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POLICY BRIEF 1.

INSTITUTIONS, DIGITIZATION AND REGIONAL DEVELOPMENT IN THE EUROPEAN UNION

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Policy brief on advancing Romania's digital transition
Speeding up Romania's digital transition
Advancing Romania's digital path

1. Executive summary (RO)

O evoluție remarcabilă a tehnologiei a avut loc în ultimii ani, inteligența artificială, robotica, IoT și alte tehnologii fiind utilizate pe scară tot mai largă în întreaga lume. Anticipându-i potențialul de a stimula competitivitatea și de a îmbunătăți deciziile instituționale, UE a adoptat tranziția digitală ca pilon în principalele sale politici de investiții, cum ar fi politica regională și NextGenerationEU. Astfel, în 2021, Comisia Europeană (2021, 9 martie) și-a conturat foaia de parcurs pentru transformarea digitală în sprijinul cetățenilor și întreprinderilor. „Deceniul digital" stabilește ținte la nivelul UE pentru transformarea digitală până în 2030. În acest scop, Indicele economiei și societății digitale (DESI), conceput în 2017, a fost ajustat pentru a se alinia la cele patru obiective principale ale programului său de politică a Deceniului digital: competențe digitale, infrastructură digitală, digitalizarea afacerilor și digitalizarea serviciilor publice.

Transformările induse de digitalizare sunt complexe și provocatoare pentru populația UE, pentru economiile statelor membre și pentru sistemele de guvernanță. Spre exemplu, aproximativ un sfert (23%) din populația UE a raportat că digitalizarea serviciilor publice și private de zi cu zi a avut un impact negativ asupra vieții lor (Comisia Europeană, 2024, iulie). România prezintă cea mai mare prevalență cu 34%, urmată de Franța cu 32% și Italia cu 26%. Faptul că România este în mod clar una dintre țările UE care rămâne în urmă în ceea ce privește transformările digitale se reflectă în performanța sa raportat la obiectivele programului de politică *Deceniu Digital*, cu excepția celui legat de infrastructura digitală.

Documentul de față include o scurtă analiză a contextului strategic și legislativ privind digitalizarea și a dimensiunii digitalizării în România (aspecte privind digitalizarea serviciilor publice, a competențelor, a infrastructurii și a afacerilor), cu un set de recomandări pentru accelerarea digitalizării, pe fondul reducerii vulnerabilităților și a inegalităților. Recomandările au la bază un nou model de analiză a interdependențelor între digitalizare și instituții, pe baza unui indice de vulnerabilitate digitală dezvoltat în cadrul proiectului *Institutions, digitalization and regional development in the European Union*, finanțat prin PN-III-P4-PCE-2021 -1878, PNCDI III și implementat în cadrul Centrului de Studii Europene al Universității "Alexandru Ioan Cuza" din Iași.

2. Overview on the raising role of digitalization

Digitalization, a concept that emerged during the third industrial revolution, has played a central role in transitioning from analog to digital information, facilitating data conversion into digital format and opening up new opportunities for processing and using it (Nyman-Metcalf and Papageorgiou, 2018). However, digitalization goes beyond data conversion and digital infrastructures. It refers to integrating digital technologies to optimize and improve existing processes in both private and public sectors. In the private sector, digitalization involves using IT technologies to transform business processes by facilitating workflows and reporting, making them more competitive and manageable (Vrana and Singh, 2021). Furthermore, digitalization creates new communication channels that fundamentally change traditional interactions between firms and customers (Verhoef et al., 2021). In the public sector, e-government services, such as online platforms and automated processes, have improved transparency and reduced administrative barriers, enabling more efficient management of public resources (Mergel et al., 2019). The modernization of public administration, underpinned by digitization, continues to streamline governance through automation and the deployment of electronic systems (OECD, 2019).

Digitalization experienced a rapid growth over the last decades, marked by the rise of smart devices and social media platforms. This development has improved citizens' access to digitized public

services and information, but the success of these innovations largely depends on users' digital competencies (Janowski, 2015). Having a workforce with the right skills allows countries to fully benefit from innovations such as Big Data and cloud computing, boosting productivity and economic growth (Schiopu, 2015). Successful digital transformation requires a well-developed digital infrastructure and a skilled workforce (Olczyk and Kuc-Czarnecka, 2022). Countries with more digitally skilled workers and ICT specialists demonstrate greater efficiency in adopting advanced technologies such as cloud computing and Big Data, enhancing their digital transformation capabilities (Ha et al., 2022). Studies emphasize the importance of human capital, showing that differences in education and digital skills contribute to a significant digital divide (Androniceanu et al., 2017).

