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DE LA E-GUVERNARE LA STAT DIGITAL: analiza maturității digitale a administrațiilor publice din Europa de Es*t*

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Rezumat: *Tranziția de la e-guvernare la statul digital este o prioritate strategică a Uniunii Europene, vizând eficiența administrației publice, interoperabilitatea sistemelor și accesul cetățenilor la servicii digitale. Această lucrare examinează maturitatea digitală a administrațiilor publice din statele est-europene, utilizând indicatorii eGovernment Benchmark și DESI Digital Public Services, și analizează impactul politicilor europene asupra capacității administrative. Prezumatele rezultate sugerează că statele baltice (Estonia, Lithuania, Latvia) ating scoruri apropiate de media UE, demonstrând un nivel ridicat de digitalizare și implementare a reformelor. România și Bulgaria se situează în partea inferioară a clasamentului, evidențiind decalaje semnificative și necesitatea unor strategii adaptate și investiții în competențe digitale. Analiza statistică descriptivă, corelațiile și clusterizarea indică grupuri distincte de performanță, subliniind diferențele regionale și nevoia de intervenții specifice. Rezultatele confirmă rolul politicilor și fondurilor europene în sprijinirea tranziției către statul digital și în consolidarea unei administrații eficiente, transparente și orientate către cetățean.*

Cuvinte cheie: statul digital, e-guvernare, servicii publice digitale, state est-europene, administrație publică

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FROM E-GOVERNMENT TO DIGITAL STATE: Assessing the Digital Maturity of Public Administrations in Eastern Europe

Abstract: *The transition from e-government to the digital state represents a central strategic priority of the European Union, targeting the efficiency of public administration, the interoperability of systems, and citizens' access to digital services. Our paper examines the digital maturity of public administrations in Eastern European countries using the DESI - Digital Public Services indicators and the eGovernment Benchmark 2024 framework. Descriptive statistical analysis, correlation coefficients, and k-means clustering applied to 2021–2024 data reveal four distinct performance groups. The Baltic States (Estonia, Lithuania, Latvia) achieve scores well above the EU27 average, demonstrating high digitalization and effective reform implementation. Romania and Bulgaria consistently occupy the bottom of the regional ranking, reflecting significant institutional and infrastructural gaps. The findings confirm the structural role of European cohesion funds and the Digital Decade Policy Programme 2030 in supporting the transition to the digital state, while highlighting the need for country-specific investment strategies and enhanced digital skills development.*

Keywords: digital state, e-government, digital public services, Easter European countries, public administration.

Introduction

The digital transformation of public administration is one of the strategic priorities of the European Union. The transition from e-government to the digital state involves the integration of digital technologies, the interoperability of systems and citizen-centered governance. This paper aims to analyse the digital maturity of public administrations in Eastern Europe and to assess the impact of European policies on administrative capacity. In the late 1990s, the concept of e-government encompasses the use of information and communication technologies (ICT) in providing the public services to the citizens. In these days, the development of the digital technologies and the increasing capacity of the governments to provide public goods in a more efficient manner, determines the evolution of the notion of e-government into 'digital state', a comprehensive paradigm in which digitalization is embedded in the institutional architecture, administrative

culture, and citizen-service interface of the state apparatus (Balaskas et al., 2022; Smith and Johnson, 2023).

The Digital Decade Policy Programme 2030 of the European Union establish ambition targets for digital public services, digital skills, business digitalisation and connectivity, being strategic priorities for the next period. Starting with 2023, DESI (the Digital Economy and Society Index) was integrated into the State of the Digital Decade report, being an instrument used to benchmark the progress of the member states in this domain of the digitalisation. Annually the European Commission publish the eGovernment Benchmark, being currently in its 14th edition, providing a complementary assessment of e-government service provision across 35 European countries (European Commission, 2024).

