Data and Technology Based Bureaucratic Governance Innovations: A Model for Strengthening Institutional Quality in Public Sector Reform in Indonesia

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ABSTRACT

This study aims to examine the role of data-driven governance innovation in improving institutional quality in the Indonesian public sector. Specifically, the research analyzes the direct and indirect effects of technology, organizational capacity, and regulatory frameworks on institutional quality, with data-driven governance innovation positioned as a mediating variable. The study responds to the growing demand for evidence-based public administration amid digital bureaucracy reform and the implementation of e-government initiatives in Indonesia. The research employs a mixed-methods approach with a sequential explanatory design. Quantitative data were collected through a structured survey of civil servants across central and local government institutions that have implemented digital governance systems. The data were analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM) to test measurement validity, reliability, and structural relationships among variables. This quantitative phase was complemented by qualitative data obtained from in-depth interviews with key informants involved in digital governance, which were analyzed thematically to provide contextual explanations of the statistical findings. The results indicate that data-driven governance innovation has a positive and significant effect on institutional quality. Technology emerges as the most influential factor, exerting both direct and indirect effects through governance innovation. Organizational capacity shows a moderate but significant influence, while regulatory factors display a weak and inconsistent effect. These findings suggest that strengthening technological infrastructure and organizational capabilities is essential for enhancing institutional quality through data-driven governance in the public sector.

Keywords: Data-Driven Governance, Institutional Quality, Digital Bureaucracy

INTRODUCTION

The rapidly evolving digital transformation of the past decade has driven fundamental changes in the way governments manage bureaucracy, provide public services, and build more effective institutional quality. Digitalization in the public sector is no longer understood as limited to the adoption of information technology, but as part of the governance reform process that touches on the structural, procedural, and cultural

aspects of government organizations. This change is characterized by the increasing use of big data technology, integrated information systems, artificial intelligence, and the use of data as the main basis in the formulation and evaluation of public policies.

In Indonesia, the digital transformation of the bureaucracy is developing in line with the direction of national policies that place data as a strategic asset of the state. Indonesia's One Data policy, the implementation of the Electronic-Based Government System (SPBE), and the national digital transformation agenda show the government's commitment to realizing a more adaptive, efficient, and accountable bureaucracy (KemenPAN-RB, 2022). These policies aim to improve the quality of public services, improve cross-agency coordination, and strengthen government transparency and accountability. However, the realization of this vision still faces various fundamental challenges that are institutional, technical, and cultural.

Various evaluations show that the implementation of bureaucratic digital transformation in Indonesia has not been fully able to bridge the gap between policy and practice in the field. Data fragmentation between agencies, overlapping information systems, limited interoperability, and weak integration of central and regional policies are still major problems. This condition shows that bureaucratic digitalization is not just a matter of technology application, but an institutional reform process that requires changes in organizational structure, work patterns, and bureaucratic culture as a whole. Without strengthening institutional quality, digital transformation risks only producing symbolic administrative modernization.

The urgency of data-driven governance is getting stronger in the context of increasingly complex social, economic, and digital security dynamics. The experience during the COVID-19 pandemic has clearly demonstrated the importance of the availability of accurate, up-to-date, and integrated data in supporting effective public policy-making. The distribution of social assistance, population mobility control, public health tracking, and cross-sector service coordination are highly dependent on the quality of government data systems (OECD, 2020). At the global level, countries that have succeeded in developing strong digital governance have proven to be able to increase the effectiveness of public services, strengthen transparency, and optimize the use of state resources (UN DESA, 2022).

In contrast, in Indonesia, the challenge of data fragmentation and weak integration of information systems are still significant obstacles to evidence-based decision-making. Many ministries, institutions, and local governments develop data systems sectorally without uniform standards, creating information silos and slowing down policy coordination processes (Widodo & Nugroho, 2021). This condition shows that the success of digital transformation is not only determined by the availability of technology, but also by data governance that is able to connect technology with institutional decision-making processes.

