

DIGITAL CAPACITY, RULE OF LAW, AND REGULATORY QUALITY AS DETERMINANTS OF GOVERNMENT EFFECTIVENESS: A POOLED OLS INTERACTION MODEL FOR EU MEMBER STATES

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Abstract: Government effectiveness, as a measurable institutional outcome, has been extensively studied, assessed and discussed in the academic literature. Building on the theories of moderation and institutional complementarity, this study argues that digital capacity, the rule of law, and regulatory quality are significant determinants of government effectiveness. The analysis draws on data for four internationally recognised composite indices used to assess the state of public administration. This study proposes a pooled OLS interaction model to examine whether the effects on government effectiveness depend on the levels of digital capacity, the rule of law and regulatory quality, and on the interactions among them.

The aim of this article is: 1. To outline the theoretical basis for the application of an institutional interaction model to the study of governance effectiveness; 2. To construct and apply such a model using observed cross-national data for EU countries and Bulgaria.

In this regard, the authors set themselves the following tasks: 1. To review a methodological framework for analyzing administrative structures; 2. To examine the influence of digital maturity, the quality of regulations, the rule of law and their multiplier effect on the effectiveness of public administration management in EU countries; 3. To draw conclusions about the institutional interaction of the three factors on the effectiveness of public administration in Bulgaria.

The findings reveal significant positive effects of digital capacity, the rule of law and regulatory quality on government effectiveness. The analysis of internationally comparable composite indices with longitudinal coverage enables both cross-national

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and temporal comparisons, yielding policy-relevant insights for strategies aimed at enhancing public administration effectiveness. Comparable panel data for the DES, RoL and RQ coefficients for all 27 EU Member States for the period 2022–2024 were used as independent variables determining the levels of the dependent variable Government Effectiveness (GE).

Key words: public administration, government effectiveness, e-government, rule of law, quality of regulation

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Introduction

Any serious examination of public administration must engage with its methodological framework for analysing administrative structures. This framework encompasses a variety of scientific methods, each of which has focused on specific parameters depending on the prevailing theory at any given time.

The search for the focus (what it studies) and the locus (what it concerns) of public administration marked the beginning of its emergence as an independent discipline and its separation from the political sciences. According to W. Wilson, cited by Shafritz and Hyde, administration lies outside the proper sphere of politics; consequently, administrative matters are not political matters, even though politics sets the tasks for administration (Shafritz & Hyde, 2016). Effective administration was conceived as neutral, professional and impartial, executing political decisions without interference. Its performance was measured by the consistency and impartiality with which laws were applied. This early conception of the administration as a professional and rationally organised system can also be linked to the classical concept of rational-legal bureaucracy, according to which the effectiveness of the state organisation is based on formalised rules, hierarchy and the impersonality of administrative action (Weber, 1922/1978). Later, analytical criticism of the universal principles of administration shifted the focus to decision-making processes within organisations (Simon, 1946).

As the discipline moved closer to the social sciences and management, attention shifted to internal structure and processes, initially drawing on the principles of effective public administration. It began to be evaluated on the basis of adherence to certain uni-versal principles, such as unity of command, span of control and specialisation. This line of development was also influenced by the classical management ideas of administrative

specialisation, the chain of command and organisational control, as formulated in early management literature (Fayol, 1949).

The humanistic organizational theory introduced a new dimension to the concept of effective administration by emphasizing the role of the human factor. The effectiveness of public institutions is assessed not only by the results achieved, but also by staff satisfaction and motivation. Research focuses on social norms, leadership and interpersonal relationships, the assumption that happier employees are more effective. This understanding is in line with the humanistic organisational tradition, which links effectiveness not only to formal structure but also to motivation, informal relationships and organisational climate (Mayo, 1933).

New Public Management (NPM) introduced clear criteria for effectiveness and efficiency, drawn from the private sector (Pollitt & Bouckaert, 2011). More broadly, this managerial shift was conceptualised by Hood, who systematised the key characteristics of New Public Management and emphasised the focus on measuring results, control through indicators, and the adoption of practices from the private sector (Hood, 1991). Within the framework of NPM, the assessment of effectiveness focuses on achieving 'value for money' (Agostino & Arnaboldi, 2015). This means that the public sector must provide maximum benefit to citizens at minimum cost. To achieve this, NPM relies on Key Performance Indicators (KPIs).

