

## DIGITALIZATION AND INFORMALITY IN THE EU: A PESTLE-BASED CLUSTER ANALYSIS

MASTAC LAVINIA

BUCHAREST UNIVERSITY OF ECONOMIC STUDIES

e-mail: [laviniamastac@gmail.com](mailto:laviniamastac@gmail.com)

### Abstract

*This paper analyses the relationship between digitalisation and the shadow economy in European countries, applying a PESTLE (Political, Economic, Social, Technological, Legal, Ecological) approach. The study proposes an alternative classification of 30 European countries into three clusters (Low, Medium, High), based on the average shadow economy as a percentage of GDP for the period 2000–2022. The aim is to highlight how the degree of digitalisation interacts with institutional quality and other structural variables to influence the level of tax compliance. The research integrates governance indicators (Control of Corruption, Government Effectiveness, Regulatory Quality) and provides a comparative analysis between groups. The results show that technology is not sufficient to reduce the informal economy in the absence of a coherent, legitimate and functional institutional framework. The study contributes to the literature through an applied, contextualised and differentiated perspective on the role of digitalisation in combating the shadow economy.*

**Keywords:** *Digitalization, Shadow Economy, Institutional Quality, PESTLE, Governance*

**JEL Classification:** *H11, O17, O33, O52, O57*

### 1. Introduction

In recent decades, digitalization has transformed modern economies, increasing efficiency, reducing administrative costs and strengthening the state's ability to collect revenues. In parallel, the shadow economy remains a significant challenge in regions with weak institutions and low fiscal culture, affecting budgetary sustainability and public trust.

Although the literature extensively analyses shadow economy, its relationship with the level of technology remains insufficiently explored in a comparative framework. At the same time, the classic East-West division does not fully capture current economic dynamics. The paper proposes an alternative approach, by classifying European states into three clusters (Low, Medium, High), depending on the average shadow economy, between 2000–2022. It also analyses this relationship through the lens of the PESTLE (Political, Economic, Social, Technological, Legal, Ecological) framework.

The contribution of the study is twofold. On the theoretical side, it offers an integrated vision of the link between digitalization, institutional quality and the informal economy in Europe. Methodologically, it proposes a new typology of comparative analysis. By identifying good practices and structural bottlenecks, the research offers recommendations for more coherent public policies. It also emphasizes that technology is only effective when supported by a solid institutional context.

### 2. Literature review

PESTLE analysis is a strategic tool for assessing external factors that influence organizations or economies. The method is structured on six dimensions: Political, Economic, Social, Technological, Legal and Ecological (Belsare, 2025). Unlike traditional methods, it offers an extensive framework, useful, especially in periods of structural change or in the analysis of institutional risks (Kolios & Read, 2013; Vintilă et al., 2017). In the context of European economies, it is relevant to understand the complex interactions between technology, institutions and the informal economy. PESTLE methodology supports the formulation of public policies and the detection of systemic imbalances (Çitilci & Akbalık, 2020). PESTLE is

not only an analytical technique, but also a useful decision-making tool in exploring the relationships between technology, institutions and tax compliance. Rashid (2023) highlights its applicability in the assessment of organizational performance. Afshar & Shah (2025) also consider it relevant in the public sector, in the analysis of structural reforms in emerging economies.

The shadow economy encompasses economic activities carried out outside fiscal, legal or statistical regulations. It is also frequently associated with tax evasion, undeclared work and undeclared trade. Determinants include corruption, weak institutional quality, low economic development and lack of trust in authorities (Achim et al., 2021; Kotlán et al., 2021; Munteanu et al., 2024). Studies show that in countries with fragile institutions, the shadow economy can become a structural component that erodes the fiscal base and weakens economic policy (Ceașescu, 2015). Recent bibliometric research also emphasizes how economic fraud risks are interconnected with institutional fragility and governance gaps, supporting the link between informality and systemic vulnerabilities (Aivaz et al., 2024). In the EU, higher economic and sustainable development contributes to reducing corruption and the shadow economy, but can also stimulate forms such as money laundering (Achim et al., 2021). A large shadow economy also negatively affects financial stability, influencing GDP, inflation and interest rates (Mazur et al., 2025).

The shadow economy does not have an exclusively negative impact. In times of crisis, it can act as an economic buffer, providing jobs and increasing resilience (Agiropoulos et al., 2024; Florea & Aivaz, 2022). However, this temporary benefit comes with long-term risks to tax revenues and fiscal sustainability. Fenzl (2023), in an analysis of the impact of artificial intelligence (AI), discusses the opportunity costs of not using the technology to combat invisible phenomena such as the shadow economy. Furthermore, Pagallo & Durante (2022) argue that the underuse of AI in key areas perpetuates informal areas and structures. Corruption exacerbates the phenomenon. A DSGE (Dynamic Stochastic General Equilibrium) model, applied to the Czech Republic, shows that it amplifies the negative effects of environmental taxes and favors informality. It also undermines sustainable development and trust in green policies (Kotlán et al., 2021). Moreover, governance limitations at the local level, such as reduced autonomy, limited budgetary authority, and uneven administrative capacity, can significantly weaken the effectiveness of public service delivery and fiscal monitoring. These structural weaknesses not only reduce the visibility of informal practices but also undermine citizens' trust in the state's ability to enforce compliance equitably (Romanescu, 2013).