Another problem that is increasingly prominent in the digital transformation of the bureaucracy is the aspect of security and protection of public data. A series of data leak incidents, including disruptions to national data centers as well as exposure to personal data from various public service agencies, show that the Indonesian government's digital infrastructure is still vulnerable to cyber threats (Fauzan & Santoso, 2023). This vulnerability not only causes harm to society, but also has direct implications for government legitimacy and the level of public trust. Setiawan and Hidayat (2022) emphasized that institutional quality is greatly influenced by the government's ability to

ensure data security, implement transparent technology governance, and ensure accountability in the use of public data. Weak data protection has the potential to increase the risk of abuse of authority and reduce public trust in state institutions.

In addition to technical and regulatory challenges, bureaucratic digital transformation is also faced with organizational culture issues. The Indonesian bureaucracy is still relatively dominated by manual work patterns, rigid hierarchical structures, and resistance to technology-based changes. Research shows that the digital transformation of the public sector is often hampered by low organizational adaptation capacity, limited data literacy training for apparatus, and weak incentives to encourage bureaucratic behavior change (Sari & Wicaksana, 2021). In many cases, the apparatus has used information technology, but does not yet have the analytical ability to utilize data as a basis for evidence-based policymaking. As a result, technology adoption tends to be administrative and has not had a significant impact on improving the quality of public services.

The urgency of this research is further strengthened when it is associated with the condition of Indonesia's institutional quality, which is still in the middle category and has not shown significant improvement in recent years (UNDP, 2022). On the other hand, global pressure on developing countries to adopt digital transformation is increasing, both in the context of economic competitiveness, investment climate, and public demands for fast and transparent services. Without strong digital governance, technological transformation has the potential to create new risks, such as excessive data centralization, technology misuse, and inequality of access to information.

Based on this background, this study aims to formulate a data- and technology-based bureaucratic governance innovation model that is able to strengthen the quality of government institutions in Indonesia. This research specifically focuses on the integration between the technical components (data interoperability, digital security standards, technology architecture), organizational components (business process redesign, HR capacity, data use culture), and regulatory components (personal data protection, digital audits, open data policies).

To clarify the analytical focus and align the conceptual framework with the methodological design, this research is formulated in the following research questions: How do data-based and technology-based governance innovations affect the institutional quality of government in Indonesia?, To what extent do technical, organizational, and regulatory components in data-driven governance contribute differently to improving institutional quality?, What factors are the drivers and inhibitions main in the implementation of data-based governance innovations in central and regional government agencies?, How can contextual and decentralized data-based governance models be formulated to strengthen institutional quality in a sustainable manner? By formulating these research questions, this study seeks not only to answer the "why" of digital transformation is important, but also the "what" and "how" data-driven governance innovations can be empirically tested and developed as policy models relevant to the Indonesian context.

METHODOLOGY

This study uses a mixed methods approach with a sequential explanatory design, where quantitative analysis is carried out as the main stage and followed by qualitative analysis to deepen and explain the empirical findings. This design was chosen because

data- and technology-based bureaucratic governance innovation is a complex, multidimensional, and contextual phenomenon, so it cannot be adequately explained only through a separate quantitative or qualitative approach. Integration between statistical evidence and contextual understanding is needed to produce a comprehensive governance model that is relevant to public sector reform in Indonesia (Creswell & Plano Clark, 2018).

This mixed-methods approach allows the research to, first, empirically examine the relationship between data-driven governance innovation and institutional quality through structural models, and second, understand the institutional dynamics, implementation barriers, and organizational context that underlie these relationships through qualitative exploration. Data-driven bureaucratic transformation has technical, structural, and social dimensions, so quantitative analysis is used to objectively measure the strength of relationships between variables, while qualitative analysis is used to capture patterns of organizational behavior, resistance to change, and institutional practices that are not fully reflected in survey data (Yin, 2020).

The first stage of the research is a quantitative analysis with a cross-sectional design, using primary data collected through a survey of State Civil Apparatus (ASN) in central ministries/institutions and local governments that have implemented the Electronic-Based Government System (SPBE), One Data Indonesia, and various other digital data management systems. The research population includes civil servants who work in planning units, public services, information technology, data management, and other strategic units that are directly involved in the technology-based decision-making process.