The concepts of the New Public Service (NPS) and the theory of New Public Administration (NPA) refocused attention on democratic values and the common good (Denhardt & Denhardt, 2000). This perspective is also close to the concept of public value, according to which the task of public organisations is not merely to operate efficiently, but to create socially significant value whilst possessing institutional legitimacy and organisational capacity (Moore, 1995). The administration came to be assessed on the extent to which it served citizens and encouraged their active participation. The results of its work were viewed in the context of the public interest and the potential for achieving social equality, rather than merely economic efficiency.

In the context of the concepts of NPS and NPA, key indicators for measuring the quality of public administration include various indices such as the Transparency Index, the Chandler Institute of Governance (CGGI), the Worldwide Governance Indicators (WGI), the E-Government Development Index (EGDI), the Digital Economy and Society Index (DESI), certain components of the Human Freedom Index (HFI), and others. Their advantage is that they cover many characteristics of public administration

and provide a comprehensive assessment of its state. At the same time, the literature emphasises that governance is a multidimensional concept and its measurement through composite indices requires conceptual caution, as different indicators capture different aspects of state capacity, institutional quality and the performance of public functions (Fukuyama, 2013).

Contemporary literature on digital government shows that digitalisation should not be understood merely as a technical upgrade, but as a more profound transformation of the logic of public administration. The concept of digital-era governance describes a transition beyond classical NPM towards more integrated, reintegrated and technologically connected forms of governance, in which digital solutions alter the way coordination, service delivery and administrative interaction take place (Dunleavy et al., 2006). More recent literature also shows that digital transformation has organisational and institutional implications that go beyond purely technological modernisation (Mergel, Edelmann, & Haug, 2019).

The empirical analysis employs a pooled OLS model incorporating two-way and three-way interaction effects among the DESI, RoL and RQ indices, alongside annual dummy variables, to address the following research questions and hypotheses:

Question 1: Is digital maturity significant for administrative effectiveness in EU Member States?

Question 2: Does the rule of law moderate or strengthen this relationship?

Question 3: How does the quality of regulations affect administrative effectiveness?

Question 4: What is the multiplier effect of the interaction among these factors on the effectiveness of public administration?

Question 5: What conclusions might be drawn for Bulgaria from the application of this model?

The theoretical logic of the model is based, on the one hand, on the distinction between direct and moderated effects, and on the other, on the idea of institutional complementarity, according to which the return on a single factor depends on the presence of other complementary institutional conditions (Baron & Kenny, 1986; Hall & Soskice, 2001; Milgrom & Roberts, 1990).

The following research hypotheses are proposed:

H1: The level of digitalisation is positively associated with the effectiveness of public administration.

H2: Stronger performance in the area of the rule of law significantly increases the effectiveness of governance.

H3: Regulatory quality also has a positive impact on the effectiveness of public administration.

H4: The combined interaction of digitalisation, the rule of law and regulatory quality can be quantified to inform policy design for public administration modernisation.

1. Theoretical Framework

Among the many indicators used to assess the state of public administration, several stand out because they are calculated using official surveys from prestigious international organisations. Among the most popular of these are the Worldwide Governance Indicators (WGI). Despite the widespread use of the WGI in comparative analyses, the composite nature of these indicators also implies a need for theoretical caution when interpreting them as measures of governance and state capacity (Fukuyama, 2013). The methodology for calculating the WGI, often referred to as 'Governance Indicators', was developed by the World Bank (Kaufmann et al., 2010) and represents a complex statistical model for aggregating multiple sources into six composite governance indices. The Worldwide Governance Indicators measure the quality of governance in over 200 countries across six dimensions:

1. Voice and Accountability
2. Political Stability and Absence of Violence
3. Government Effectiveness
4. Regulatory Quality
5. Rule of Law
6. Control of Corruption

Government Effectiveness (GE) constitutes one of the six WGI dimensions. The methodology for its calculation was developed by the World Bank and is based on the Unobserved Components Model (UCM), a statistical model for estimating a latent (unobserved) variable. GE is best understood as a widely used composite indicator of the perceived quality of public governance, rather than as an objective or exhaustive measure of administrative effectiveness (Fukuyama, 2013). In the present model, GE acts as a dependent variable.

Another subindex of the WGI is the Rule of Law Index (RoL). The methodology for calculating the RoL takes into account eight key factors:

1. Constraints on Government Powers
2. Absence of Corruption
3. Open Government
4. Fundamental Rights
5. Order and Security
6. Regulatory Enforcement
7. Civil Justice
8. Criminal Justice

Regulatory Quality (RQ), another WGI subindex, captures the government's capacity to formulate and implement sound policies that foster private sector development. It encompasses assessments of regulatory burden, ease of doing business, and the degree of economic intervention.

