger effect in urban districts, where digital communication is more active, while transparency has a more pronounced influence in rural settings characterized by higher informational asymmetry. To address potential endogeneity, an instrumental-variables specification employing regional digital-infrastructure growth as an instrument confirms that the estimated DPC effects are not driven by reverse causality; instrument strength is validated by the Kleibergen–Paap rk Wald statistic. All models use robust standard errors to address heteroskedasticity and serial correlation (Table 4).

To complement these results, Figure 4 presents a forest plot of coefficient estimates across robustness models, illustrating visually that the DPC effect remains consistently positive under varied assumptions (Figure 4).

Taken together, these robustness tests confirm that the relationship between digital performance and substantive representation is not model-dependent and remains stable across diverse analytical specifications, reinforcing the credibility of the study's core findings.

General Interpretation of the Findings

Across all empirical models, the findings consistently demonstrate that the Digital Performance Criteria (DPC) Index is a central determinant of substantive representation at the local level. Higher DPC scores are associated with measurable improvements in deputies' transparency, responsiveness, and policy actions, indicating that digital practices do more than modernize administrative routines – they fundamentally reshape how representatives interpret and address citizen demands.

The disaggregated results confirm that digital responsiveness is the strongest individual driver of substantive representation. Deputies who provide timely and meaningful replies through digital channels exhibit substantially higher representative performance, reflecting broader governance shifts in which immediacy and interactive communication have become core public expectations.

The mediation analysis further clarifies the mechanism through which digitalization influences representation. Digital infrastructure enhances substantive representation primarily by enabling greater transparency: the publication of decisions, disclosure of reports, and provision of accessible documentation equip citizens with the information necessary for meaningful oversight. Thus, infrastructure establishes technical capacity, but transparency converts that capacity into accountable representative behavior.

Robustness checks – including alternative index normalizations, exclusion of pandemic years, urban-rural comparisons, and instrumental-variable estimates – reinforce the stability of these findings. The consistency of effect sizes across diverse settings confirms strong internal validity and indicates that the results are not sensitive to model assumptions or specific contextual conditions. Differences across urban and rural districts highlight complementary dynamics: digital responsiveness plays a greater role where online engagement is high, while transparency matters more where information asymmetry is greater.

Overall, the evidence shows that digital performance is not a peripheral administrative feature but a structurally embedded determinant of representational quality. The DPC Index functions both as an analytical instrument and a practical governance tool – capable of identifying behavioral patterns, supporting accountability reforms, and aligning institutional practice with evolving citizen expectations. These findings offer a strong foundation for the Discussion section to explore broader theoretical implications for digital accountability, institutional design, and democratic practice in transitioning governance systems.

**Discussion**

The findings clarify how digital performance shapes substantive representation in local governance. The Digital Performance Criteria (DPC) framework translates Pitkin's conception of "acting for" constituents into measurable digital-era indicators, demonstrating its value as both an analytical and practical tool. Mechanisms widely discussed in national legislative studies – digital visibility, mediatization, and data-driven behavior – are similarly influential at the local level, where accountability practices are more easily observed (Leston-Bandeira & Siefken, 2023; Serra-Silva, 2022; Neihouser & Oullet, 2024). The DPC framework captures this through its four dimensions: responsiveness, transparency, engagement, and data use.

Among these, digital responsiveness emerges as the strongest predictor of substantive representation. In an environment of rapid information flows and rising expectations, citizens increasingly evaluate deputies through concrete, traceable interactions on official digital platforms – an especially significant pattern in Uzbekistan. Transparency serves as the main channel through which digital infrastructure improves representational performance, as it enables citizens to monitor decisions and assess behavioural consistency (Zaznaev, 2024). In smaller local political units, where feedback loops are tighter, transparency exerts a more immediate and observable influence on representative conduct.

Variation across DPC components reflects Uzbekistan's institutional context. Unlike European parliaments, where engagement and transparency often reinforce one another, digital engagement in Uzbekistan exerts a weaker effect due to the partial institutionalization of formal participatory platforms and the population's reliance on informal communication channels (Serra-Silva, 2022; Welp & Wheatley, 2022). Engagement becomes most impactful when embedded in stable, institutionalized mechanisms rather than dispersed across informal spaces.