Digitalization and technologization are becoming central pillars of modern economic development, influencing education, trade, infrastructure and corporate governance. This synergy is visible in the correlation between digitalization and investment in research and business development. In particular, at the EU level, innovation funding and digital capacity, often reinforce each other (Aivaz & Tofan, 2022). It supports the transition to a knowledge-based economy, where human capital and IT skills are imperative for competitiveness (Ahmadova et al., 2025). In education, it increases access and motivation, but requires coherent policies and adequate infrastructure (Constantin, 2024). In transition economies, low participation in lifelong learning, limits the impact of fiscal digitalization (Ștefănescu & Trandafir, 2024). More broadly, the effectiveness of digital public services in reducing informality depends not only on technological adoption, but also on user competence, infrastructure quality, and trust in digital platforms. Several studies point to persistent gaps in digital literacy and uneven development of e-government services across European regions, which hinder the impact of digital reforms (Răboțu & Babucea, 2020). In trade, technologies such as Hyperloop can redefine European routes, but involve risks that need to be carefully managed (Vesjolijs et al., 2025). At the corporate level, digitalization reduces emissions and

streamlines processes, especially within a framework of strong governance (Yang et al., 2025). Even in construction, modern constructive techniques and technologies such as the use of eco-innovative materials, have helped reduce waste, lower emissions, and support the transition to more sustainable building practices (Drăghici & Maican, 2018). Overall, digitalization and technologization represents a strategic transformation, with direct effects on economic sustainability and resilience. Technologization accelerates economic and social changes, influencing public policies and development models.

In Romania, the lack of digital infrastructure has exacerbated educational inequalities during the pandemic (Manta et al., 2025). Kus et al. (2025) highlight the role of the smart digital economy, based on AI and digitalization, in reducing regional disparities and stimulating innovation, conditional on stable economic policies. At the same time, the balance between digitalization, innovation and coherent policies is important, as to avoid regional polarization (Wan & Wu, 2025). In the EU, digitalization and technologization supports rural regeneration and ecological transition. Ciampa et al. (2025) propose a circular model for European villages, based on digital connectivity and sustainability, in line with the Smart Villages and New European Bauhaus initiatives. Also, integrating digitalization with geospatial intelligence helps reducing emissions and adopting green energy, especially in emerging economies (Doran et al., 2025).

The East–West divide does not fully capture the economic and institutional complexity of Europe. Barysch (2006) shows that Eastern states, although perceived as *social dumping* areas, have protection systems comparable to Western ones and contribute significantly to the EU economy. Voronov (2025) proposes a division into three regions, West, East and a distinct Centre (e.g. Poland, Czech Republic), with their own identities. Although there has been economic convergence after EU enlargement, subnational discrepancies, institutional vulnerabilities and dependence on foreign investment persist (Volintiru et al., 2021). Recent literature nuances this division, highlighting multiple East-West, North-South, centre-periphery cleavages and significant internal differences. Uneven integration in value chains, democratic divergences and perceptions of the rule of law maintain these tensions and fuel Euroscepticism, affecting EU cohesion and external action (Volintiru et al., 2024).

The literature has extensively documented the East-West divide and disparities in digitalization or the quality of governance. However, few studies directly link the level of the shadow economy to institutional structuring and the degree of technologization in a comparative manner across European countries. The current study fills this conceptual gap by applying a PESTLE approach to three country clusters (Low, Medium, High), providing a differentiated perspective on how digitalization produces distinct effects depending on the institutional and economic context.

### 3. Methodology and research aims

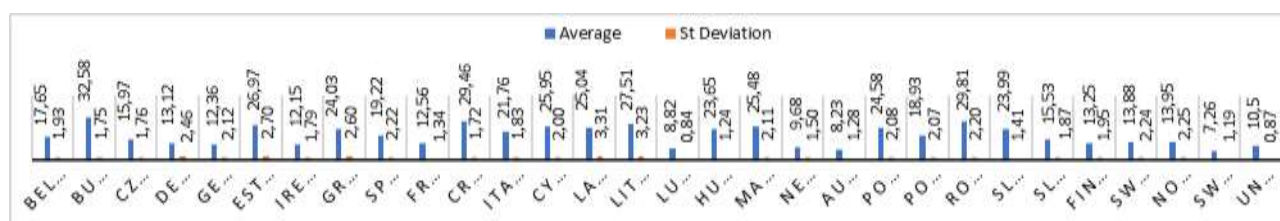
This paper aims to analyse how technological development contributes to the reduction of the shadow economy in the European Union member states, Switzerland, Norway and the United Kingdom, using a PESTLE approach. The research is comparative in nature and applies this analysis to three groups of countries, classified according to the average size of the shadow economy, expressed as a percentage of GDP for the period 2000–2022. The main goal is to identify structural differences between countries with varying levels of the shadow economy. Also, how technologization interacts with other institutional factors to influence tax compliance and economic behaviour.