The progressive integration of digital technologies into public administration has led the European Commission to establish, from 2014 onwards, the Digital Economy and Society Index (DESI) as a systematic monitoring framework for Member States' digital progress (European Commission, 2025). It measures the structural digital maturity of countries across four dimensions, but does not incorporate the institutional and legal dimensions that featured in the earlier, broader DESI composite index. The use of DESI in this analysis is also supported by the literature, which suggests that digital technologies can enhance administrative effectiveness through better coordination, greater transparency, the reduction of transaction costs, and improved public service delivery, but only when supported by an adequate organisational and institutional environment (Cordella & Tempini, 2015).

The literature review identifies three interrelated institutional dimensions that theoretically determine administrative effectiveness, namely: digital capacity, the rule of law and the quality of regulation. Government Effectiveness has been selected as the dependent variable, as it represents a widely used and methodologically robust composite indicator that captures the perceived quality of public administration from a comparative perspective. The indicators on the DESI dashboard operationalise digital capacity at Member State level, whilst RoL and RQ, the other two components of the WGI, reflect the institutional and regulatory quality of the environment, in which the administration operates. The selection of these three indicators as independent variables stems not only from their conceptual compatibility with the theory of institutional complementarity, but also from the availability of

comparable panel data for all 27 EU Member States for the period 2022–2024.

2. Materials and Methods

To ensure cross-year comparability, only the four DESI components, officially reported from 2023 onwards within the Digital Decade framework, were drawn from the composite DESI for 2022. These are:

- Digital skills
- Digital infrastructure
- Digitalisation of business
- Digitalisation of public services

This selection aligns with the broader literature on digital government evolution, which treats digital skills, infrastructure, business digitalisation, and digital public services as interrelated dimensions of a broader digital transformation (Janowski, 2015; Mergel et al., 2019).

All raw indicator values were normalised using a min-max rescaling procedure, yielding a uniform 0-100 scale.

The analysis draws on cross-national secondary data and employs Pearson's correlation alongside a pooled OLS regression model incorporating two-way and three-way interaction terms. The full model specification is as follows:

$$GE_{it} = \alpha + \beta_1 DESI_{c,it} + \beta_2 RoL_{c,it} + \beta_3 RQ_{c,it} + \beta_4 (DESI_{c,it} \times RoL_{c,it}) + \beta_5 (DESI_{c,it} \times RQ_{c,it}) + \beta_6 (RoL_{c,it} \times RQ_{c,it}) + \beta_7 (DESI_{c,it} \times RoL_{c,it} \times RQ_{c,it}) + \varepsilon_{it}, \quad (1)$$

where:

c is a variable centered around the mean.

Centring reduces multicollinearity between main effects and interaction terms, and ensures that the main coefficients reflect the effect of each variable when the others are held at their mean. The other designations are:

i - country

t - year

it = observation for country i in year t .

The analysis covers all 27 EU Member States ($i = 1, 2, \dots, 27$) across three time points: 2022, 2023 and 2024.

The dependent variable in the model is the GE index - Government Effectiveness for country i , which measures the quality of public administration.

The independent variables are:

- DESI - Digital Economy and Society Index;
- RoL - Rule of Law Index;
- RQ - Regulatory Quality.

The model coefficients, estimated from panel data for all 27 EU Member States, are interpreted as follows:

- β_0 - Constant (intercept), representing the expected value of GE when all predictors are at their mean and the base year is 2022;
- β_1 - marginal effect of DESI on GE, holding RoL and RQ at their mean;
- β_2 - marginal effect of RoL on GE, holding DESI and RQ at their mean;
- β_3 - marginal effect of RQ on GE, holding DESI and RoL at their mean;
- β_4 - coefficient of the DESI×RoL interaction term;
- β_5 - coefficient of the DESI×RQ interaction term;
- β_6 - coefficient of the RoL×RQ interaction term;
- β_7 - coefficient of the three-way DESI×RoL×RQ interaction term.

The stochastic term ε_{it} captures all unmeasured factors, with the standard assumptions $E(\varepsilon_{it}) = 0$ and $Var(\varepsilon_{it}) = \sigma^2$.