More broadly, these patterns situate Uzbekistan's reforms within global debates on digital governance. As digital tools increasingly shape observable deputy behaviour, a hybrid model of representation emerges, combining traditional political mediation with digitally enabled practices of responsiveness, transparency, and accountability. Overall, the DPC framework links normative theories of substantive representation with the empirical realities of digital-era governance, offering both theoretical advancement and practical guidance for strengthening accountability in transitioning political systems.

**Conclusion**

This study develops and empirically validates the Digital Performance Criteria (DPC) framework as a comprehensive tool for assessing substantive representation in local governance. By integrating transparency, responsiveness, engagement, and data use into a unified composite index, the DPC model translates Pitkin's conception of substantive representation into measurable digital-era indicators, thereby advancing representation theory and aligning it with contemporary governance practices.

Empirical results show that the DPC Index is a strong and consistent predictor of substantive representation. Digital responsiveness – capturing the timeliness and substantive quality of deputies' replies – emerges as the most influential component, reflecting citizens' growing reliance on interactive digital communication when

evaluating representative performance. Transparency functions as a key mediating mechanism: digital infrastructure enhances representation only when accompanied by systematic disclosure of decisions, reports, and justifications. These findings confirm the DPC framework's theoretical coherence and empirical robustness.

The study also offers practical implications. Strengthening digital responsiveness requires clear institutional standards for handling electronic inquiries. Embedding routine transparency practices – regular publication of decisions, budgets, and activity reports – is essential for effective oversight. Digital participation tools must be more fully institutionalized, and data-driven decision-making should be supported through improved analytical capacity and greater use of open data.

Future research may extend the DPC framework through AI-based monitoring, analysis of large-scale digital interaction data, and comparative benchmarking across councils and regions. Overall, the DPC model provides a solid foundation for institutionalizing digital accountability and improving representative performance in Uzbekistan and similar transitional governance systems.

**Policy implications**

The findings of this study offer several strategic policy directions for strengthening local representative institutions and advancing digital governance. First, the demonstrated reliability of the Digital Performance Criteria (DPC) highlights the need for a unified system to evaluate deputies' digital behavior. A standardized DPC monitoring mechanism would enable regular, comparable assessments of transparency, responsiveness, and communication quality across regions.

Second, the results underscore the importance of formalizing institutional standards for digital responsiveness. Clear requirements – such as minimum response timelines, substantive reply criteria, and automated tracking of electronic inquiries – would enhance accountability and improve the operational performance of local councils.

Third, because digital infrastructure contributes to representation only when paired with consistent disclosure, adopting a "transparency-by-design" approach is essential. Automatically updated dashboards that publish decisions, budgets, reports, and responses would ensure continuous and verifiable public oversight.

Fourth, digital participation mechanisms require stronger institutionalization. Formalized online hearings, consultations, feedback tools, and e-petition systems would increase the effectiveness and legitimacy of participatory governance.

Finally, the DPC framework can support long-term performance-based governance by informing resource allocation, incentive structures, and evaluation processes. Embedding DPC indicators into administrative and electoral assessments would help strengthen digital accountability and improve representative quality over time.

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**Supplementary material**

Supplementary materials for this article include additional methodological documentation, robustness analyses, and detailed descriptions of all variables used in constructing the Digital Performance Criteria (DPC). The online appendix contains: (1) full coding procedures for the DPC index, including indicator definitions, scoring rules, and normalization methods; (2) extended regression outputs with alternative specifications such as random-effects models, instrumental-variable estimations, and sub-sample analyses; (3) mediation analysis results, including confidence intervals and Sobel test statistics; and (4) the complete set of survey items and expert interview protocols used in data collection. All supplementary materials are available through the journal's online repository or upon request to support transparency, replication, and further scholarly inquiry.

*Conflicts of Interest:* None declared.

**Data Availability**

The data supporting this study include qualitative interview transcripts and raw survey responses from 350 citizens and 55 local deputies. Due to the politically sensitive nature of these materials and the potential risk

of compromising participant anonymity and security within the institutional context of Uzbekistan, the underlying raw data cannot be publicly shared. Only aggregated results presented in the article's text, tables, and figures are available. Additional technical details or documentation used in the analysis may be provided by the author upon reasonable request.

