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Nudging digital transformation: behavioral economics approaches to e-government adoption in the European Union with implications for Romania

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Abstract: This paper examines the application of behavioral economics principles to digital government adoption across the European Union in 2024, with specific implications for Romania and Eastern Europe. Despite increasing investments in digital infrastructure and services, individuals' adoption of e-government solutions remains uneven across Europe, with behavioral barriers often overlooked in technology adoption strategies. The study employs comparative analysis of existing data from the EU Digital Economy and Society Index (DESI), national digital government initiatives, and published case studies to identify effective behavioral interventions. The research aims to identify critical behavioral techniques driving digital adoption in European public administration, including pre-filled forms, user support, mobile centricity, and transparency by design. Findings reveal important considerations for Romanian public administrators seeking to accelerate digital government adoption through behavioral approaches. This paper contributes to the ongoing research in the field of behavioral public administration by analytically comparing successful behavioral strategies in the European digital government context and proposing similar strategies to be applied in Romania's ongoing digital transformation efforts.

Keywords: behavioral economics; behavioral insights; digital transformation; public administration, public services

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Introduction

The digital transformation of public services represents one of the most significant changes of the 21st century. Across Europe, governments have invested billions of euros in digital infrastructure, online platforms, and e-services to improve public service delivery, enhance administrative efficiency, and increase citizen engagement. Despite these substantial investments and the clear benefits of digital government adoption, uptake remains uneven across member states and citizen demographics (Yera et al., 2020; Androniceanu, 2024)). This gap between technological availability and actual usage represents a critical challenge for policymakers and public administrators throughout the European Union. While traditional explanations for this adoption gap focus on technological infrastructure, digital literacy, and socioeconomic factors, this paper argues that behavioral barriers often play an equally important yet frequently overlooked role in limiting digital government adoption (Horobet et al., 2023).

Building on research from behavioral economics—a field that examines the intersection between psychology and economics (Benartzi et al., 2017)—this paper examines how behavioral principles have been applied to enhance digital government adoption across European contexts by assessing publicly available data, such as DESI indicators. The behavioral economics perspective offers unique insights into human decision-making that more traditional approaches may miss. Concepts such as nudges, defaults, and social norms can significantly influence how citizens interact with government services. As Thaler and Sunstein (2008) demonstrated through their concept of "nudges," small and cost-effective interventions that account for these behavioral tendencies can improve policy and societal outcomes without restricting freedom of choice (Thaler and Sunstein, 2008).

Taking these principles and applying them to build a digital government, it can be observed that the way options are presented to citizens is as important as the digital solutions themselves. This study is contributing to the existing body of research placed at the intersection of behavioral economics, technology innovation, and European public administration. While extensive research exists on technical aspects of e-government implementation and separate studies examine behavioral interventions in public policy, few scholars have analyzed how behavioral economics principles can enhance digital government adoption specifically in the European context, with even less attention paid to applications in Eastern European countries like Romania.

As a result, the primary research questions this paper is looking to answer are:

RQ1: What are the key indicators of e-government adoption in different European countries?

RQ2: Have behavioral economics principles been effectively applied to enhance digital government adoption across European Union member states?

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RQ3: What lessons and best practices from successful behavioral interventions in digital government can be applied to Romania and other Eastern European contexts?

To address these questions, this study employs comparative analysis, and the quantitative data used for this study comes from the EU Digital Economy and Society Index (DESI), national digital government initiatives, and existing research. As opposed to generating new primary data, this approach is based on rich, existing data which can be used to identify patterns, successful interventions, and indicators that may potentially influence effectiveness. The findings from this research have implications for both theory and practice.

Theoretically, this work contributes to the emerging field of behavioral public administration by examining how behavioral insights can apply specifically to adoption. Practically, it provides digital government evidence-based recommendations for public administrators in Romania and other Eastern European countries seeking to accelerate digital transformation through cost-effective behavioral interventions. The remainder of this paper is structured as follows: Section 2 reviews relevant literature on behavioral economics and building a digital government. Section 3 outlines the methodology used in this study. Section 4 analyzes behavioral interventions implemented across European digital government initiatives. Section 5 synthesises key findings and discusses implications for Romania specifically. Finally, Section 6 concludes this paper with theoretical contribution, directions for future research, as well as limitations of the existing study.