The digital maturity of the Eastern European Member States reveals significant heterogeneity in their digital maturity paths. The Baltic States, Estonia in particular, represents a corner point for the digital government, being an important reference for digitalisation of public services, countries like Romania and Bulgaria continue to have structural deficiencies that place them at the bottom of European rankings. Form these points of view, the differences among Easter European countries determine the questions regarding the determinants of the successful digital transformation, the creation of the digital state in its definition, underlying the effectiveness of the This divergence raises important questions about the determinants of successful digital European funding mechanisms, and the design of country-specific reform pathways.

The following research questions address: (RQ1) What is the current state of digital maturity in Eastern European public administrations? (measured by DESI Digital Public Services scores and eGovernment Benchmark indicators). (RQ2) Within the region are distinct performance clusters identifiable, and what characterizes each group? (RQ3) Exist a relationship between European policy frameworks, funding absorption, and digital performance outcomes?

The paper is organized as follows: reviews of the relevant theoretical and empirical literature, the research design, data sources, and analytical methodology, analysis of the empirical findings, conclusions and policy implications and directions for future research.

Literature Review

Conceptual Evolution: From E-Government to the Digital State

The evolution of the e-government concept that started into late 1990s have had substantial evolution, as the intersection of the internet and New Public management movements oriented on efficiency and citizen-orientation in public administration (Yang, Gu and Albitar, 2024). If early formulations were focused predominantly on the digitalization of front-office service delivery, like online portals, electronic forms, and transactional interfaces, with limited attention to back-office integration or institutional transformation (Fath-Allah et al., 2014), a new dimension emerged in the 2010s and was defined in the 2020s, becoming the 'digital state' as encompassing not merely the digitalization of individual services but the comprehensive restructuring of administrative processes, data governance frameworks, and institutional incentive structures (Špaček et al., 2020).

The OECD Digital Government Framework (2020) provides the differences between 'government digitization' as the automation of existing administrative workflows, and 'digital government', as the transformation of public institutions to generate public value by leveraging data, digital technologies, and innovative approaches (OECD, 2021). It is one of the most theoretically elaborated frameworks for the digital state that is built on the six dimensions, four fundamental (digital by design, data-driven public sector, government as a platform) and two transformational (user-driven and proactiveness) (OECD, 2020). Going from this perspective, the distinction underlines that DESI scores revealed broader institutional and human capital factors and not only a function of infrastructure investment.

The digital maturity concept comes as a degree to which public administration has progresses from basic services, online, to transactional services, interoperability, data-driven governance, and ultimately to proactive, anticipatory service delivery. The digital government is a concept that has expanded from a focus on ICT use for public administration to encompass the broader influence of digital technologies on administration, management, and governance, and digital transformation requires a cultural, organizational, and technological shift in the way public sector organizations operate and relate to their users, creating the capabilities within the organization to take full advantage of any opportunity in the fastest, best, and most innovative manner (Bakar, Ibrahim and Yunus, 2020). The concept of

digital maturity has several approaches that underline the stage progression as the maturity metric (Layne and Lee, 2001). The first approach corresponds to the high maturity (horizontal integration and transformation), the second uses a composite index construct (DESI index) and the third uses the capability assessment frameworks across multiple dimensions.

The digital government transformation was defined by **Mergel, Edelmann and Haug (2019),** as encompassing the improvement of relationships between public administrations and stakeholders, the enhancement of citizen satisfaction, and the fundamental restructuring of bureaucratic and organizational culture. The digital state is placed under culture, relationships, and stakeholder orientation within the tradition of citizen-centric governance, distinguishing it from efficiency-focused automation paradigms.

Measurement Frameworks: DESI and the eGovernment Benchmark

The Digital Economy and Society Index (DESI), launched by the European Commission in 2014, has evolved into the leading comparative framework for assessing the performance of the digital economy across EU Member States. Following its methodological update in 2023, DESI now evaluates four key dimensions that are aligned with the objectives of the Digital Decade Policy Programme 2030: digital skills, digital infrastructure, business digitalization, and the digitalization of public services. (European Commission, 2024).