3. Results

Following the logic of moderation analysis, the interaction coefficients capture the extent to which the effect of one variable on GE varies as a function of another (Baron & Kenny, 1986). Since all variables are mean-centred, the main effects are interpreted at the mean levels of the remaining predictors. The model yields the following estimates:

Intercept ($\alpha = 74.4591$): the expected value of GE when DESI, RoL and RQ are all at their mean and the base year is 2022. This value represents the baseline level of GE in the model.

Main effects

a) DESI ($\beta_1 = 0.1233$, $p = 0.0287$)

When $\overline{RoL}$ and $\overline{RQ}$ are held at their mean values, a one-unit increase in DESI corresponds to a predicted 0.1233-point increase in GE - an effect that is statistically significant at the 5% level.

b) RoL ($\beta_2 = 0.2809$, $p = 0.0794$)

When $\overline{DESI}$ and $\overline{RQ}$ are held at their mean values, a one-unit increase in RoL corresponds to a predicted 0.2809-point increase in GE. This effect

falls short of the conventional 5% significance threshold but approaches significance at the 10% level ($p = 0.0794$), indicating a positive but statistically weaker influence of RoL on GE.

c) RQ ($\beta_3 = 0.4624$, $p = 0.0029$)

When $\overline{DESI}$ and $\overline{RoL}$ are held at their mean values, a one-unit increase in RQ corresponds to a predicted 0.4624-point increase in GE - an effect that is highly statistically significant ($p = 0.0029$). Among the three predictors, RQ emerges as the strongest and most reliable positive predictor of GE.

Interactions

a) $DESI \times RoL$ ($\beta_4 = -0.0286$, $p = 0.0087$)

This statistically significant interaction ($p = 0.0087$) indicates that the effect of DESI on GE is conditional on the level of RoL, and vice versa. The negative coefficient implies that the positive effect of DESI on GE weakens as RoL increases - consistent with a dynamic of substitution or saturation rather than complementarity.

b) $DESI \times RQ$ ($\beta_5 = 0.0290$, $p = 0.0082$)

This significant interaction ($p = 0.0082$) indicates that the effect of DESI on GE is amplified at higher levels of RQ - consistent with institutional complementarity, whereby digitalisation yields greater returns when operating within a higher-quality regulatory environment.

c) $RoL \times RQ$ ($\beta_6 = 0.0020$, $p = 0.8044$)

The near-zero magnitude of this coefficient and the very high p-value provide no grounds for inferring any joint moderating effect of RoL and RQ on government effectiveness beyond their individual contributions.

Three-way interaction $DESI \times RoL \times RQ$ ($\beta_7 = 0.0006$, $p = 0.1740$)

The three-way interaction tests whether the effect of DESI on GE depends simultaneously on both RoL and RQ. The coefficient is positive but negligible, and fails to reach statistical significance ($p = 0.1740$). DESI, RoL and RQ therefore do not operate as a single integrated mechanism.

Annual effects:

a) Year 2023 ($\gamma_{2023} = -1.9284$, $p = 0.0600$)

Holding all other variables constant, GE in 2023 was on average 1.93 points lower than in the base year 2022, an effect that approaches but does not reach the conventional 5% significance threshold.

b) Year 2024 ($\gamma_{2024} = -1.7998$, $p = 0.0622$)

Holding all other variables constant, GE in 2024 was on average 1.80 points lower than in 2022, with a similarly marginal level of statistical significance.

To summarise, DESI and RQ exert positive and statistically significant effects on GE, whilst RoL has a positive but statistically weaker influence. The effect of DESI is conditional - weakening at higher levels of RoL and strengthening at higher levels of RQ. No significant three-way interaction was identified. GE in 2023 and 2024 was marginally lower than in 2022, though this pattern falls short of conventional significance thresholds.

These dynamics are best illustrated through a country-level application. The model is applied to Bulgarian data for the three years under review (2022, 2023 and 2024) using Equation 2.

$$GE = \alpha + \beta_1 DESI_c + \beta_2 RoL_c + \beta_3 RQ_c + \beta_4 (DESI_c \times RoL_c) + \beta_5 (DESI_c \times RQ_c) + \beta_6 (RoL_c \times RQ_c) + \beta_7 (DESI_c \times RoL_c \times RQ_c) + \gamma_{2023} + \gamma_{2024} \quad (2)$$

The values of the coefficients in the model are:

- $\alpha = 74.4591$
- $\beta_1 = 0.1233$
- $\beta_2 = 0.2809$
- $\beta_3 = 0.4624$
- $\beta_4 = -0.0286$
- $\beta_5 = 0.0290$
- $\beta_6 = 0.0020$
- $\beta_7 = 0.0006$
- $\gamma_{2023} = -1.9284$
- $\gamma_{2024} = -1.7998$

Table 1 reports the actual and fitted GE values for Bulgaria alongside the corresponding DESI, RoL and RQ scores.