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**Table 1.** Comparative Analysis of Conceptual Mechanisms and Their Theoretical Linkages

| **Conceptual Mechanism** | **Primary Theoretical Foundations** | **Key Authors** | **How the Mechanism Relates to Substantive Representation** |
|---|---|---|---|
| **Transparency** | Accountability theory; information asymmetry reduction | (Mechkova et al., 2019; Christensen et al., 2020) | Provides citizens with verifiable information needed to evaluate representatives' actions; enhances trust and oversight. |
| **Responsiveness** | Classic representation theory; democratic legitimacy | (Pitkin, 1972; Wayne et al., 2010) | Converts citizen needs into immediate representative action; strongest behavioral indicator of substantive representation. |
| **Citizen Engagement** | Participatory governance; deliberative democracy | (Serra-Silva 2022; (Noviawati et al., 2025; Welp & Wheatley, 2022) | Enables active citizen input and feedback loops, strengthening the quality of policy representation. |
| **Evidence-Based Decision-making** | Data-driven governance; performance-based administration | (Dunleavy et al., 2006; Vaccari & Valeriani, 2021) | Ensures representative decisions are justified through objective information, improving policy accuracy and legitimacy. |
| **Digital Mediatization** | Political communication and mediated representation | (Neihouser & Ouellet, 2024) | Shapes how representatives signal their performance and maintain political visibility in digital environments. |
| **Multi-level Governance Linkages** | Decentralization and vertical accountability | (Zaznaev, 2024) | Highlights the structural constraints and opportunities affecting local deputies' capacity to represent citizen interests. |

*Note:* Author's compilation based on literature on representation, digital governance, and mediatized accountability. Table summarizing six mechanisms – transparency, responsiveness, citizen engagement, evidence-based decision-making, digital mediatization, and multilevel governance linkages – alongside their theoretical foundations, key authors, and contributions to representative accountability.

**Table 2**. Hypotheses linking DPC indicators to substantive representation

| DPC Component | Theoretical Logic (Short Justification) | Hypothesis Statement | Expected Effect |
|---|---|---|---|
| **Overall Digital Performance (DPC Index)** | Digital governance research shows that visibility, communication, and online accountability enhance representative behavior (Christensen et al., 2020). | H1. Higher levels of digital performance (DPC) are associated with greater substantive representation among local deputies. | Positive (+) |
| **Responsiveness** | Responsiveness is the core behavioral element of substantive representation (Pitkin, 1972; Wayne et al., 2010) and the strongest predictor of perceived representational quality in digital environments (Stier, 2020). | H2. Among the DPC components, digital responsiveness will have the strongest positive effect on substantive representation. | Strong Positive (+++) |
| **Transparency (Mediator)** | Transparency reduces information asymmetry and shapes how citizens interpret representative behavior (Mechkova et al., 2019). It amplifies the effects of digital actions by providing informational context. | H3. Transparency mediates the relationship between digital performance and substantive representation. | Indirect Positive (Mediation) |
| **Citizen Engagement** | Participatory governance theory argues that engagement integrates citizen input into policymaking, improving representational accuracy (Welp & Wheatley, 2022). Particularly salient where formal participation is weak. | H4. Citizen engagement is positively associated with substantive representation. | Positive (+) |
| **Evidence-Based Decision-Making** | Data-driven decision-making improves policy justification, precision, and alignment with citizen needs (Dunleavy et al., 2006). | H5. Evidence-based decision-making is positively associated with substantive representation. | Moderate Positive (++) |

*Note:* Author's compilation based on foundational literature on digital accountability and representation (Pitkin, 1972; Wayne et al., 2010; Mechkova et al., 2019; Dunleavy et al., 2006; Welp & Wheatley, 2022). Table summarizing five hypotheses connecting digital performance dimensions (overall index, responsiveness, transparency, engagement, and data use) to substantive representation, indicating whether each effect is strong, positive, or mediated.

**Table 3**. Fixed-effects estimates of the impact of Digital Performance Criteria (DPC) on substantive representation outcomes

| Predictor Variables | β Coefficient | Std. Error | p-value |
|---|---|---|---|
| Digital Performance Criteria (DPC) | 0.312 | 0.067 | <0.001 |
| Economic Development | 0.118 | 0.049 | 0.017 |
| Population Density | –0.043 | 0.021 | 0.038 |
| Digital Infrastructure Index | 0.196 | 0.054 | <0.001 |
| Local Budget Revenues | 0.081 | 0.033 | 0.014 |
| Fixed Effects | Yes | — | — |

| | | | |
|---|---|---|---|
| Year Effects | Yes | — | — |
| $R^2$ (within) | 0.472 | — | — |
| F-statistic | 13.87 | — | <0.001 |
| Hausman test ($\chi^2$) | 14.62 | — | 0.004 |

*Note:* Author's estimation using panel data from 55 local deputies (2020-2025). Regression table showing a strong positive effect of DPC ($\beta = 0.312$, $p < 0.001$) on substantive representation. Economic Development and Local Budget Revenues are positive and significant; Population Density is slightly negative; Digital Infrastructure is strongly positive ($\beta = 0.196$, $p < 0.001$). Model includes fixed and year effects, with $R^2$ (within) = 0.472; Hausman test confirms FE ($\chi^2 = 14.62$, $p = 0.004$).