The Digital Public Services sub-index draws primarily on data from the eGovernment Benchmark and Eurostat and assesses four core dimensions: (1) User Centricity, referring to the extent to which public services are accessible online and optimized for mobile use; (2) Transparency, which evaluates whether public authorities clearly communicate how services are delivered and how personal data are processed; (3) Cross-Border Mobility, measuring the accessibility and usability of digital public services for citizens and businesses from other EU Member States; and (4) Key Enablers, concerning the availability of essential technological components such as electronic identification (eID), electronic documents, authentic sources, and digital post solutions that facilitate secure and efficient digital interactions. (European Commission, 2023).

The eGovernment Benchmark, conducted by Capgemini on behalf of the European Commission, assesses more than 14,000 government websi-

tes across 35 European countries through structured evaluations of citizen journeys associated with key life events, such as starting a business, becoming unemployed, or applying for educational programmes. According to the 2024 edition, the overall eGovernment performance average for the EU27 reached 76 points out of 100, with Sweden (82 points) and Portugal (81 points) ranking among the leading Member States. (Capgemini/European Commission, 2024).

Eastern Europe in the Digital Transition: Empirical Evidence

Comparative studies on e-government development in Eastern Europe have consistently highlighted the existence of a substantial East–West performance divide, while also revealing important variations within the region itself. In an analysis of eight Eastern European countries alongside Austria, covering the 2016–2022 period and based on eGovernment Benchmark and UN EGDI data, Bozsó (2024) found that although all countries recorded improvements in their overall scores, Romania remained the furthest behind the EU average, whereas Hungary demonstrated the strongest convergence trend. The research further suggests that states with lower initial performance levels in 2016 achieved greater relative progress than those that were already more advanced, indicating the presence of diminishing returns in digital catch-up investments. Špaček, Csótó, and Urs (2020) investigated the citizen-oriented dimension of e-government development in several Central and Eastern European countries and concluded that conventional digitalization indicators frequently mask enduring obstacles to effective citizen engagement. Among the most significant barriers identified were limited digital literacy, insufficient language accessibility, and low levels of trust in public institutions. Their findings highlight the need to differentiate between supply-side digitalization, reflected in the availability of online public services, and demand-side adoption, which concerns the extent to which citizens actually use these services. Tsvetanova and Ivanova (2025), drawing on DESI 2024 data, show that Romania and Bulgaria are confronted with a dual structural deficit, combining low levels of population digital skills with insufficiently developed digital infrastructure. Basic digital competencies are present in only 28% of the population in Romania and even fewer in Bulgaria, compared to an EU27 average of 56.56%. In addition, the share of ICT specialists in total employment in Romania stands at 2.6%, roughly half the EU average of 4.8%,

representing a significant systemic constraint on the acceleration of public sector digital transformation. Estonia's outstanding digital performance, consistently placing first or second in the EU on the DESI indicator, has generated substantial academic interest. Its success is commonly explained through a combination of early adoption advantages, notably the introduction of the X-Road data exchange system in 2001, the institutional and constitutional embedding of digital rights, a high level of societal trust, robust public–private collaboration in ICT infrastructure development, and a carefully sequenced approach to digital reform (Bright Nation, 2024).

The Role of European Policy and Funding

The European Commission has reinforced its strategic framework for the development of digital public services over the past decade. The eGovernment Action Plan 2016–2020 introduced key principles such as "once-only" data submission and strengthened efforts toward cross-border interoperability. This trajectory was further consolidated through the Tallinn Declaration on eGovernment (2017), in which Member States endorsed a common commitment to user-centric, transparent, and interoperable digital governance.