Table 1

Input data for Bulgaria (normalised values, min-max, 0-100), actual and fitted values of Government Effectiveness (GE) derived from the interaction model, 2022–2024

Year	GE actual	DESI	RoL	RQ	Fitted GE	Residual (actual – fitted GE)
2022	49.9067	33.96	55.247	58.7677	52.9685	-3.0618
2023	53.4046	42.63	56.507	59.4055	56.205	-2.8004
2024	52.1731	40.53	56.3909	59.4055	55.3148	-3.1417

Source: Authors' own calculations

The model consistently overestimates GE for Bulgaria by approximately 2.8-3.1 points across the three-year period. This systematic bias can be interpreted through the lens of the state capacity literature,

according to which formal indicators of institutional quality and digital progress do not always fully capture the actual constraints on administrative implementation, interinstitutional coordination, and the sustainability of reforms (Fukuyama, 2013). The impact of the individual components of the model is presented in the following table:

Table 2
Breakdown of the forecast GE by model components for Bulgaria (normalised and centred values), 2022-2024

Year	Coeff. α	DESI	RoL	RQ	DESI×RoL	DESI×RQ	RoL×RQ
2022	74.4591	-2.7185	-5.6054	-5.9316	-12.5932	8.1976	0.5059
2023	74.4591	-1.6493	-5.2515	-5.6367	-7.1579	4.7262	0.4504
2024	74.4591	-1.9083	-5.2841	-5.6367	-8.3333	5.4683	0.4532

Year	Triple interaction	Year effect	GE
2022	-3.3453	0	52.968
2023	-1.8069	-1.9284	56.205
2024	-2.1037	-1.7998	55.315

Source: Authors' own calculations

Table 2 shows that whilst the intercept is high, almost all main effects reduce the fitted GE, reflecting Bulgaria's below-average scores on DESI, RoL and RQ relative to the EU mean. The strongest negative contributions stem from RoL, RQ and, in particular, the DESI × RoL interaction term. The only positive interaction contribution of note is DESI × RQ. The three-way interaction term is also negative, further depressing the fitted GE estimate for Bulgaria.

4. Discussion

The model demonstrates high explanatory power ($R^2 = 0.9125$, $\text{Adj.}R^2 = 0.900$), with approximately 91% of the variation in Government Effectiveness accounted for by the included variables and their interactions. This aligns with the literature on digital-era governance, which holds that digitalisation creates the potential for more effective and integrated administrative processes, but that its effect is contingent on institutional design and governance capacity (Dunleavy et al., 2006; Janowski, 2015).

Government Effectiveness in EU Member States during 2022–2024 is shaped not only by the individual values of DESI, RoL and RQ, but also by the interactions among them. This finding suggests that the impact of digital development on government effectiveness cannot be assessed in isolation from the broader institutional environment.

The positive and statistically significant coefficient for DESI confirms that higher levels of digitalisation are associated with greater government effectiveness. This is consistent with theoretical expectations: digital tools expand service access, enhance administrative coordination, and strengthen policy implementation capacity. Digital transformation thus emerges as an important structural driver of administrative capacity, a finding that aligns with the literature viewing digital transformation as a factor in organisational renewal and more effective public service delivery, but not as an automatic substitute for institutional capacity (Cordella & Tempini, 2015; Mergel et al., 2019).

RQ emerges as the strongest individual predictor of GE in the model. The positive and highly significant coefficient indicates that the institutional capacity to formulate and implement high-quality regulatory frameworks is directly associated with more effective governance. Even where digital tools are available, their impact on government effectiveness remains constrained if the regulatory environment does not enable their full utilisation, a finding consistent with broader quality-of-government concepts, according to which administrative effectiveness depends not only on the state's technical capacity but also on the quality of the institutional rules guiding public action (Rothstein & Teorell, 2008; Fukuyama, 2013).

RoL also exerts a positive effect on GE, albeit one that falls short of conventional significance thresholds. Its weaker statistical influence relative to RQ admits two interpretations. First, RoL may operate at a more foundational level, providing the institutional stability that underpins governance without necessarily producing short-term improvements in administrative effectiveness. Second, the weaker significance may reflect partial overlap between RoL and RQ, as both capture distinct but correlated dimensions of institutional quality.