1. Literature review

Behavioral economics has emerged as a research field that challenges traditional economic assumptions by incorporating psychological data into economic analysis. This has been viewed at the opposite field of neoclassical economics, which assumes that individuals make well-informed, self-interested decisions based on preferences that are pre-set (Herbert, 1959). The core theory of behavior in traditional economics has been increasingly challenged by scholars, who have looked to provide alternative explanations for how individuals make decisions. Cohen and Dickens (2002) argue that evolutionary psychology can provide a partial foundation for behavioral economics, offering methods for generating theories about the origins of behavior as well as testing those theories. This field of economics is grounded in empirical observations showing that people do not always make what traditional economists consider the "rational" or "optimal" decision, even when they have the information and tools available to do so. It argues that people as human beings are subject to emotion and impulsivity and are influenced by their environments and circumstances (Craciun, 2022). This description of how individuals behave in the economics context draws a contrast to traditional models and paradigms that have treated people as purely rational. This

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field has been further developed based on the work of Daniel Kahneman and Amos Tversky (1973) and shaped in the last two decades by the work of scholars like Richard Thaler and Cass Sunstein. Their "nudges" approach, introduced in their 2008 seminal book, *Nudge* (Thaler and Sunstein, 2008), acted as the thesis for how behavioral economics can be applied both in the public and private sectors. These choice architecture interventions, or "nudges," have received widespread attention from both researchers and policymakers over the past decade.

Built on insights from the behavioral sciences, this class of behavioral interventions focuses on the design of choice environments that facilitate personally and socially desirable decisions without restricting people in their freedom of choice (Thaler, 2016). An empirical meta-analysis of choice architecture interventions drawing on more than 200 studies found that such interventions promote behavior change with a small to medium effect size (Cohen's d = 0.43). The effectiveness of these interventions varies significantly because of both technique and domain. Across different behavioral domains, interventions that target the organization and structure of choice alternatives (or how a decision is structured) consistently outperform interventions that focus on the description of alternatives (decision information) or the reinforcement of behavioral intentions (Mertens et al., 2021).

The analysis also reveals that choice architecture interventions affect behavior relatively independently of contextual study characteristics such as geographical location or target population. In the context of the government, behavioral insights (referred to as BI throughout this paper) are described as a methodological approach to policy making that combines insights from the fields of psychology, cognitive sciences, as well as social science (Amir & Lobel, 2008). This methodology is mainly focused on empirically tested results to discover how humans make choices. The behavioral insights methodology relies on a combined mix of methods to test and retest solutions before moving to full implementation, as well as to diagnose and evaluate problems. Common methods include randomised controlled trials, laboratory experiments, pilot tests, online experiments, and literature reviews.

These methods allow for empirical testing of behavioral interventions before committing to full-scale implementation (Carlsson & Johansson-Stenman, 2012). Behavioral insights have become increasingly entrenched in governments around the world as a tool to improve the effectiveness of public policy. A survey identified over 200 institutionalised BI-related bodies in the public sector globally, indicating the growing acceptance and application of behavioral approaches in policymaking. These bodies range from dedicated teams within government departments to standalone units that provide behavioral expertise across multiple policy areas (Khadzhyradieva et al., 2019). E-government adoption has become a significant priority for the EU during the past decade, partly because of the role that digital public-facing services play in simplifying interactions in society, but also in facilitating a digital single market. This comes amid rising concerns about European digital sovereignty, with non-EU technology companies perceived as

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potential threats to EU citizens' control over their data as well as constraints to the growth of EU technology companies (Tony Blair Institute for Global Change, 2023). While there is a high degree of alignment with EU strategies and frameworks in some EU and European Free Trade Association (EFTA) countries (notably Austria, Estonia, Iceland, Montenegro, the Netherlands, and Norway), progress lags at both the national and local levels in many other countries. This uneven development presents challenges for creating a truly integrated European digital government ecosystem (Javaid et al., 2024).

Looking at the European civil services, they face significant challenges in embedding 21st-century digital skills among their workforces. Only 35% of civil services have made substantial progress in this area, indicating a significant skills gap that may hinder the effective implementation and management of digital government services. This skills gap extends beyond technical capabilities to include understanding of user needs, service design, and data management. In turn, governments are increasingly using behavioral insights to design, enhance, and reassess their policies and services.