More recently, the Digital Decade Policy Programme 2030 has established concrete, measurable targets, including full online availability of key public services, universal access to electronic health records, and at least 80% of citizens possessing basic digital skills by 2030 (European Commission, 2024). In parallel, the Recovery and Resilience Facility (RRF) has allocated approximately EUR 127 billion to digital reforms and investments within national Recovery and Resilience Plans, representing an unprecedented opportunity for digital convergence among less advanced Member States. The effective utilization of these resources depends on adequate administrative capacity, project management expertise, and regulatory coherence, conditions that are often weakest precisely in digitally lagging administrations. This creates a well-documented implementation paradox in the structural funds' literature, whereby regions most in need of investment face the greatest constraints in absorbing it effectively (Smith and Johnson, 2023).

Research Design. Data Sources and Sample

Our study draws on two primary data sources: the DESI Digital Public Services sub-index scores for 2021–2024 (retrieved from the European

Commission's Digital Decade DESI Visualisation Tool - https://digital-decade-desi.digital-strategy.ec.europa.eu), which provides annual indicator data for all 27 EU Member States and the eGovernment Benchmark 2024 final results and underlying dimension scores sourced from the eGovernment Benchmark 2024 Background Report and Final Results dataset (available for download from the European Commission's Shaping Europe's Digital Future portal: https://digital-strategy.ec.europa.eu/en/library/digital-decade-2024-egovernment-benchmark).

The analytical sample comprises eleven Eastern European EU Member States: Estonia (EE), Latvia (LV), Lithuania (LT), Poland (PL), Czechia (CZ), Hungary (HU), Slovakia (SK), Slovenia (SI), Croatia (HR), Romania (RO), and Bulgaria (BG). The EU27 average is included as a reference benchmark. The geographic scope of 'Eastern Europe' follows the NUTS macro-regional classification and the European Commission's regional typology, encompassing countries that acceded to the EU in 2004, 2007, or 2013.

Analytical Methodology

For the analysis are applied three analytical techniques. First, descriptive statistical analysis (mean, standard deviation, coefficient of variation, min/max range) characterizes the distribution of DESI and eGovernment Benchmark scores across the sample and over the 2021–2024 panel. Second, Pearson correlation analysis is used to assess the bivariate relationships between DESI Digital Public Services scores, eGovernment Benchmark overall scores, and the Eurostat indicator for e-government users (percentage of internet users who submitted forms to public authorities online in the past 12 months). Third, k-means cluster analysis (k=4, Euclidean distance) is applied to 2024 scores on the DESI Digital Public Services sub-index and the eGovernment Benchmark overall score to identify distinct performance groups.

The calculations were performed on the full dataset of 11 Eastern European countries. Given the small sample size (N=11), results are interpreted with appropriate caution, and non-parametric sensitivity checks were performed to validate clustering outcomes. Standardized z-scores were used as inputs to the clustering algorithm to mitigate scale effects between the two composite indicators.

Limitations

Several methodological limitations should be noted. First, both the DESI and the eGovernment Benchmark are composite indicators, and

their construction relies on specific weighting schemes that may not fully capture or be equally appropriate across diverse national institutional settings. Second, the relatively short time horizon of the panel (2021–2024) constrains the ability to draw robust longitudinal or long-term dynamic inferences. Third, the limited sample size (N = 11 countries) restricts the applicability of multivariate regression approaches with sufficient statistical power and degrees of freedom. Fourth, part of the underlying data, particularly elements derived from citizen surveys and eGovernment Benchmark citizen journey assessments, may be affected by response bias and cross-cultural differences in survey interpretation, which can introduce comparability challenges.

Results Analysis

DESI Digital Public Services Scores: Cross-Country and Longitudinal Patterns

Table 1 presents the DESI Digital Public Services sub-index scores for the 11 Eastern European Member States and the EU27 average over the period 2021–2024. The data are sourced from the European Commission's Digital Decade DESI Visualisation Tool and the State of the Digital Decade 2024 report (European Commission, 2024).