Besides education and digital skills acquirement, the quality of institutions also stands out as important prerequisite of digital transition (Bănică et al., 2024). In the same vein, empirical evidence also suggests that digitalization, along with institutional quality, also plays a pivotal role in facilitating access to European funds and thus boost the impact of both the Cohesion Policy and the NextGenerationEU (Tiganasu and Lupu, 2023).

The development of digital competences facilitates access to public services and supports citizens' engagement in digital governance processes, thus contributing to increased trust in public institutions. This trust is a cornerstone of more transparent and accountable governance (Terlizzi, 2021). The importance of digital skills has been emphasized not only in the public sector but also in the private sector, where the development of these skills is needed to increase operational efficiency, drive innovation, and maintain competitiveness in an increasingly digitized business environment (Peart et al., 2020). Adopting digital technologies is highly dependent on employees' digital competencies, which are necessary to drive organizational innovation and effectively overcome the challenges of digital transformation (Sousa and Rocha, 2019). In addition, the effectiveness of digital technology adoption in business is highly dependent on the continuous development of employees' technical, collaboration, and problem-solving skills and their ability to adapt to the rapidly changing demands of the digital economy (van Laar et al., 2020).

Adopting digital technologies is closely linked to productivity growth, innovation, and economic development, especially when public institutions and private companies integrate these technologies into their daily work (European Commission, 2017; Novak et al., 2018; Vezzani et al., 2018). The digital economy is transforming traditional economic structures. Research evidence that digital economy enhances urban economic resilience, driving innovation, diversifying industrial structures, and accelerating human capital accumulation. Additionally, the digital economy generates significant positive externalities that contribute to urban economic resilience in surrounding territories (Xu et al., 2024). Technologies such as the Internet of Things (IoT), enabling seamless connectivity and real-time data collection, combined with advances in cybersecurity and Big Data analytics, are pushing to accelerate economic growth by increasing productivity, optimizing resource management, and promoting innovation across industries (Edquist et al., 2021). Not last, digital platforms have been shown to be capable of addressing structural shortcomings and improving rural adaptability (Singh et al., 2023). By tackling the structural and functional challenges faced by knowledge economies in rural areas, digital platforms offer a promising solution for strengthening rural resilience.

3. Legal framework

Anticipating the leading importance of digital transition, the European Commission (2021, March 9) outlined a comprehensive roadmap for digital transformation in order to empower citizens and businesses. The 'Digital Decade' establishes EU-level targets for digital transformation by 2030. In Romania, the Romanian Digitization Authority (ADR) was established in 2020 to oversee the implementation of digital transformation and information society strategies and policies. The Government Decree 89/2020 mandates the ADR as a legally independent entity under the Ministry of Research, Innovation, and Digitization, responsible for developing and coordinating strategies and policies in the field of digital transformation, as well as monitoring and ensuring compliance with relevant domestic and international regulations (The Romanian Government, 2020, January 28).

As Member States are obliged to draw up National Digital Decade Action Plans setting out the national contribution to the achievement of the overall objectives and European digital targets (EP and CEU) (2022, December 14), the Ministry of innovation, research and digitalisation in Romania adopted the *National action plan regarding the digital decade for Romania* (MCID, 2024). This includes essential coordinates of the Romanian digital ecosystem and outlines the national trajectories, aligned with European values and targets.

Recent efforts of the Romanian government to boost digitalisation include the adoption of two national strategies:

- *The National Strategy for Artificial Intelligence 2024-2027* (The Romanian Romanian Government, 2024 July 25) was developed in the broader context provided by the project "Strategic framework for the adoption and use of innovative technologies in public administration 2021-2027 - solutions for streamlining the activity"[1] (code SIPOCA 704) funded under the Operational Programme Administrative Capacity 2014-2020, implemented by the Authority for the Digitalization of Romania, in partnership with the Technical University of Cluj-Napoca. The overall objective of the project was to correlate international strategies on the use of innovative technologies in public administration with the national context and to develop strategic directions for the period 2021-2027. These strategic directions are mainly aimed at making the public institutional activity more efficient in its relations with citizens and at better development and coordination of these national institutions.