The sampling technique used is stratified purposive sampling, with stratification based on the level of government, namely the central government, provincial government, and district/city government. The purposive approach was chosen because this study requires respondents who have experience and direct involvement in the implementation of data-based governance, so that they are able to provide relevant and substantive information (Etikan, 2020). The inclusion criteria for respondents include active civil servants with a minimum working period of three years, involvement in data management or the use of government digital systems, and involvement in the planning or decision-making process. ASNs who are not related to the use of digital systems or only carry out routine administrative functions are excluded from the sample.

A total of 450 questionnaires were distributed through a combination of online and offline methods with the support of related work units. Of these, 372 questionnaires were successfully returned, and after a data screening process to address incomplete responses and inconsistencies in answers, as many as 250 questionnaires were declared valid and used in the analysis. The response rate reached 77.8 percent, indicating a relatively high participation rate for public policy research. The distribution of respondents reflects cross-institutional representation, with 38 percent coming from the central government, 32 percent from provincial governments, and 30 percent from district/city governments. To minimize the potential for selection bias, the researcher ensured the variation of agencies, regions, and work functions of respondents, and conducted an initial examination of non-response bias.

The main data collection instrument is a structured questionnaire developed based on a synthesis of digital public governance literature and the OECD framework on data-driven governance (OECD, 2020). The questionnaire consists of four main latent

constructs, namely data governance maturity, digital technology and infrastructure, institutional capacity and data use culture, and institutional quality. All indicators were measured using a five-point Likert scale, ranging from strongly disagree to strongly agree. The dimensions used reflect institutional aspects relevant to the context of bureaucratic digital transformation in Indonesia, as presented in Table 1.

Table 1. Operationalization of Institutional Quality

Dimensions	Operational Indicators	Sample Questionnaire Items	Source
Government Effectiveness	Clarity of procedures, consistency of policies, cross-agency coordination	"Digital systems help improve the effectiveness of policy coordination"	UNDP (2022)
Quality Regulation	Certainty of rules, adaptability of digital regulations	"Digital regulations are easy to understand and implement"	OECD (2020)
Public Accountability	Process transparency, access to information	"Digital systems increase transparency of public services"	A VILLAGE (2022)
Integrity & Corruption Control	Prevention of abuse of authority	"Digitalization reduces the opportunity for maladministration practices"	Rahman & Dewi (2022)
Public Service Performance	Speed, accuracy, user satisfaction	"Public services become faster and more responsive"	Widodo & Nugroho (2021)

Source : Primary Data, processed 2025

The selection of these dimensions is based on their suitability with Indonesia's bureaucratic reform agenda, where digital transformation is expected to not only improve internal efficiency, but also strengthen accountability, regulatory quality, and public service performance. The development of the instrument is carried out through several stages. First, indicators are compiled based on international literature and policy frameworks. Second, the instrument was tested on 30 respondents to assess the clarity of the item and internal consistency. The test results showed that four items were eliminated because they had a corrected item-total correlation value below 0.40. Content validation was carried out by three experts in the fields of public administration, government technology, and digital policy, with an expert agreement rate above 0.85. This approach ensures that the instrument is not only statistically valid, but also substantively relevant (Sekaran & Bougie, 2020).

The survey data was analyzed using Structural Equation Modeling based on Partial Least Squares (SEM-PLS). This method was chosen because the research model involves several latent constructs with complex relationships, as well as because SEM-PLS is more tolerant of moderate sample sizes and data distributions that are not completely normal (Hair et al., 2021). The entire construct is modeled as reflective, as the indicator is seen as a manifestation of a latent variable. Evaluation of the measurement model shows that the entire construct meets the criteria of validity and reliability. The Average Variance