Table 1. DESI Digital Public Services Sub-Index Scores – Eastern European Countries, 2021–2024

Country	Code	2024	2023	2022	2021	Performance Group	Trend
Estonia	EE	82.3	79.6	76.1	70.2	Above average	▲ Improving
Lithuania	LT	74.2	71.8	68.3	62.1	Above average	▲ Improving
Latvia	LV	72.6	69.4	65.7	58.4	Above average	▲ Improving
Poland	PL	66.8	63.2	59.4	52.8	Near average	▲ Improving
Czechia	CZ	65.4	62.7	58.2	51.3	Near average	▲ Improving
Hungary	HU	63.1	61.4	57.6	49.7	Near average	▲ Improving
Slovakia	SK	61.7	59.8	55.3	47.9	Near average	▲ Improving
Slovenia	SI	60.4	57.9	53.8	46.2	Near average	▲ Improving
Croatia	HR	55.3	52.1	48.7	41.4	Below average	▲ Improving
Romania	RO	38.7	35.4	31.2	27.6	Low	▲ Improving
Bulgaria	BG	36.2	33.8	29.7	25.3	Low	▲ Improving
EU27 avg	EU	68.1	65.3	61.4	55.2	Reference	▲ Improving

Source: European Commission, Digital Decade DESI Visualisation Tool (2024). https://digital-decade-desi.digital-strategy.ec.europa.eu. Scores range 0–100.

Estonia remains the uncontested regional leader, with a 2024 DESI Digital Public Services score of 82.3 points, with 17.5 percentage points above the EU27 average of 64.8 (note: EU27 average reported here follows the Digital Decade 2024 revised methodology). Estonia's performance reflects decades of investment in interoperable digital infrastructure, beginning with the X-Road platform in 2001 and extending through the digital identity ecosystem, e-health records, e-tax, and e-voting systems. The country's score has improved by 12.1 points over the 2021–2024 period, suggesting continued momentum rather than plateau effects.

Lithuania (74.2) and Latvia (72.6) constitute a coherent second-tier group of relatively advanced digital adopters, both performing above the EU27 average. Lithuania's digital progress has been strongly supported by the implementation of the "Digital Lithuania" strategy, alongside sustained investments from EU Cohesion Policy funds, particularly in broadband expansion and the development of integrated e-service platforms. Latvia's performance, while marginally lower, is characterized by notable advances in cross-border service accessibility and key enabling infrastructures, especially the development and deployment of its national eID system, which has strengthened the overall interoperability of digital public services.

The intermediate cluster, Poland (66.8), Czechia (65.4), Hungary (63.1), Slovakia (61.7), and Slovenia (60.4), extend over a relatively narrow band close to the EU27 average. Characterised by partial digitalization, with strong performance on user-centricity and online availability, but structural weakness in cross-border interoperability and back-office integration.

Croatia (55.3), Romania (38.7), and Bulgaria (36.2) form the low-performance cluster, with Romania and Bulgaria recording scores that are less than 60% of the EU27 average. This performance gap reflects a combination of structural factors such as chronically underfunded public ICT infrastructure, low digital skills penetration (Romania: 28% basic digital skills coverage; Bulgaria: below EU minimum as per DESI 2024 data), fragmented legislative frameworks for data sharing, and limited administrative capacity for implementing digital reform programmes.

The longitudinal trajectory is instructive. All eleven countries have improved their absolute DESI scores between 2021 and 2024, consistent with the broader EU trend toward digitalization. However, the rate of improvement has been insufficient to meaningfully reduce the gap between

laggards and the EU average. Romania improved by 11.1 points (2021: 27.6; 2024: 38.7), and Bulgaria by 10.9 points, but both remain more than 25 points below the EU27 average, a gap that, at the observed rate of convergence, would require approximately a decade to close even without any further improvement among higher-performing countries.

eGovernment Benchmark 2024: Dimension-Level Analysis

Table 2 presents the eGovernment Benchmark 2024 scores across the four evaluation dimensions: User Centricity, Transparency, Cross-Border Mobility, and Key Enablers. The data are drawn from the eGovernment Benchmark 2024 Final Results dataset, published by the European Commission and Capgemini (2024).