To define the clusters, the average values of the shadow economy, for 30 European countries were used. It was recorded a minimum value of 5.5% and a maximum value of 35.9%. The total variation range of 30.4 percentage points was divided into three equal-width intervals (approx. 10.13 p.p. each), resulting in three clusters based on the predefined value

thresholds. Thus, the countries were classified into: the “Low” cluster (5.5% – 15.63%), the “Medium” cluster (15.64% – 25.76%) and the “High” cluster (25.77% – 35.9%). This classification formed the basis of the PESTLE analysis for each group, allowing for a differentiated interpretation of how digitalization policies and the quality of institutions influence the size of the informal economy. To deepen the analysis, the research also integrated the average values related to the Control of Corruption (CC), Government Effectiveness (GE) and Regulatory Quality (RQ) indicators, taken from the Worldwide Governance Indicators (WGI) database for the period 2000–2022. These indicators allow for a more nuanced understanding of how the quality of governance influences the efficiency of digitalization measures and the degree of tax compliance, complementing the perspective offered by the PESTLE analysis.

#### 4. Empirical results

The analysis highlights not only good practices, but also the structural limitations that prevent technology from having a uniform impact across countries. At the heart of the discussion is the idea that digitalization, while necessary, is not sufficient in the absence of effective institutions, a consolidated fiscal culture, and a high degree of public trust.



**Fig.1. Average Shadow Economy % GDP level and standard deviation (SD) for 2000-2022**

Source: Own Processing via Excel and European Parliament(2022)

The data presented (Fig.1.) reflect the estimated average of the shadow economy as a percentage of GDP in the period 2000–2022 for 30 European countries, along with the standard deviation associated with each country. It is noted that the Nordic and Western European countries, such as Switzerland (7.26%), Austria (8.23%), the Netherlands (9.68%), Luxembourg (8.82%) or the United Kingdom (10.5%) have the lowest averages of the shadow economy, accompanied by low variability (standard deviations below 1.5). Therefore, they indicate institutional stability and a consolidated fiscal culture. At the opposite pole, countries such as Romania (29.81%), Bulgaria (32.58%), Croatia (29.46%) or Lithuania (27.51%) record high values of the shadow economy and, in some cases, increased volatility (e.g. Latvia-SD: 3.31). Thus, signalling a context in which informality is persistent, but also unpredictable. The high average in Estonia (26.97%) is surprising in contrast to the high degree of digitalization. This observation suggests that digitalization is not enough without a solid complementarity with institutional quality and equitable redistribution. The moderate SD (around 2) for most countries in the middle group reflect oscillations of the shadow economy. This is probably determined by economic crises, partial reforms or fiscal instability. Overall, a general correlation can be observed between the low level of the underground economy and stable institutional performance. Simultaneously, the high values of the average and the variation are specific to countries in transition or with weak institutions.



an intermediate zone with some progress in regulation but without complete institutional consolidation.

**Tab.1. PESTLE Analysis**

<b>PESTLE</b>	<b>Low Shadow Economy</b>	<b>Medium Shadow Economy</b>	<b>High Shadow Economy</b>
<b>Political</b>	Stable institutions, clear policies, strong support for digitalization.	Digitalization driven by EU or post-crisis policies; uneven implementation.	Present but limited by weak governance and political instability.
<b>Economic</b>	High financial inclusion, incentives for e-payments and Small and Medium Enterprises (SMEs) digitalization.	Ongoing efforts, but grey economy remains in traditional sectors.	Partial digitalization with widespread informality and low tax compliance.
<b>Social</b>	High trust in authorities, strong digital and financial literacy.	Mixed levels of trust and digital education; fiscal culture in transition.	Low trust, urban–rural divide, resistance to digital systems.
<b>Technological</b>	Mature, interoperable tax systems; AI and fintech integrated in public admin.	Functional platforms, but fragmented and underused; emerging tech evolving.	Fast adoption, but poor interoperability and limited public use.
<b>Legal</b>	Clear, harmonized digital laws on e-invoicing, e-payments, tax compliance.	Adapting laws, uneven enforcement, EU directive pressure.	Weak enforcement, ineffective sanctions, low voluntary compliance.
<b>Ecological</b>	Digitalization aligned with sustainability and lower ecological impact.	Isolated green initiatives, partial integration in policy.	Minimal ecological focus, low impact from digital reforms.

Source: Own processing based on the information and data gathered

The PESTLE analysis (Tab.1.) applied to the three clusters of countries, classified according to the size of the shadow economy, reveals a deep connection between institutional quality, socio-economic context and the efficiency of digitalization processes. The countries in the Low cluster are distinguished by a stable political and legal framework, with clear and mature regulations in the fiscal and administrative fields. They also have a consolidated digital culture and efficient cooperation between the state and citizens. In these countries, digitalization is not just a technological strategy, but an integrated component of responsible governance. It's supported by public trust and coherent policies. In addition, the integration of the ecological dimension into digital processes reflects a holistic approach to sustainable development. In contrast, the countries in the High and, in part, Medium clusters, although adopting similar technologies, face significant structural challenges. The lack of interoperability of systems, legislative fragmentation and low trust in authorities reduce the positive impact of digitalization. In many cases, digital transformation is implemented formally, but without a real correlation with a functional institutional framework or a consolidated fiscal culture. Thus, the quintessential conclusion of this section is that the success of digitalization in combating shadow economy does not depend exclusively on technology, but on its integration into a coherent, transparent and legitimate institutional ecosystem.