Dedicated teams have been set up in the national governments of the UK, the US, Germany, as well as many European countries, with some of them adopting fewer formal arrangements. (Tony Blair Institute for Global Change, 2023).

The Organization for Economic Co-operation and Development has published 150 case studies of behavioral insights applied to public policy, and the European Commission and World Bank have also started to focus on this area.

The adoption of new technology typically follows an S-shaped pattern, with adoption proceeding slowly at first, accelerating as it spreads throughout potential adopters, and then slowing down as the relevant population becomes saturated. This pattern is a natural implication of the observation that adoption is usually an absorbing state and can be explained by various models (Organisation for Economic Co-operation and Development [OECD], 2017). Having examined the theoretical foundations of behavioral economics and its applications in digital government contexts, the methodology section aims to employ a comparative analysis to examine standardised metrics of behavioral interventions across ten European countries, with particular focus on how this correlates with digital government adoption.

2. Research methodology

This study employs a comparative analysis approach to examine how behavioral economics principles influence digital government adoption in ten European countries, including Romania.

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2.1 Analytical framework and data collections

Using this method, the research aims to identify patterns and correlations between different interventions and e-government adoption. The comparative analysis examines ten selected EU member states representing diverse regions and digital maturity levels. Countries were selected based on three criteria: geographic representation, digital government performance, and data availability. Data was sourced primarily from the European Commission's DESI 2024 report. Other data sources included the EU eGovernment Benchmark reports and national digital government portals directly. The study focuses on three dimensions: digital service adoption rates, implementation of user-centred design features that embody behavioral principles, and contextual factors that may influence adoption. For analysing data, this paper leveraged biblioshiny and gg-plot2, an R-based tool, to identify correlation and run regression analysis, as well as visualizing the outputs for interpretation.

Ten EU member states were selected for this research, using sampling to ensure representation across: geographic regions (Northern, Southern, Western, and Eastern Europe), digital maturity levels (leaders, mid-range, and developing digital governments), institutional contexts (diverse administrative traditions) and finally inclusion of Romania as the focal country of interest and a baseline.

The selected countries are Estonia, Denmark, Finland (digital leaders); France, Germany (large economies); Spain, Portugal (Southern Europe); and Poland, Hungary, Romania (Eastern Europe). Data for the comparative analysis was sourced primarily from: European Commission Digital Economy and Society Index (DESI) reports (2023-2024), EU eGovernment Benchmark reports (2023), national digital government strategy documents and OECD Digital Government Reviews. The comparative analysis utilised a framework examining digital government adoption metrics, observable design features of digital government services, and finally, the relationship between these two.

2.2 Analysis of behavioral approaches in European Digital Government

The Digital Economy and Society Index (DESI) data reveals significant variation in digital government adoption across European Union member states. This section analyses ten selected countries representing different regions, digital maturity levels, and contexts to establish a comparative framework for understanding behavioral approaches to digital government. Table 1 presents key adoption metrics for the selected countries based on the most recent DESI data, reflecting the 2024 report.

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Country	e-Government users (% of individuals)	Digital Public Services for citizens score (0 to 100)	Overall Internet Take-up (% of households)	At least basic digital skills (% of individuals)
Estonia	94.72%	95.83	93.22%	62.61%
Denmark	98.68%	84.24	96.09%	69.62%
Finland	97.61%	90.61	96.78%	81.99%
France	90.81%	72.09	93.34%	59.67%
Germany	62.15%	75.83	91.66%	52.22%
Spain	83.03%	84.18	96.45%	66.18%
Portugal	80.61%	81.58	89.01%	55.97%
Poland	66.44%	82.33	93.30%	44.30%
Hungary	82.39%	73.36	92.73%	58.89%
Romania	24.64%	52.18	92%	27.73%

Table 1. Digital Government Adoption Metrics

Source: Author's contribution based on DESI indices

Examining this comparison of DESI indicators, the authors propose three distinct tiers: (1) digital leaders such as Estonia, Denmark, Finland, characterised by adoption rates of above 80%, (2) moderate adopters like France, Germany, Spain and Portugal demonstrating strong adoption between 65-80% with substantial recent progress. Finally, (3) developing digital governments such as Romania, with an adoption rate of 24.64% in 2024. Romania's position suggested that there are significant opportunities for improvement, and using a behaviour insights approach could potentially accelerate that. Analysing these indices, there is a strong positive correlation of 0.914 between e-government users and individuals having basic digital skills, as shown in Figure 1. This suggests that countries with a higher percentage of e-government users tend to also have higher levels of basic digital skills among their population.