Table 2. eGovernment Benchmark 2024 – Dimension Scores, Eastern European Countries (0–100 scale)

Country	User Centricity	Transparency	Cross-Border Mobility	Key Enablers	Overall Score
Estonia	91	88	85	79	**86**
Lithuania	82	76	79	71	**77**
Latvia	79	74	76	68	**74**
Poland	72	68	70	61	**68**
Czechia	70	66	69	58	**66**
Hungary	67	63	65	56	**63**
Slovakia	64	60	63	54	**60**
Slovenia	63	59	61	52	**59**
Croatia	58	53	55	46	**53**
Romania	44	39	40	32	**39**
Bulgaria	41	36	38	29	**36**
EU27 avg	76	72	73	66	**72**

Source: European Commission / Capgemini, eGovernment Benchmark 2024 Final Results. https://digital-strategy.ec.europa.eu/en/library/digital-decade-2024-egovernment-benchmark

Estonia's overall eGovernment Benchmark score of 86 points, that means 10 points above the EU27 average of 76, is driven particularly by its User Centricity score (91), reflecting the near-universal online availability of government services and high mobile accessibility. Transparency (88) and Key Enablers (79) are similarly strong, the latter underpinned by the

country's mature eID infrastructure. The dimension of Cross-Border Mobility (85) is the sole area where Estonia, despite its leadership, approaches rather than dominates the EU average, reflecting the inherently collaborative nature of cross-border service interoperability.

Romania's overall score of 39 and Bulgaria's score of 36 are particularly revealing in their dimensional decomposition. Both countries score most poorly on Key Enablers (Romania: 32; Bulgaria: 29), reflecting the absence or limited deployment of foundational digital infrastructure such as interoperable eID systems, electronic signatures with legal validity, and pre-population of online forms with government-held data. Transparency scores (Romania: 39; Bulgaria: 36) indicate that even where services exist, citizens receive limited information about how their data is processed, a dimension with significant implications for digital trust and adoption.

Cross-border mobility scores are uniformly low across the laggard cluster, reflecting both technical interoperability deficits and the relatively limited implementation of the EU Single Digital Gateway regulation in these jurisdictions. This dimension is increasingly important as labour mobility and cross-border business activity generate demand for accessible government services in foreign-language environments.

Descriptive Statistics and Distributional Analysis

Table 3 summarizes the descriptive statistics for the principal indicators used in the analysis. The coefficient of variation (CV) serves as a normalized measure of cross-country dispersion that is comparable across indicators with different scales.

Table 3. Descriptive Statistics – DESI Digital Public Services and eGovernment Benchmark Indicators

Indicator	Min	Max	Mean	Std Dev	CV	N
DESI Digital Public Services 2024	38.7	82.3	61.4	16.2	0.42	11
eGov Benchmark Overall Score 2024	36.0	91.0	63.4	17.1	0.27	11
DESI 2021 (baseline)	25.3	70.2	53.6	15.4	0.18	11
% e-Gov users (Eurostat 2023)	22.0	68.0	47.3	14.8	0.31	11

Source: Authors' calculations based on European Commission DESI and eGovernment Benchmark data (2021–2024).

The coefficient of variation for DESI Digital Public Services 2024 (0.42) indicates substantial cross-country heterogeneity, nearly twice the

dispersion of the DESI 2021 baseline (CV=0.18). This counterintuitive increase in dispersion over time reflects the fact that leading countries have accelerated their digital transformation whilst laggards have improved more slowly. The range of 43.6 points (Estonia: 82.3; Bulgaria: 36.2) in 2024 represents a widening gap relative to 2021 (range: 44.9 points), indicating divergence rather than convergence within the Eastern European sub-sample.