## 5. Discussion of empirical results

### 5.1 Low cluster: low level of shadow economy

The countries in the low shadow economy cluster (Denmark, Germany, Ireland, France, Luxembourg, Netherlands, Austria, Slovakia, Finland, Sweden, Norway, Switzerland, United Kingdom) are distinguished by a clear and sustained commitment to digitalization. This is applied not only in the tax administration, but also in the entire governmental and economic

ecosystem. These nations have implemented integrated online tax reporting systems (e.g. ELSTER in Germany, Skatteverket in Sweden, MyTax in Finland), which have significantly reduced informal interactions and increased tax compliance. Most of these countries have adopted mandatory electronic invoicing, both in B2G and B2B relations, which has contributed to reducing tax fraud and evasion.

A common element is the active promotion of digital payments and the reduction of cash circulation. Sweden and Denmark are almost completely cashless, while France, Ireland and the Netherlands encourage electronic transactions in all areas of the economy through regulations and incentives. This transition has been accompanied by government initiatives to support Small and Medium Enterprises (SMEs), as well as educational policies that have increased the digital literacy of the population. In addition, the digital infrastructure is supported by secure electronic identification solutions (e.g. MitID in Denmark, BankID in Norway), facilitating citizens' access to public and tax services.

On the political and legal dimension, the Low cluster countries stand out for their institutional stability, clear, transparent and easy-to-implement regulations. This reduces the temptation for taxpayers to resort to informality. The “Making Tax Digital” programs in the United Kingdom or the strict legal framework on tax receipts and marking equipment in Austria and France (Fiskaly, 2025) demonstrate an effective synchronization between digitalization and legislation. Last but not least, these countries associate digital transformation with sustainability, reducing paper consumption and promoting e-government as an environmentally friendly way.

## **5.2 Medium cluster: medium level of shadow economy**

The countries in the Medium cluster (Belgium, Czechia, Greece, Spain, Italy, Cyprus, Latvia, Hungary, Malta, Poland, Portugal, Slovenia) present a heterogeneous landscape in terms of digitalization. Most have made significant progress in modernizing tax administration and regulating undeclared work. On the policy dimension, many of them (e.g. Belgium, Portugal, Slovenia) have adopted proactive and coherent policies since the beginning of the 21st century (OECD, 2008; Spiegel, 2019; Bučar & Udovič, 2023), supporting reforms in the field of tax digitalization. Cases such as Italy, Poland or Spain have introduced dedicated national strategies (DigWatch, 2020; DecentCybersecurity, 2024; Digital Skills Jobs Europe, 2023), while others, such as Cyprus or Greece, have adapted their policies in the context of alignment with European regulations (DAC7, e-invoicing, e-commerce) (Tax News, 2023; Edicom Group, 2025A).

Economically, these countries have focused on digitizing SMEs, promoting electronic payments, and supporting digital transformation in strategic sectors such as tourism in Malta or trade in Poland. However, the effectiveness of these measures is affected by regional disparities as well as budgetary constraints (Maltachamber, 2022; Chiriac et al., 2022; Aivaz et al., 2023). On the social dimension, the level of digital education is variable. Some nations invest in digital skills in formal education. Others have a persistent cultural resistance to digital compliance, due to low trust in public institutions.

Technologically, most countries have implemented digital tax platforms (e.g. eDavki in Slovenia, e-Deklaracje in Poland), and some have even introduced advanced solutions, such as blockchain in VAT reporting in Slovenia (Edicom Group, 2025B). However, despite these efforts, institutional quality remains a limiting factor. Digitalization only works effectively when supported by administrative capacity and sustained political will.

In the ecological dimension, digitalization indirectly contributes to reducing the carbon footprint by eliminating physical documents, promoting electronic invoicing and streamlining public administration. The environmental dimension is still rarely used as a direct motivation for digitalization in countries with moderate shadow economies.

### 5.3 High cluster: high level of shadow economy

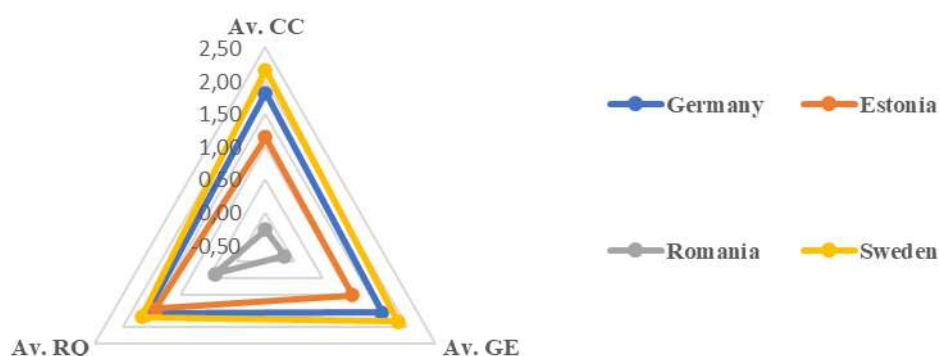
The countries in the High cluster (Bulgaria, Estonia, Croatia, Lithuania, Romania), despite progress in digitalization, continue to face important challenges in reducing the shadow economy. On the political side, all have introduced tax reforms with a digital component. However, their implementation is often reactive and fragmented. In Romania, Bulgaria or Croatia, e-invoicing and digital monitoring policies have been implemented with delays or in isolation, without a coherent strategy that includes tax education or real simplification of administrative processes. The only notable exception is Estonia, which has built an integrated e-government model since the early 2000s (Vassil, 2015), becoming an international model.