Extracted (AVE) value for each construct is above 0.50, which indicates adequate convergent validity. The composite reliability value ranges from 0.87 to 0.93, indicating high internal consistency. Discriminant validity was tested using the Heterotrait–Monotrait ratio (HTMT), with all values being below the 0.85 threshold. Once the measurement model was declared feasible, structural model testing was carried out through a bootstrapping procedure with 5,000 subsamples to estimate the path coefficient, t-value, and significance of the influence between variables.
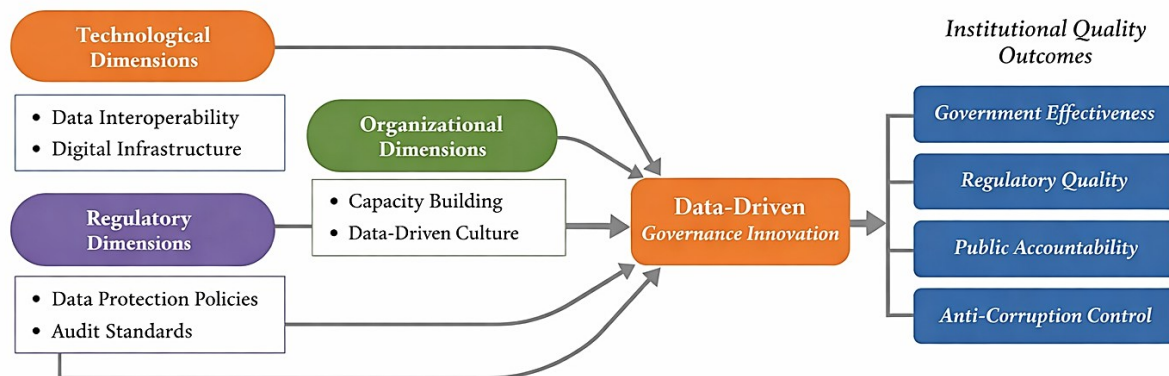

Figure 1. Research Mindset
Source: Author, 2025

The second stage of the research is qualitative analysis, which is carried out after quantitative results are obtained. This stage aims to explain and deepen quantitative findings, especially related to variables that show strong or weak influences on institutional quality. The qualitative methods used include in-depth interviews and analysis of policy documents. A total of 3 key informants were selected using purposive and snowball sampling techniques, consisting of SPBE management officials, data managers, digital security practitioners, internal auditors, and public policy experts.

The interviews focused on data management practices, interoperability challenges, interagency coordination dynamics, human resource readiness, and the implementation of regulations such as the Personal Data Protection Law. Interview data was analyzed using thematic analysis techniques, which included the transcription process, open coding, theme grouping, and thematic narrative development (Braun & Clarke, 2019). In addition, document analysis was carried out on SPBE regulations, One Data Indonesia Presidential Regulation, government evaluation reports, and SPBE audit results to identify gaps between policy design and implementation in the field (UN DESA, 2022). The final stage of the research is the integration of findings (meta-inference), which is the unification of quantitative and qualitative results in one complete conceptual framework. Integration is carried out in a narrative and model manner to formulate strategic policy recommendations in the form of operational and contextual data- and technology-based bureaucratic governance models.

RESULTS AND DISCUSSION

The results of the study "Data-Based and Technology-Based Bureaucratic Governance Innovation: A Model for Strengthening Institutional Quality in Public Sector Reform in Indonesia" show that the dynamics of digital transformation in the Indonesian bureaucracy are progressing in a progressive direction but are not fully optimal. The

research conducted through a mixed-methods approach provides an in-depth understanding of how the driving and inhibiting factors work simultaneously in influencing the success of strengthening institutional quality. Digital transformation, which is the main focus of this research, is not only related to the application of technology in the administrative process, but also includes a change in the bureaucratic work paradigm in using data as the main basis for decision-making, program planning, supervision, and performance evaluation. This transformation is one of the important prerequisites for Indonesia, which seeks to accelerate public sector reform in line with the national bureaucratic reform agenda and the development of an electronic-based government system (SPBE).
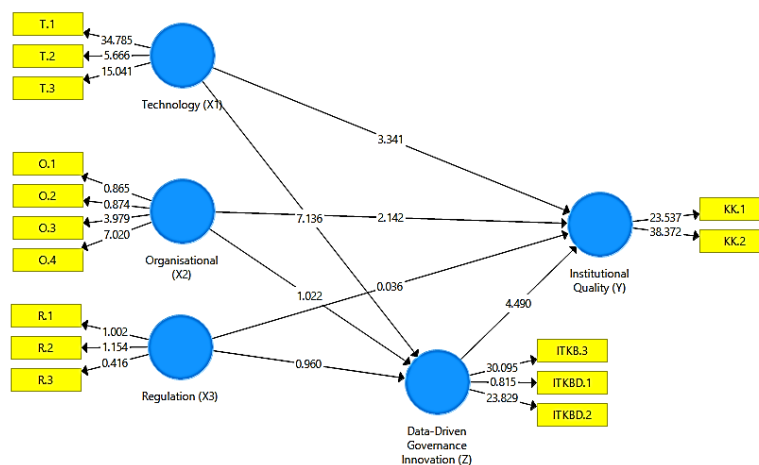