The interaction terms yield particularly informative results. The positive and significant DESI×RQ interaction indicates that digitalisation yields greater gains in government effectiveness when operating within a high-quality regulatory environment. From the perspective of moderation analysis, the effect of DESI is not fixed but varies according to institutional conditions. From the perspective of institutional complementarity theory, the returns from

digitalisation are higher when supported by complementary regulatory conditions (Baron & Kenny, 1986; Milgrom & Roberts, 1990; Hall & Soskice, 2001).

The negative and statistically significant $DESI \times RoL$ interaction warrants careful interpretation. This should not be read as implying that the Rule of Law exerts an adverse influence on governance. Rather, in countries with already high levels of institutional legal stability, the marginal contribution of digitalisation to government effectiveness may be more limited - as baseline administrative performance is already relatively high. This is consistent with a saturation effect: where institutions already operate within a stable legal environment, digitalisation yields smaller additional gains than in countries where greater scope for institutional improvement remains.

For Bulgaria, the below-average values of DESI, RoL and RQ relative to the EU mean produce a compounded negative effect on fitted GE, with the $DESI \times RoL$ interaction term contributing the largest negative component. The $DESI \times RQ$ interaction partially offsets this, but the net effect remains negative, accounting for the model's consistent overestimation of approximately 3 points per year.

These findings are consistent with theoretical expectations drawn from digital-era governance and institutional theory. Countries such as Denmark and Estonia combine well-developed digital infrastructures with robust legal frameworks, yielding high levels of administrative effectiveness. Bulgaria's governance trajectory, by contrast, illustrates the challenges of partial digitalisation coupled with institutional instability. The evidence suggests that technological investment must be accompanied by structural reforms in the rule of law - consistent with the comparative literature, which holds that digital advantages translate into actual governance quality only when supported by a stable institutional architecture and sufficient public policy implementation capacity (Dunleavy et al., 2006; Hall & Soskice, 2001).

Conclusions

The study underscores the importance of institutional foundations in digital governance reform. Future research should investigate longitudinal dynamics and develop strategies for causal identification. This positions digital governance firmly within an institutionalist framework, in which technological capacity is a necessary, but not sufficient, condition for administrative effectiveness.

The model confirms that DESI and RQ exert positive and statistically significant effects on Government Effectiveness, whilst RoL has a positive but statistically weaker influence. Two significant interaction effects were identified: a negative DESI $\times$ RoL interaction and a positive DESI $\times$ RQ interaction - indicating that the effect of digitalisation on Government Effectiveness is conditional on the characteristics of the institutional environment. The three-way interaction among DESI, RoL and RQ does not reach statistical significance.

The model carries meaningful policy implications for the modernisation of public administration in Bulgaria. While the findings establish statistical associations rather than causal effects, the combined improvement of digital capacity and regulatory quality has the potential to generate better administrative outcomes than isolated investments in either domain alone. Reforms targeting integrated digital platforms and the interoperability of public databases are likely to yield greater impact when accompanied by structural measures to strengthen the institutional environment. Strengthening judicial independence and depoliticising the appointment of senior civil servants fall outside the scope of the present model, but represent structural prerequisites for sustainable administrative effectiveness. Accordingly, modernisation strategies should combine digital investment with institutional reform - an approach consistent with the literatures on institutional complementarities (Hall & Soskice, 2001), public value (Moore, 1995), and digital government transformation (Mergel et al., 2019).

Although the model demonstrates high explanatory power, the results should be interpreted as statistical associations rather than evidence of causality. The principal limitations include the short panel timespan, the relatively small number of observations, potential multicollinearity among the institutional indicators, and the likely presence of omitted variables that also bear on Government Effectiveness.

The principal contribution of this study is a pooled OLS interaction model that quantifies the combined and conditional effects of digital development and the institutional environment on Government Effectiveness across EU Member States. The findings demonstrate that the effect of DESI on GE is moderated by both RoL and RQ, advancing the understanding of the relationship between digitalisation and governance quality.

The scientific novelty of the study lies in the empirical application of an interaction specification that treats Government Effectiveness as a function not only of DESI, RoL and RQ individually, but also of their two-way and

three-way interactions - establishing that the digitalisation–governance relationship is inherently conditional on institutional context.

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