On the economic side, the states in this cluster have tried to increase the degree of collection by automating taxation (e.g. the i.MAS system in Lithuania, e-Transport in Romania), but the effects of these measures are limited by the lack of infrastructure, compliance costs for SMEs and the lack of interoperability between institutions. Although digitalization could reduce tax evasion and administrative costs, in many cases it has also brought additional pressure on small taxpayers, who do not benefit from sufficient technological or financial support. This tension is also visible, in the way innovative businesses, in emerging economies, struggle to adapt to new financial realities, such as the accounting of crypto assets, under the pressure of rapid digital transformation (Munteanu et al., 2023). Nonetheless, Romania's digital economy has shown encouraging progress between 2019 and 2022, reflecting a stronger push toward technological adoption and integration with EU digital objectives (Toma et al., 2023).

The social dimension highlights important differences between Estonia and the other cluster countries. Estonia benefits from a high degree of digital literacy and trust in institutions. In Romania, Bulgaria or Croatia, systemic distrust, a low level of fiscal culture and a reluctance to use online services persist. This situation is compounded by gaps in digital public services and low levels of digital competence, as reflected in national assessments (Răbonțu & Babucea, 2020). The reluctance is partly explained by low levels of digital trust, especially among younger populations, engaging with algorithmic systems, such as in Romanian e-commerce contexts (Teodorescu et al., 2023). Thus, digitalization often remains a formal tool, without real commitment or participation from citizens. In addition, urban-rural gaps, age or educational level contribute to the perpetuation of shadow economy. At the technological level, existing platforms (e.g. SPV in Romania, ePorezna in Croatia) are functional, but rarely fully integrated between institutions. This reduces the state's ability to detect fiscal risk behaviours in real time. Regarding the ecological dimension, all these countries report minimal benefits of digitalization on the environment.

#### 5.4. Technologization level and institutional quality interplay

The analysis of the relationship between the level of technology and institutional quality starts from the premise that administrative digitalization has significant potential in reducing the shadow economy only in the context of functional, efficient and credible institutions.



**Fig.4. Comparison Estonia, Germany, Sweden, Romania, average CC, GE, RQ, 2000 - 2022**

Source: Own processing using Excel and WGI

A special case is Estonia. Although it is a model of administrative digitalization, it fails to reach the same level of institutional performance as the Nordic countries. With relatively good scores (CC: 1.14, GE: 1.03, RQ: 1.43), Estonia clearly outperforms other Eastern European countries, but is still below the level of Germany, the Netherlands or Sweden. This partly explains the “Estonian paradox”. Despite the almost complete digitalization of the administration and an extremely technologically efficient public system, the shadow economy remains high. Therefore, the degree of digitalization cannot fully compensate for the lack of a consolidated tax culture and an institutional system perceived as impeccable by taxpayers.

The radar chart (Fig.4.) visually highlights the gaps between the four selected countries in terms of the three key institutional indicators CC, GE and RQ. It is observed that Sweden and Germany occupy a higher and relatively balanced level on all three dimensions. This also explains the very low levels of the shadow economy. These states not only offer an efficient technological framework, but also an institutional environment in which public trust is solid, and fiscal compliance makes both moral and pragmatic sense. The citizen perceives the state as efficient, fair and accountable. In contrast, Romania stands out with an extremely low level on all three axes. In this context, even if advanced tax technologies were implemented, the lack of trust in institutions and the perception of an inefficient or corrupt state determine a structural reluctance to tax compliance. Estonia, located between these two extremes, offers an interesting case to analyse. Although it approaches the values of Germany and Sweden on the RQ component, the differences of 0.5–1 point in each of the three indicators are significant. These differences are not just quantitative. They reflect a qualitative reality regarding taxpayers' perception of how fair, efficient and incorruptible the state is. Thus, in Estonia, although digital systems are performing well, participation in the shadow economy remains high, because technology cannot substitute trust and authentic institutional capital.

## 6. Conclusion

The research clearly showed that the shadow economy is not just the result of the absence of regulations or the lack of digitalization. It is a symptom of institutional weaknesses, social fragmentation and an incomplete social contract between the state and citizens. Technologization and digitalization, although necessary, are not an all-encompassing fix. Countries like Estonia, which have achieved an exceptional technological level in public administration, continue to record high levels of the shadow economy. This is possible due to imbalances between digital progress and the degree of trust in fiscal redistribution, institutional coherence and civic culture.

The PESTLE analysis applied to the three clusters created, showed that where digitalization was accompanied by political stability, clear regulations, social trust and consistent economic incentives (as is the case of the Low cluster), the effects on the reduction of the informal economy were palpable and sustainable. On the other hand, in countries in the High cluster, where digitalization was applied in a context with weak institutions, low levels of digital literacy, and a fiscal culture in transition or even contested, the technology had a limited or even superficial effect.

Comparing the average values for Control of Corruption, Government Effectiveness and Regulatory Quality reinforced the idea that institutional differences are a strong predictive factor for the degree of tax compliance and for the reduction of the shadow economy. Countries with consistent values above 1.5 in these indicators (Sweden, Denmark, the Netherlands, Switzerland) are also those with significantly smaller shadow economies. Conversely, negative or sub-unit values in the case of Romania, Bulgaria or Croatia reflect the lack of an institutional environment in which technology can function as an effective tool for voluntary compliance. In conclusion, this research supports the idea that the success of digitalization in combating the shadow economy depends on three fundamental pillars: (1) a solid and legitimate institutional framework; (2) a social culture of compliance, based on trust in the state and tax education; (3) a strategic vision of integrating technology into public policies, not as an end goal, but as a means to strengthen transparency and efficiency of governance. Only in the presence of these elements can digitalization go from being a technical solution to becoming a true driver of compliance and sustainable development.