Figure 2. Evaluation of Model Measurement (Outer Model)
Source : Primary Data processed Smart-PLS 2025

The figure shows a SEM-PLS structural model that tests the influence of Technology (X1), Organisational (X2), and Regulation (X3) on Institutional Quality (Y) with Data-Driven Governance Innovation (Z) as a mediating variable. The results of the pathway test show that the technology and organizational dimensions have a significant effect on institutional quality, both directly and through data-based governance innovations. Meanwhile, regulation has a relatively weaker indirect influence, suggesting that the effectiveness of regulation is highly dependent on the capacity of digital governance implementation and innovation.

1.   Convergent Validity

Convergent validity is a type of construct validity that shows whether indicators or measures that are supposed to represent the same concept actually "converge" by correlating strongly with each other. In practice, it is commonly evaluated in measurement models (e.g., SEM-PLS or CFA) by checking whether each item loads highly on its intended construct (often ≥ 0.70), whether the construct's Average Variance Extracted (AVE) meets an acceptable threshold (commonly ≥ 0.50), and whether composite reliability supports internal consistency. When convergent validity is established, it indicates that the items share sufficient common variance to accurately capture the underlying latent variable, strengthening confidence that the construct is being measured consistently and meaningfully.

Table 2. Outer Loadings

	Data-Driven Governance Innovation (Z)	Institutional Quality (Y)	Organizational (X2)	Regulation (X3)	Technology (X1)
ITKB.3	0.863				
ITKBD.1	0.747				
ITKBD.2	0.835				
KK.1		0.836			
KK.2		0.885			
O.1			0.796		
O.2			0.768		
O.3			0.641		
O.4			0.854		
R.1				0.849	
R.2				-0.929	
R.3				0.139	
T.1					0.880
Q.2					0.509
T.3					0.792

Source : Primary Data processed Smart-PLS 2025

The table shows the outer loading value of each indicator against the latent construct in the SEM-PLS model. In the Data-Driven Governance Innovation (Z) variable, all indicators (ITKB.3, ITKBD.1, and ITKBD.2) had a loading value above 0.70, which indicates good convergent validity. Institutional Quality (Y) also showed strong measurement strength, with KK.1 and KK.2 loading values above 0.80. In the Organisational construct (X2), most of the indicators meet the criteria, although O.3 has a marginal value so it needs to be considered theoretically. For Regulation (X3), there are indicators with negative (R.2) and very low (R.3) charges, which indicate specification problems or inconsistencies in respondents' perceptions. Meanwhile, Technology (X1) is relatively valid, although T.2 shows moderate contributions. Overall, these results confirm that the quality of measurements varies between constructs and requires further theoretical assessment.

2.   Discrimnant Validity

Discriminant validity refers to the extent to which a construct is truly distinct from other constructs in a model, meaning it captures a unique concept that is not simply a reflection of another variable. It is typically assessed by examining whether indicators load more strongly on their own construct than on others (cross-loadings), whether the square root of AVE for each construct is greater than its correlations with other constructs (Fornell–Larcker criterion), and whether the HTMT ratio falls below recommended thresholds (commonly < 0.85 or < 0.90, depending on model strictness). Strong discriminant validity indicates that each construct explains phenomena that are

conceptually and empirically different, reducing the risk of overlap and improving the interpretability and credibility of the measurement model.

Table 3. Cross Loading Value

	Data-Driven Governance Innovation (Z)	Institutional Quality (Y)	Organizational (X2)	Regulation (X3)	Technology (X1)
ITKB.3	0.863	0.444	0.175	0.169	0.344
ITKBD.1	−0.117	0.004	0.022	−0.190	−0.068
ITKBD.2	0.835	0.348	0.176	0.171	0.378
KK.1	0.425	0.836	0.202	0.058	0.262
KK.2	0.376	0.885	0.281	0.050	0.459
O.1	−0.084	−0.021	−0.196	0.065	0.222
O.2	−0.001	−0.047	−0.168	0.004	0.022
O.3	0.162	0.137	0.641	0.003	0.314
O.4	0.145	0.280	0.854	−0.100	0.323
R.1	−0.067	−0.014	0.192	−0.449	−0.015
R.2	−0.187	−0.072	0.066	−0.929	−0.050
R.3	0.090	−0.014	0.086	0.139	−0.099
T.1	0.427	0.440	0.291	−0.032	0.880
Q.2	0.234	0.145	0.212	0.126	0.509
T.3	0.236	0.284	0.303	−0.006	0.792