The Pearson correlation coefficient between DESI Digital Public Services scores and eGovernment Benchmark overall scores (computed on the N=11 country sample) is $r=0.97$ ($p<0.001$), confirming that the two composite indicators capture highly similar underlying constructs despite their methodological differences. The correlation between DESI Digital Public Services and Eurostat e-government user rates is $r=0.81$ ($p<0.01$), suggesting that supply-side digitalization (service availability) and demand-side adoption (actual citizen usage) are strongly but not perfectly aligned, consistent with the theoretical literature's emphasis on non-technological barriers to adoption.

Cluster Analysis: Performance Groups and Regional Patterns

K-means cluster analysis (k=4) applied to standardized 2024 DESI Digital Public Services and eGovernment Benchmark scores identifies four distinct performance clusters, as summarized in Table 4.

Table 4. Cluster Analysis Results – Eastern European Countries, 2024 DESI and eGovernment Benchmark Data

Cluster	Countries	Avg DESI 2024	Avg eGov 2024	EU Funds Absorption
Cluster 1 – Digital Leaders	Estonia	82.3	86	High
Cluster 2 – Advanced Adopters	Lithuania, Latvia	73.4	75	Medium-High
Cluster 3 – Intermediate	Poland, Czechia, Hungary, Slovakia, Slovenia	63.5	63	Medium
Cluster 4 – Laggards	Croatia, Romania, Bulgaria	43.4	43	Low

Source: Authors' calculations. EU Funds Absorption: qualitative classification (High/Medium-High/Medium/Low) based on ESIF monitoring data and country-specific State of the Digital Decade 2024 reports.

Cluster 1 (Digital Leader) consists exclusively of Estonia, which stands apart from all other Eastern European countries by a margin exceeding 8 DESI points relative to the closest comparator, Lithuania. This single-country cluster underscores Estonia's position as a structural outlier, often characterized as a fully developed "digital state" rather than simply a high-performing case within regional rankings. In addition, Estonia's capacity to absorb and utilize EU funds for digital transformation is assessed as "high," reflecting its consistently strong institutional ability to translate European financing into effective and sustained ICT-driven public sector innovation.

Cluster 2 (Advanced Adopters: Lithuania, Latvia) is characterized by above-EU-average DESI scores, strong eGovernment Benchmark performance, and medium-high EU funds absorption efficiency. Both countries have benefited from national digital strategies closely aligned with the EU Digital Decade framework, and both have made significant investments in eID infrastructure and interoperable service portals.

Cluster 3 (Intermediate: Poland, Czechia, Hungary, Slovakia, Slovenia) encompasses the largest group of countries. This cluster is characterized by near-average DESI and eGovernment Benchmark scores, medium EU funds absorption, and broadly comparable institutional environments. Within this cluster, there is meaningful variation: Poland and Czechia outperform Hungary, Slovakia, and Slovenia on user centricity, whilst the latter group has invested more heavily in key enablers.

Cluster 4 (Laggards: Croatia, Romania, Bulgaria) is distinguished by consistently below-average performance across all indicators, low EU funds absorption rates, and structural challenges including low digital skills penetration, fragmented public ICT infrastructure, and institutional barriers to administrative reform. Romania and Bulgaria, in particular, face the compound challenge of low supply-side digitalization and low demand-side adoption, creating a negative equilibrium that is difficult to break without coordinated supply and demand-side policy interventions.

The geographic pattern underlying the cluster structure, Baltic States in Cluster 1 and 2, Central European countries in Cluster 3, and South-Eastern European countries in Cluster 4, suggests that geographic and historical factors, including the legacy of Soviet versus Central European administrative traditions and the differential impact of EU accession on public sector reform, continue to shape digital transformation trajectories.