## 7. References

- [1] Achim, M. V., Văidean, V. L., Borlea, S. N., & Florescu, D. R. (2021). *The impact of the development of society on economic and financial crime. Case study for European Union member states*. *Risks*, 9(97). <https://doi.org/10.3390/risks9050097>
- [2] Afshar, M. Z., & Hussain Shah, M. (2025). Strategic evaluation using PESTLE and SWOT frameworks: Public sector perspective. *ISRG Journal of Economics and Business Management*, 3(1), 108–110. <https://doi.org/10.5281/zenodo.14854362>
- [3] Agiropoulos, C., Chen, J. M., Poufinas, T., & Galanos, G. (2024). *Shadows of resilience: Exploring the impact of the shadow economy on economic stability*. *Eng. Proc.*, 68(44). <https://doi.org/10.3390/engproc2024068044>
- [4] Ahmadova, A. A., Rzayev, M. A., Ismayilova, L. H., & Muradova, J. N. (2025). Digitalization of the economy as the basis of human capital potential. *Academy Review*, 1(62). <https://doi.org/10.32342/3041-2137-2025-1-62-2>
- [5] Aivaz, K. A., & Tofan, I. (2022). The Synergy Between Digitalization and the Level of Research and Business Development Allocations at EU Level. *Studies in Business and Economics*, 17(3), 5-17. DOI: 10.2478/sbe-2022-0042

[6] Aivaz, K. A., Munteanu, I., & Rus, M. I. (2023). Clarifying The Impact Of Sanctions On Financial Indicators In Transports. An Empirical Comparative Analysis Using The Discriminant Model. *Transformations in Business & Economics*, 22.

[7] Aivaz, Kamer-Ainur, Iulia Oana Florea, and Ionela Munteanu. "Economic Fraud and Associated Risks: An Integrated Bibliometric Analysis Approach." *Risks* 12.5 (2024): 74. DOI: 10.3390/risks12050074

[8] Barysch, K. (2006). East versus West? The EU economy after enlargement. Centre for European Reform. [https://www.cer.eu/sites/default/files/publications/attachments/pdf/2011/essay\\_eastvswest\\_jan06-2088.pdf](https://www.cer.eu/sites/default/files/publications/attachments/pdf/2011/essay_eastvswest_jan06-2088.pdf)

[9] Belsare, H. V. (2025). PESTLE analysis. *International Journal of Advanced Research*, 13(2), 608–612. <https://doi.org/10.21474/IJAR01/20411>

[10] Bučar, M. & Udovič, B. (2023). The Slovenian Perception of the EU: From Outstanding Pupil to Solid Member. *Comparative Southeast European Studies*, 71(3), 388-411. <https://doi.org/10.1515/soeu-2022-0049>

[11] Ceaușescu, I. (2015). Underground Economy, Influences on National Economies. *Annals of the „Constantin Brâncuși” University of Târgu Jiu, Economy Series*, 2, 344–348. [https://www.utgjiu.ro/revista/ec/pdf/2015-02/50\\_Ceausescu.pdf](https://www.utgjiu.ro/revista/ec/pdf/2015-02/50_Ceausescu.pdf)

[12] Chiriac, A., Munteanu, I., & Aivaz, K. A. (2022, May). The Financial Implications of Non-Compliance in the Transportation Business. In 8th BASIQ International Conference on New Trends in Sustainable Business and Consumption (pp. 298-305). DOI: 10.24818/BASIQ/2022/08/039

[13] Ciampa, F., Marchiano, G., Girard, L. F., & Angrisano, M. (2025). *The Rural Village Regeneration for the European Built Environment: From Good Practices Towards a Conceptual Model*. *Sustainability*, 17(7), 2787. <https://doi.org/10.3390/su17072787>

[14] Çitilci, T., & Akbalık, M. (2020). The importance of PESTEL analysis for environmental scanning process. In *Handbook of Research on Strategic Fit and Design in Business Ecosystems* (pp. 336–357). IGI Global. <https://doi.org/10.4018/978-1-7998-2559-3.ch016>

[15] Constantin, A. (2024). *Digitalization of Romania's Education Sector: A PESTLE Analysis*. Proceedings of the 18th International Conference on Business Excellence. <https://doi.org/10.2478/picbe-2024-0009>

[16] Doran, N. M., Badareu, G., & Siminică, M. I. (2025). *Integrating Geospatial Intelligence and Digital Transformation for Advancing Environmental Sustainability in Emerging EU Economies*. *Applied Sciences*, 15(7), 3444. <https://doi.org/10.3390/app15073444>

[17] Drăghici, G., & Maican, A. M. (2018). Modern solutions for sustainable, environmentally friendly construction. *SGEM International Multidisciplinary Scientific GeoConference: Ecology, Economics, Education and Legislation*, 18(5.3), 593–600. DOI: 10.5593/sgem2018/5.3/S28.076