Source : Primary Data processed Smart-PLS 2025

The table represents the cross loading of indicators on the SEM-PLS model to assess the validity of the discriminator. In general, most indicators have the highest loading value on the construct that should be measured compared to other constructs, so that the discriminant validity can be declared met. The ITKB.3 and ITKBD.2 indicators showed the strongest correlation with Data-Driven Governance Innovation (Z), while KK.1 and KK.2 had the highest loading in Institutional Quality (Y). In the Organisational construct (X2), indicators O.3 and O.4 have a dominant contribution compared to other indicators. However, in the Regulation variable (X3) there were anomalies, especially R.2 with very high negative loading (-0.929), as well as weak R.1 and R.3, indicating potential conceptual problems or measurement misdirection. Meanwhile, the Technology (X1) indicator shows relatively good validity, although T.2 has moderate strength. These results confirm the need to re-evaluate regulatory indicators theoretically and empirically.

3.   Composite Reliability and Avarage Variance Extracted (AVE)

Composite Reliability (CR) and Average Variance Extracted (AVE) are two key metrics used to evaluate the quality of a measurement model, particularly in SEM-PLS and CFA. Composite Reliability assesses the internal consistency of indicators in measuring a latent construct, similar to Cronbach's alpha but generally considered more suitable in SEM because it accounts for different indicator loadings; values around ≥ 0.70 are typically seen as acceptable for established research. Meanwhile, AVE measures

convergent validity by indicating how much variance a construct captures from its indicators relative to measurement error; an AVE value ≥ 0.50 suggests the construct explains at least half of the indicator variance. Together, CR and AVE provide complementary evidence that a construct is measured reliably and that its indicators meaningfully represent the underlying concept.

Table 4. AVE Values

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Data-Driven Governance Innovation (Z)	0.834	0.811	0.618	0.785
Institutional Quality (Y)	0.953	0.664	0.851	0.741
Organizational (X2)	0.786	0.757	0.314	0.802
Regulation (X3)	0.538	0.872	0.445	0.361
Technology (X1)	0.802	0.732	0.780	0.554

Source: Primary Data processed Smart-PLS 2025

The table presents the results of convergent reliability and validity tests on the SEM-PLS model. The Data-Driven Governance Innovation (Z) and Institutional Quality (Y) constructs show excellent reliability, as reflected in Cronbach's Alpha and Composite Reliability values above 0.70 and AVE above 0.50. The Technology variable (X1) also meets the criteria of convergent reliability and validity. However, in the Organisational (X2) and especially Regulation (X3) constructs, the Composite Reliability and AVE values are relatively low, which indicates internal consistency and the ability to explain indicators that are not optimal. These findings show the need to re-evaluate indicators, especially in the regulatory dimension, in order to make construct measurements stronger and more stable.

4.   Hypothesis Testing

Hypothesis testing is a statistical procedure used to evaluate whether a proposed relationship or difference in a study is supported by empirical data. It begins by formulating a null hypothesis (H0), which assumes no effect or no relationship, and an alternative hypothesis (H1), which represents the expected effect or relationship. Researchers then select a significance level (commonly 0.05) and calculate test statistics (e.g., t-values, z-values, or path coefficients in SEM) to obtain a p-value that indicates how likely the observed results would occur if H0 were true. If the p-value is below the chosen threshold, H0 is rejected and the hypothesis is considered supported; if not, H0 is not rejected. In addition to significance, hypothesis testing should be interpreted alongside effect size and confidence intervals to understand the practical strength and precision of the findings.

a. Direect Effect; A direct effect refers to the immediate influence of an independent variable (X) on a dependent variable (Y) without passing through any intervening or mediating variable. In structural models such as SEM (PLS-SEM or CB-SEM) and regression analysis, the direct effect is represented by a path coefficient (β) or regression coefficient that shows the direction (positive/negative) and strength of the relationship. The significance of a direct effect is commonly assessed using t-statistics and p-values (often via bootstrapping in PLS-SEM), where a significant coefficient

indicates that changes in X are associated with changes in Y even after accounting for other variables in the model.