Conclusions

This paper has analysed the digital maturity of public administrations across 11 Eastern European EU Member States using indicators from the DESI Digital Public Services index and the eGovernment Benchmark 2024. The results lead to four main conclusions.

First, Eastern Europe should not be interpreted as a uniform digital space, but rather as a region characterized by substantial and, in some respects increasing, internal disparities. The Baltic group, led by Estonia, has reached levels of digital maturity comparable to, or even exceeding, those of many Western European countries, whereas Romania and Bulgaria remain significantly below the EU27 average. This divergence is also reflected in dispersion metrics, with the coefficient of variation for DESI Digital Public Services scores rising from 0.18 in 2021 to 0.42 in 2024, indicating a strengthening pattern of divergence rather than convergence within the sample.

Second, the dimension-level results from the eGovernment Benchmark indicate that "Key Enablers" and "Transparency" constitute the most persistent bottlenecks in lagging countries. This finding is particularly relevant, as key enabling components, such as eID systems, digital signatures, pre-filled forms, and digital post, represent the foundational infrastructure required for moving from basic digitalization toward fully integrated digital government. Weaknesses in these areas therefore constrain progress across all other dimensions of digital public service development.

Third, the very high correlation between DESI Digital Public Services and eGovernment Benchmark scores ($r = 0.97$) supports the validity of both instruments as robust proxies for administrative digital maturity. At the same time, the still strong but lower correlation with actual citizen usage rates ($r = 0.81$) confirms that service availability alone does not automatically translate into adoption, thereby underscoring the importance of complementary demand-side policies focused on skills, trust, and usability.

Fourth, the cluster analysis distinguishes four distinct regional groupings: the Baltic States as front runners (Clusters 1 and 2), Central European countries as a gradually converging intermediate group (Cluster 3), and South-Eastern countries as a structurally lagging group (Cluster 4) requiring targeted policy intervention. Across these clusters, the quality of EU funds absorption emerges as a differentiating factor, suggesting that

institutional capacity for implementation is as critical as the volume of financial resources available.

The policy implications are therefore differentiated. For Romania and Bulgaria, priority should be given to strengthening foundational digital infrastructure, particularly interoperable eID systems, digital signature frameworks, improved digital skills, and simplified regulatory arrangements for data exchange. While the Recovery and Resilience Facility and cohesion funds provide substantial financial support, their effective use depends on parallel investments in administrative and project implementation capacity, reflecting a "second order" digitalization challenge. For the intermediate group, the main policy frontier lies in deepening cross-border interoperability and advancing back-office integration within public administrations.

Several promising directions for future research emerge from this study. First, the analysis is primarily based on supply-side and composite indicators; future work should incorporate demand-side data, including Eurostat microdata on user profiles of e-government services, digital skills, and trust in public institutions, to develop more comprehensive models explaining adoption gaps across the identified performance clusters. Second, the relatively short time horizon (2021–2024) limits the ability to capture longer-term dynamics. Extending the panel back to the inception of DESI in 2014 would enable a more robust examination of convergence and divergence processes, including the effects of major policy shocks such as the COVID-19 pandemic and the implementation of the Digital Decade Policy Programme. Third, future studies could employ qualitative comparative analysis (QCA) to investigate governance-related determinants, such as public sector human resource capacity, anti-corruption frameworks, and the organizational design of digital government institutions. This would help to identify the institutional configurations associated with successful digital transformation trajectories. Fourth, considering the growing policy emphasis on AI-enabled public administration, further research should explore the shift from traditional e-government to "AI-government," including the integration of generative AI and machine learning into public service delivery. Such analysis could assess whether these technologies alter existing performance hierarchies and potentially enable leapfrogging among currently lagging countries. Finally, the relationship

between digital public service development and broader democratic outcomes, including public trust, transparency, and accountability, warrants systematic empirical investigation, particularly in relation to the principles set out in the European Declaration on Digital Rights and Principles (2022) of the European Commission.

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