[18] European Parliament (2022). Taxation of the informal economy in the EU 2022. [https://www.europarl.europa.eu/RegData/etudes/STUD/2022/734007/IPOL\\_STU\(2022\)734007\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2022/734007/IPOL_STU(2022)734007_EN.pdf)

[19] Fenzl, M. (2025), A shadow on democracy? The shadow economy and government responsiveness. *European Journal of Political Research*. <https://doi.org/10.1111/1475-6765.12732>

[20] Florea, I. O., & Aivaz, K. A. (2022). A Dynamic Analysis of Economic Crime in Europe: The Role of the European Institutions in the Prevention of Economic Crimes in the COVID-19 Pandemic. *Annals of the University Dunarea de Jos of Galati: Fascicle: I, Economics & Applied Informatics*, 28(3). DOI: 10.35219/eai15840409283

[21] <https://bankid.no/en>

[22] <https://decentcybersecurity.eu/poland-unveils-landmark-digital-strategy-2035-a-comprehensive-roadmap-for-digital-transformation/?utm>

- [23] <https://digital-skills-jobs.europa.eu/en/actions/national-initiatives/national-strategies/spain-digital-spain-agenda-2026?utm>
- [24] <https://edavki.durs.si/EdavkiPortal/OpenPortal/CommonPages/Opdynp/PageA.aspx>
- [25] [https://edicomgroup.com/blog/greece-mandatory-electronic-invoice?utm\\_source](https://edicomgroup.com/blog/greece-mandatory-electronic-invoice?utm_source) A.
- [26] [https://edicomgroup.com/blog/slovenia-b2b-electronic-invoice?utm\\_source](https://edicomgroup.com/blog/slovenia-b2b-electronic-invoice?utm_source) B.
- [27] <https://e-porezna.porezna-uprava.hr/Prijava.aspx?ReturnUrl=%2f>
- [28] <https://imas.vmi.lt/isaf/>
- [29] [https://maltachamber.org.mt/digitalisation-voucher-scheme-for-tourism-smes/?utm\\_source](https://maltachamber.org.mt/digitalisation-voucher-scheme-for-tourism-smes/?utm_source)
- [30] <https://mfinante.gov.ro/ro/web/etransport>
- [31] <https://skatteverket.se/>
- [32] <https://taxnews.ey.com/news/2023-1888-cyprus-enacts-law-implementing-tax-transparency-rules-for-digital-platforms-dac-7>
- [33] [https://www.anaf.ro/anaf/internet/ANAF/servicii\\_online/inreg\\_inrol\\_pf\\_pj\\_spv/](https://www.anaf.ro/anaf/internet/ANAF/servicii_online/inreg_inrol_pf_pj_spv/)
- [34] <https://www.elster.de/eportal/start>
- [35] <https://www.fiskaly.com/blog/fiscalization-and-tax-compliance-in-europe>
- [36] <https://www.gov.uk/government/publications/making-tax-digital>
- [37] <https://www.mitid.dk/en-gb/>
- [38] <https://www.podatki.gov.pl/e-deklaracje/>
- [39] <https://www.spiegel.de/international/europe/antonio-costa-a-socialist-success-story-in-portugal-a-1288837.html>
- [40] <https://www.vero.fi/henkiloasiakkaat/>
- [41] Kolios, A., & Read, G. (2013). A political, economic, social, technology, legal and environmental (PESTLE) approach for risk identification of the tidal industry in the United Kingdom. *Energies*, 6(10), 5023–5045. <https://doi.org/10.3390/en6105023>
- [42] Kotlán, I., Němec, D., Kotlánová, E., Skalka, P., Macek, R., & Machová, Z. (2021). *European Green Deal: Environmental taxation and its sustainability in conditions of high levels of corruption*. *Sustainability*, 13(1981). <https://doi.org/10.3390/su13041981>
- [43] Kuś, A.; Kuflewska, W.; Trocewicz, A. (2025) European Vision of a Gigabit Society: Evidence from Poland. *Sustainability*, 17, 1271. <https://doi.org/10.3390/su17031271>
- [44] Manta, A.G.; Ghertescu, C.; Bădîrcea, R.M.; Manta, L.F.; Popescu, J.; Lăpădat, C.V.M. (2025), How Does the Interplay Between Banking Performance, Digitalization, and Renewable Energy Consumption Shape Sustainable Development in European Union Countries? *Energies*, 18, 571. <https://doi.org/10.3390/en18030571>
- [45] Mazur, H., Zinevych, O., Guseva, O., Babichev, A., & Valyvsky, S. (2025). *The impact of the shadow economy on the stability of the financial system of the state*. *Salud, Ciencia y Tecnología – Serie de Conferencias*, 4(1423). <https://doi.org/10.56294/sctconf20251423>
- [46] Munteanu, I., Aivaz, K. A., Micu, A., Căpăţână, A., & Jakubowicz, F. V. (2023). Digital Transformations Imprint Financial Challenges: Accounting Assessment Of Crypto Assets And Building Resilience In Emerging Innovative Businesses. *Economic Computation & Economic Cybernetics Studies & Research*, 57(3). DOI: 10.24818/18423264/57.3.23.12
- [47] Munteanu, I., Ileanu, B. V., Florea, I. O., & Aivaz, K. A. (2024). Corruption perceptions in the Schengen Zone and their relation to education, economic performance, and governance. *Plos one*, 19(7), e0301424. DOI: 10.1371/journal.pone.0301424
- [48] Organisation for Economic Co-operation and Development. (2008). *OECD e-Government Studies: Belgium 2008*. OECD Publishing. [https://www.oecd.org/en/publications/oecd-e-government-studies-belgium-2008\\_9789264055810-en.html](https://www.oecd.org/en/publications/oecd-e-government-studies-belgium-2008_9789264055810-en.html)