Table 5. Direect Effect Hypothesis Test

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Data-Driven Governance Innovation (Z) -> Institutional Quality (Y)	0.335	0.332	0.075	4.490	0.000
Organisational (X2) -> Data-Driven Governance Innovation (Z)	0.078	0.085	0.077	1.022	0.007
Organisational (X2) -> Institutional Quality (Y)	0.157	0.174	0.061	2.594	0.010
Regulation (X3) -> Data-Driven Governance Innovation (Z)	0.218	0.002	0.228	0.960	0.338
Regulation (X3) -> Institutional Quality (Y)	0.071	-0.027	0.096	0.739	0.000
Technology (X1) -> Data-Driven Governance Innovation (Z)	0.395	0.405	0.055	7.136	0.000
Technology (X1) -> Institutional Quality (Y)	0.370	0.371	0.063	5.835	0.000

Source : Primary Data processed Smart-PLS 2025

The table of the results of the SEM-PLS path coefficient test shows the strength and significance of the relationship between variables in the research model. Data-Driven Governance Innovation (Z) has a positive and significant effect on Institutional Quality (Y) (β = 0.335; T = 4,490; p < 0.001), emphasizing the role of mediating data-based governance innovation in improving institutional quality. The Technology variable (X1) has the strongest and most significant influence on both Z (β = 0.395; T = 7.136) or directly against Y (β = 0.370; T = 5,835), showing that technological readiness is the main determinant of the quality of public institutions. Organisational (X2) also had a significant effect on Y and Z, albeit with a smaller coefficient, which indicates the supporting role of organisational capacity and data-driven culture. In contrast, Regulation (X3) does not show significant influence on Z, and its direct influence on Y is relatively weak, suggesting that regulation is not effective if it is not accompanied by implementing capacity and governance innovation.

b. Indirect Effect; An indirect effect refers to the influence of an independent variable (X) on a dependent variable (Y) that occurs through one or more mediating variables (M). In mediation analysis and SEM, the indirect effect is calculated as the product of the path coefficients along the mediated route (e.g., X → M and M → Y), showing how much of X's impact on Y is transmitted through the mediator. Its significance is commonly tested using bootstrapping to generate t-values, p-values, and confidence

intervals; an indirect effect is considered significant when the confidence interval does not include zero. A significant indirect effect indicates that the mediator plays an important role in explaining the mechanism through which X affects Y.

Table 6. Indirect Effect Test

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Data-Driven Governance Innovation (Z) -> Institutional Quality (Y)					
Organisational (X2) -> Data-Driven Governance Innovation (Z)					
Organisational (X2) -> Institutional Quality (Y)	0.026	0.029	0.027	0.969	0.333
Regulation (X3) -> Data-Driven Governance Innovation (Z)					
Regulation (X3) -> Institutional Quality (Y)	0.073	0.002	0.078	0.944	0.000
Technology (X1) -> Data-Driven Governance Innovation (Z)					
Technology (X1) -> Institutional Quality (Y)	0.132	0.134	0.035	3.762	0.000

Source : Primary Data processed Smart-PLS 2025

The table represents the indirect effects in the SEM-PLS model through the Data-Driven Governance Innovation (Z) variable as a mediator for Institutional Quality (Y). The results show that Technology (X1) has a significant indirect influence on institutional quality (β = 0.132; T = 3.762; p < 0.001), emphasizing the mediating role of data-based governance innovation. In contrast, Organisational (X2) and Regulation (X3) did not show a significant mediating effect due to the T-value < 1.96, despite the positive coefficient direction. These findings indicate that organizational and regulatory capacity is not strong enough to drive institutional quality through data-driven innovation without adequate technological support.