**Table 4**. Robustness Checks (Alternative Specifications)

| **Indicators** | **Model 1 (Baseline Fixed Effects)** | **Model 2 (Excluding Economic Controls)** | **Model 3 (Alternative Dependent Variable: Responsiveness Score)** | **Model 4 (Alternative Fixed Effects: Year Only)** |
|---|---|---|---|---|
| Independent Variable: | | | | |
| DPC Composite Index *(X)* | 0.48***(0.07) | 0.51***(0.08) | 0.59***(0.09) | 0.46***(0.06) |
| Control Variables: | | | | |
| Regional Development Index | 0.15** | - | 0.12* | 0.14** |
| Internet Penetration | 0.09* | 0.08* | 0.07 | 0.09* |
| Urbanization Rate | -0.05 | -0.04 | -0.06 | -0.03 |
| Model Statistics: | | | | |
| Observations (Kuzatuvlar) | 280 | 280 | 280 | 280 |
| Number of Kengashs | 56 | 56 | 56 | 56 |
| Fixed Effects | Region & Year | Year Only | Region & Year | Year Only (Random) |
| $R^2$ (Within) | 0.62 | 0.58 | 0.68 | 0.59 |

*Notes:* Standard errors are presented in parentheses. * p<0.1; ** p<0.05; *** p<0.01.
Author's calculations based on robustness models using panel data on deputy digital performance and representation (2020-2025). Table summarizing alternative regression specifications. In all models, the DPC coefficient remains positive and statistically significant, confirming the stability of the digital-performance effect on substantive representation.

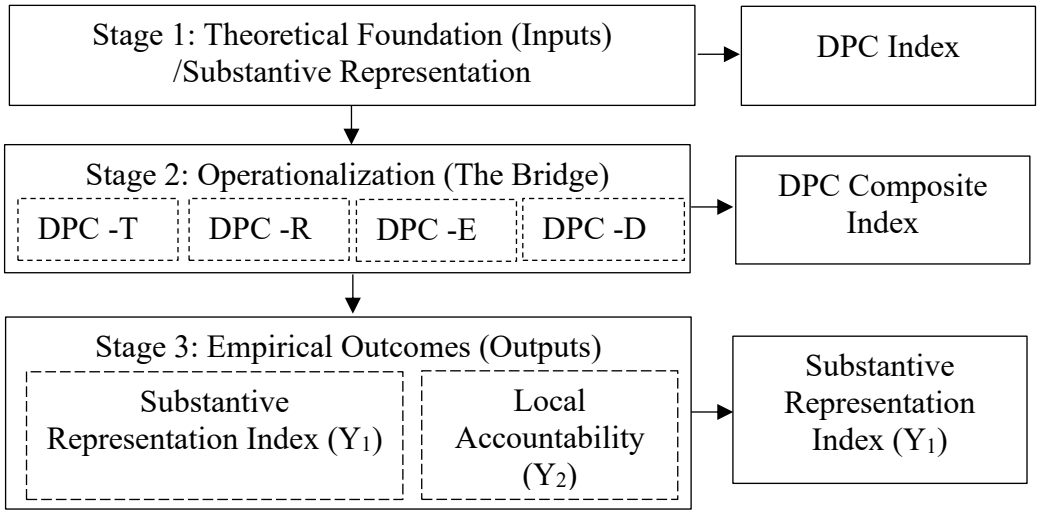



**Figure 1**. Conceptual Measurement Flow of the Digital Performance Criteria (DPC) Model
*Note:* Author's compilation based on representation theory, digital accountability, and performance-measurement literature. Diagram showing a three-stage model linking theoretical foundations to empirical indicators. Stage 1: conceptual basis of substantive representation. Stage 2: operationalization through four DPC components (T, R, E, D) and their composite index. Stage 3: empirical outcomes – substantive representation ($Y_1$) and local accountability ($Y_2$).