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Figure 1. Relationship between e-government users and at least basic digital skills Correlation = 0.914

Furthermore, the relationship between overall internet take-up and basic digital skills shows a moderate positive correlation of 0.620, as visualised in Figure 2. While there is still a positive relationship, it's not as strong as the e-government usage correlation. This suggests that e-government usage has a stronger relationship with digital skills than general internet access does. This could indicate that either e-government services drive digital skill development, or that higher digital skills enable more e-government service usage, though correlation doesn't imply causation in this case, and the dataset is limited.

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Figure 2. Relationship between Internet Take-up and Basic Digital Skills Correlation = 0.62

Having analysed these adoption metrics, this paper will focus next on design choices in public digital services. The DESI indices reflected in Table 2 provide additional insights into the maturity of digital services across four dimensions, which are relevant to this paper as they reflect how government specialists build and design their services (Craciun, 2023).

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Country	Pre-filled Forms (0 to 100)	User Support (0 to 100)	Mobile friendliness (0 to 100)	Transparency (0 to 100)	Design Feature Average score
Estonia	88.06	96.83	96.90	86.70	92.12
Denmark	91.01	84.92	99.59	80.08	88.90
Finland	87.59	96.30	100	76.07	89.99
France	62.78	79.10	96.71	67.31	76.48
Germany	40.81	83.86	96.33	48.46	67.37
Spain	80.73	87.04	94.76	71.40	83.48
Portugal	79.89	92.06	92.23	72.55	84.18
Poland	79.95	74.07	93.14	65.09	78.06
Hungary	71.11	76.46	87.19	61.15	73.98
Romania	39.58	71.16	75.96	42.60	57.33

Table 2. Design features scores

Source: Author's contribution based on the DESI indices

Given the study's focus on understanding the direct relationship between individual e-government design features and adoption rates across a limited sample of ten EU member states, bivariate regression analysis was selected as an appropriate analytical method. This approach allows for a clear and interpretable examination of the association between pairs of variables, such as the correlation between the 'Transparency' index score and the percentage of e-government users. While the small dataset size limits the feasibility and reliability of more complex multivariate models, bivariate regression remains suitable for this exploratory analysis. It provides valuable initial insights into the strength, direction, and significance of potential relationships between specific digital government indices, thereby helping to identify key factors potentially influencing adoption patterns within this specific European context (Mongomery et al., 2012). The regression shows a positive effect (≈ 0.01445) with a highly significant p-value (p ≈ 0.00089), suggesting that higher "Transparency" scores are strongly associated with increased adoption. All design features show a statistically significant positive relationship with adoption rates in these bivariate regressions. "Mobile friendliness" and "Transparency" have particularly strong significance and relatively larger coefficients, suggesting that individually they explain a substantial portion of the adoption variance. The results of the bivariate regression analyses for each design feature and its association with adoption is described in Table 3.

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Design Feature	R ² (R-squared)	p-value	Association with Adoption
Transparency	≈ 0.77	< 0.001	Higher transparency is strongly associated with increased digital government adoption.
Mobile Friendliness	≈ 0.72	< 0.01	Mobile friendliness also shows a strong positive association with adoption.
Pre-filled Forms	≈ 0.64	< 0.01	Increased use of pre- filled forms is significantly correlated with higher adoption rates.
User Support	≈ 0.44	< 0.05	While still significant, the effect size and variance explained here are lower compared to the other features.

Table 3. Bivariate regression analysis results

Source: Author's own contribution

Figure 3 further illustrates the relationship between the four key design features: The relationship between "Transparency" and adoption is particularly robust. This plot exhibits a strong, positive linear trend with narrow confidence intervals, indicating that higher transparency scores are reliably associated with increased usage of digital government services.

Similarly, the 'Mobile Friendliness' plot shows a strong positive association; most countries score highly on this feature, and a tight clustering around the trend line suggests a consistent relationship.