- [49] Pagallo, U., & Durante, M. (2022). *The good, the bad, and the invisible with its opportunity costs: Introduction to the 'J' special issue on "the impact of artificial intelligence on law"*. J, 5(1), 139–149. <https://doi.org/10.3390/j5010011>
- [50] Răbontu, C.-I., & Babucea, A.-G. (2020). Digital Services in Romania – Present and Perspective. Annals of the „Constantin Brâncuși” University of Târgu Jiu, Economy Series, 1, 35–40. [https://www.utgjiu.ro/revista/ec/pdf/2020-01/05\\_Rabontu.pdf](https://www.utgjiu.ro/revista/ec/pdf/2020-01/05_Rabontu.pdf)
- [51] Rashid, C. A. (2023). PESTEL analysis and Porter’s five forces as marketing tools to evaluate Morrison’s performance and strategy. Journal of Global Social Sciences, 4(15), 76–83. <https://doi.org/10.58934/jgss.v4i15.187>
- [52] Romanescu, M. L. (2013). The Influence of Local Autonomy on the Local Public Services. Annals of the „Constantin Brâncuși” University of Târgu Jiu, Economy Series, 2, 231–233. [https://www.utgjiu.ro/revista/ec/pdf/2013-02/35\\_Romanescu%20Marcel.pdf](https://www.utgjiu.ro/revista/ec/pdf/2013-02/35_Romanescu%20Marcel.pdf)
- [53] Ștefănescu, I. O., & Trandafir, R. (2024). Participation in Lifelong Learning Depending on Economic Development and Educational Attainment Level: A Statistical Approach Using Two-Way ANOVA. Annals of “Dunarea de Jos” University of Galati, Fascicle I. Economics and Applied Informatics, 30(3). [http://www.eia.feaa.ugal.ro/images/eia/2024\\_3/Stefanescu\\_Trandafir.pdf](http://www.eia.feaa.ugal.ro/images/eia/2024_3/Stefanescu_Trandafir.pdf)
- [54] Teodorescu, D., Aivaz, K. A., Vancea, D. P. C., Condrea, E., Dragan, C., & Olteanu, A. C. (2023). Consumer trust in AI algorithms used in e-commerce: A case study of college students at a Romanian public university. Sustainability, 15(15), 11925. DOI: 10.3390/su151511925
- [55] Toma, S.-G., Grădinaru, C., & Modreanu, A. (2023). The Evolution of the Digital Economy in Romania in the Period 2019–2022. Annals of the „Constantin Brâncuși” University of Târgu Jiu, Economy Series, 6, 205–210. [https://www.utgjiu.ro/revista/ec/pdf/2023-06/22\\_toma.pdf](https://www.utgjiu.ro/revista/ec/pdf/2023-06/22_toma.pdf)
- [56] Vassil, K. (2015). Estonian e-Government Ecosystem: Foundation, Applications, Outcomes. World Bank. <https://thedocs.worldbank.org/en/doc/165711456838073531-0050022016/original/WDR16BPEstonianeGovecosystemVassil.pdf>
- [57] Vesjolijs, A., Stukalina, Y., & Zervina, O. (2025). *Assessment of Socio-Economic Impacts of Hyperloop Technology on European Trade Routes*. Economies, 13(3), 65. <https://doi.org/10.3390/economies13030065>
- [58] Vintilă, D.-F., Filip, C., Stan, M.-I., & Țenea, D.-D. (2017). A political, economic, social, technology, legal and environmental (PESTLE) approach for maritime spatial planning (MSP) in the Romanian Black Sea. *International Conference on Management and Industrial Engineering*, (8) <https://www.proquest.com/openview/abae2224cc140597a4be66b716dd9f8c/1?pq-origsite=gscholar%26cbl=2032215>
- [59] Volintiru, C., Bârgăoanu, A., Stefan, G., Durach, F., (2021) East-West Divide in the European Union: Legacy or Developmental Failure?. Romanian Journal of European Affairs, vol. 21, no. 1, <https://ssrn.com/abstract=3991847>
- [60] Volintiru, C., Surubaru, N. C., Epstein, R. A., & Fagan, A. (2024). *Re-evaluating the East-West divide in the European Union*. Journal of European Public Policy. <https://doi.org/10.1080/13501763.2024.2313694>
- [61] Voronov, N. (2025). Conceptualization of West, East, and Center in Europe. Czech Academy of Sciences. <https://doi.org/10.5281/zenodo.14927627>
- [62] Wan, C., & Wu, Z. (2025). *How the Digital Intelligence Economy Can Promote Regional High-Quality Development Under the Influence of Economic Policy Uncertainty*. Sustainability, 17(7), 2869. <https://doi.org/10.3390/su17072869>
- [63] Yang, Q., Kong, C., & Jin, S. (2025). *Digital Transformation and Corporate Carbon Emissions: The Moderating Role of Corporate Governance*. Systems, 13(4), 217. <https://doi.org/10.3390/systems13040217>