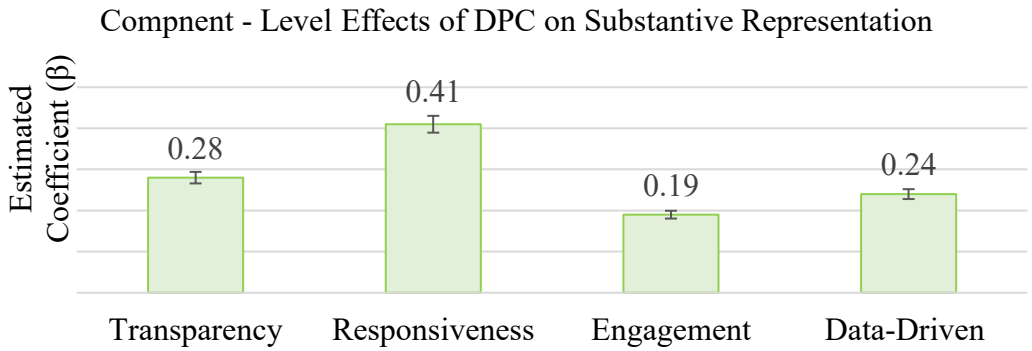



**Figure 2**. Component-Level Effects of the Digital Performance Criteria (DPC) on Substantive Representation
*Note:* Author's estimation using fixed-effects regression on panel data (2020-2025). Bar chart showing effects of four DPC components: Transparency (β≈0.28), Responsiveness (β≈0.41), Citizen Engagement (β≈0.19), and Data-Driven Decision-Making (β≈0.24). Responsiveness has the largest effect.

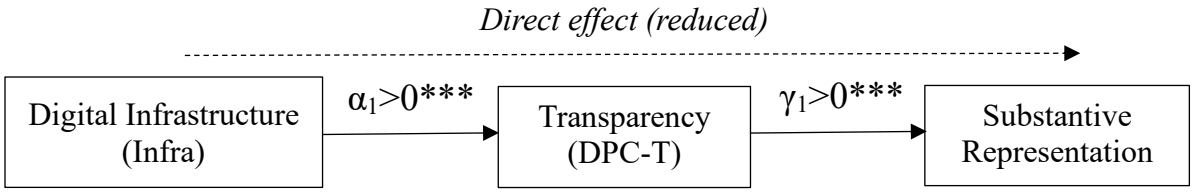
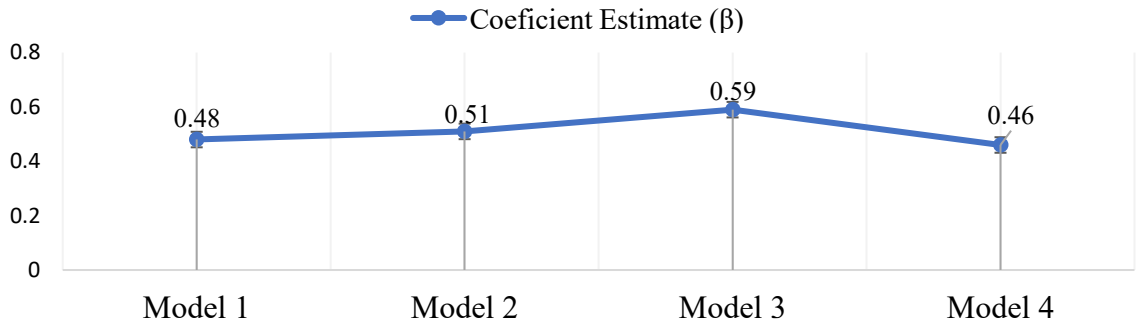



**Figure 3.** Mediation Effect of Digital Transparency (DPC-T) Between Digital Infrastructure and Substantive Representation
*Note:* Author's calculations using panel data on deputy digital activity and representation metrics (2020-2025). Diagram showing that digital infrastructure positively affects transparency, which in turn increases substantive representation. A reduced direct path from infrastructure to representation (dashed line) indicates partial mediation. Coefficient estimates and significance levels show that improvements in digital infrastructure enhance transparency, which subsequently strengthens representational outcomes.

**Figure 4**. Forest Plot of Robustness Checks Across Alternative Model Specifications




*Note:* Author's calculations based on robustness models (2020-2025). Forest plot showing positive DPC coefficient estimates (β ≈ 0.46-0.59) across four alternative models, with error bars indicating standard errors and demonstrating coefficient stability.