5.   Qualitative Research Results, based on the analysis of Interviews with Informants
       The results of qualitative research obtained from in-depth interviews with informants show that data-based governance innovation is understood as a strategic need, but its implementation still faces various institutional challenges. The majority of informants emphasized that the use of data in decision-making has increased, especially in agencies that have adequate technological infrastructure and leaders who support the use of data-based evidence. Data is no longer just an administrative function, but is starting to be used for program planning, performance monitoring, and policy evaluation.
       However, the informant also revealed that the main obstacle does not lie in the availability of technology alone, but in the capacity of human resources and organizational culture. There is still resistance to change, especially in work units that are accustomed to conventional procedural approaches. In addition, limited data interoperability between agencies leads to data duplication and hinders system integration. In terms of regulations, the informant assessed that policy frameworks such as SPBE and Satu Data Indonesia are quite comprehensive, but their implementation has not been consistent at all levels of government. Overall, these qualitative findings confirm that the success of data-driven governance innovation is highly dependent on the

synergy between technology, organizational capacity, and leadership, which ultimately determines the improvement of the quality of public institutions.

6.   xplaining Institutional Quality Through Data-Driven Governance: The Roles of Technology, Organization, and Regulation

The discussion of the results of this study integrates quantitative findings from the SEM-PLS analysis and qualitative findings from in-depth interviews to provide a comprehensive understanding of the role of data-based governance innovation in improving the quality of public institutions. Quantitative results show that Data-Driven Governance Innovation (Z) has a positive and significant effect on Institutional Quality (Y), which reflects that the systematic use of data in the process of planning, decision-making, and policy evaluation is able to improve the accountability, effectiveness, and performance of public services.

These findings are in line with the digital public governance literature that emphasizes that the use of data and analytics strengthens institutional capacity through evidence-based decision-making. Interviews with informants reinforced these findings, with most officials assessing that work units that have adopted data-driven practices show increased transparency, clarity of performance targets, and consistency in program implementation. Thus, data-based governance innovation serves as an institutional mechanism that bridges technology and the quality of bureaucratic performance.

Furthermore, the results of SEM-PLS reveal that Technology (X1) is the most dominant determinant both for data-based governance innovation and directly for institutional quality. The strength of this influence shows that the availability of digital infrastructure, integrated information systems, and data analytics capacity are the main prerequisites for the success of digital bureaucratic reform. Qualitative findings confirm that agencies with stable systems, good data interoperability, and technology budget support are better able to utilize data strategically than agencies that only have basic administrative applications.

In contrast, Organisational influence (X2) was relatively more moderate, although significant, indicating that organizational capacity and data-driven culture play a supporting role. The informant emphasized that without a change in mindset, increased data literacy, and leadership that encourages innovation, technology investment is likely to be less optimal. This explains why the indirect influence of organizational variables through data governance innovation is not as strong as the influence of technology.

Meanwhile, the Regulation variable (X3) shows a weak and inconsistent influence on both data-based governance innovation and institutional quality. These findings indicate a gap between policy design and implementation on the ground. Interviews revealed that regulations such as SPBE and Satu Data Indonesia have provided a clear direction, but are still perceived as administrative obligations rather than strategic instruments. The lack of policy harmonization between levels of government, unclear division of authority, and weak oversight mechanisms make regulations not fully able to encourage data-based innovation.

CONCLUSION

Based on the results of quantitative and qualitative research, it can be concluded that data-based governance innovation has a strategic role in improving the institutional quality of the public sector. The SEM-PLS analysis shows that Data-Driven Governance

Innovation has a positive and significant effect on the quality of institutions, which reflects that data-driven decision-making is able to strengthen accountability, organizational effectiveness, and public service performance. Qualitative findings support these results by showing that agencies that have integrated data in policy planning, monitoring, and evaluation have more transparent and measurable work processes. Thus, data-driven governance innovation serves as a key mechanism that bridges the use of technology with improved institutional performance.

In addition, this study confirms that technology is the most dominant determinant in driving data-based governance innovation and institutional quality, while organizational capacity plays a supporting role as a supporting factor that strengthens the effectiveness of implementation. In contrast, regulations have not shown a strong impact, indicating a gap between policy frameworks and practices on the ground. These findings imply that digital bureaucratic reform in Indonesia is not enough to rely solely on formal regulations, but requires strengthening technology infrastructure, improving data literacy and culture, and leadership that encourages the sustainable use of data-based evidence to achieve better institutional quality.

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