In the case of "Pre-filled Forms", the data reveal a positive correlation with e-Government adoption, though with greater dispersion around the fitted line. This wider variance indicates that while a higher prevalence of pre-filled forms tends to support greater adoption, other unobserved factors may also play a role. "The User Support" plot, while still exhibiting a positive relationship, shows the greatest scatter and the widest confidence bands. This suggests that while improved user support is generally associated with higher e-Government adoption, the relationship is less consistent compared to the other features. Collectively, these visualisations imply that features such as Transparency and Mobile Friendliness may serve as more reliable predictors of e-Government adoption. The observed clustering of Nordic countries (e.g., Estonia, Denmark, Finland) at the higher end of both design quality and adoption metrics further supports the argument that a comprehensive and user-friendly digital interface is critical for achieving high levels of digital government service usage.

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Figure 3. The relationships between design features and e-government adoption rates

Source: Author's contribution

In this context, Romania's current e-government services are underperforming compared to leading European nations like Estonia, Finland, and Denmark. The data indicates that Romania's ability to streamline administrative processes through pre-filled forms stands as the most pronounced area for improvement, with a performance gap exceeding 50 percentage points compared to other countries. This suggests that Romanian citizens are often required to manually complete forms, which can lead to increased administrative burdens and inefficiencies. This gap

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analysis is reflected in Table 4 and examines the gap between Romania and higherperforming countries, revealing specific opportunities for improvement.

Design feature	Romania score	Best Value	Gap	Potential impact
Pre-filled Forms	39.58	91.01	51.43	High
User Support	71.16	96.83	25.67	Medium
Mobile Friendliness	75.96	100	24.04	Medium
Transparency	42.60	86.7	44.1	High

Table 4. Gap Analysis Romania vs Best Value from Leaders

Source: Author's contribution

Transparency, another critical component of effective e-government, also presents a significant challenge. With scores indicating that Romanian services offer considerably less insight into service progress and outcomes, there is an evident need to enhance visibility and user engagement by adopting more robust tracking mechanisms and explanatory dashboards. User support, while slightly better in Romania than in some metrics, still lags the exemplary standards set by countries like Estonia and Finland. The current level of support may not adequately address user needs and could benefit greatly from a multi-channel support framework that includes live chat, comprehensive help documentation, and video tutorials. Lastly, mobile friendliness, although Romania performs relatively better in this domain compared to the other evaluated aspects, still shows considerable improvement potential. Ensuring that digital services are optimised for mobile devices is vital for enhancing accessibility and user satisfaction.

In summary, Romania's e-government services require significant modernisation. Prioritising the automation of form-filling processes, increasing transparency through real-time tracking, upgrading user support, and further optimising mobile interfaces will not only bridge the existing gaps but also align Romania with best practices observed in top-performing nations.

3. Conclusions

This study has demonstrated the significant impact of behavioral economics principles on digital government adoption within the European Union. The comparative analysis reveals a clear correlation between user-centred design features, such as transparency, mobile-friendliness, pre-filled forms, and user support, and higher rates of e-government usage. Notably, countries that have

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successfully integrated these behavioral considerations into their digital service design, such as Estonia, Denmark, and Finland, have achieved significantly higher adoption rates. Conversely, countries like Romania, which exhibit lower scores in these design features, also demonstrate lower levels of e-government adoption. The analysis underscores the critical need for Romanian public administrators to prioritise behavioural interventions and user-centric design to accelerate digital transformation. Specifically, closing the identified gaps in pre-filled forms and transparency could yield substantial improvements in citizen engagement with digital services. While acknowledging the study's limitations, including its reliance on secondary data and the potential for unobserved contextual factors, the findings provide a valuable framework for understanding and enhancing digital government adoption. The insights gleaned from successful European models offer actionable strategies for Romania and other Eastern European contexts. Future research should build upon this foundation by incorporating qualitative data, conducting pilot studies, and exploring the long-term impacts of behavioral interventions. Such efforts will further refine the recommendations and contribute to the ongoing evolution of effective and inclusive digital government strategies across the European Union.

Conflict of Interest Statement

The authors declare that the research was conducted without any commercial or financial relationship that could be construed as a potential conflict of interest

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