- *The National strategy in the field of quantum technologies for the period 2024-2029* (The Romanian Government, 2024, August 21) seeks to advance quantum technologies toward practical applications and contribute to a more interconnected and secure global landscape through these revolutionary technologies. It aims to consolidate Romania's position as a leader in innovation and quantum technology by establishing a national framework for their development. Additionally, the strategy aims to foster a favorable business environment and attract expertise and foreign investment to catalyze technological and economic development in the field of quantum technologies.

Besides the strategic documents, there are also various legislative initiatives among which we remind:

- *The National Program for the digital transformation of local public authorities (#DigiLocal)* (The Romanian Government, 2024, May 30) is managed by the Ministry of Research, Innovation and Digitalization, and supports the following benefits for local governments and citizens: (1) Interconnection of the IT systems of city halls and county councils with Ghișeul.ro, the official online payment platform of the Romanian state; (2) development of standardized user interfaces for citizen interaction so that they can use electronic public services easily and securely; (3) enhanced cybersecurity measures for local government IT systems, crucial for protecting frequently accessed services; and (4) acquisition of IT equipment to bolster administrative capacity and interoperability, ultimately reducing administrative burdens for citizens.

- *Government Emergency Ordinance no. 89/2022 on the establishment, management and development of cloud computing infrastructures and services used by public authorities and institutions*. This normative act regulates the general legal regime for the establishment, management and development, at national level, of a hybrid cloud infrastructure - the Government Cloud Platform (Platform) for the use of cloud services by central and local public authorities and institutions (The Romanian Government, 2022, June 27).

- *Law No 179/2022 on open data and re-use of public sector information* (Parliament of Romania, 2022, June 9). This legal act transposes Directive (EU) 2019/1.024 on open data and the re-use of public sector information and facilitates open access to public administration data, the re-use of data for research and development processes, as well as for the development of new information products and services (EP and CEU, 2019, June 20).

2. Description of the problem

A remarkable evolution of technology has been taking place over the last several years, with artificial intelligence, robotics, internet of things and other technologies start being largely used

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[1] In Romanian: „Cadru strategic pentru adoptarea și utilizarea de tehnologii inovative în administrația publică 2021-2027 - soluții pentru eficientizarea activității".

worldwide. Anticipating its potential in boosting competitiveness and improve institutional decisions, the EU has adopted digital transition as a pillar in its main investment policies, such as the Regional Policy and the NextGenerationEU. Thus, in 2021, the European Commission (2021, March 9) outlined its roadmap for digital transformation in order to empower citizens and businesses. The 'Digital Decade' establishes EU-level targets for digital transformation by 2030. To this aim, Digital Economy and Society Index (DESI), designed in 2017, was adjusted to align with the four core objectives of its Digital Decade policy programme (since 2023): digital skills, digital infrastructure, digitalisation of business and digitalisation of public services.

The transformations induced by digitalisations are complex and challenging for the EU population. About a quarter (23%) of EU population reported that the digitization of everyday public and private services has negatively impacted their lives (European Commission, 2024, July). Romania exhibits the highest prevalence at 34%, followed by France at 32% and Italy with 26%. The fact that Romania is clearly one of the EU countries that is lagging behind in terms of digital transformations is reflected by its performance in the objectives of the Digital Decade policy programme, except for the one relating to the digital infrastructure.

Digitalisation of public services

The first objective relates to the digitalization of public services and is intended to optimize efficiency, transparency, and accessibility in the relationship between citizens, businesses, and public administration. This digital transformation is anticipated to streamline administrative procedures, reduce time and resource expenditures, and elevate the user experience in interactions with public institutions.

In Romania, the radiography of the public administration digitalization reveals that the low level of ICT expertise in the public sector is hampering efforts to implement digital government strategies. When it comes to providing public digital services there seems to be a huge gap compared to the EU average. Romania has a low score of only 52.2 points compared to the EU average of 79.4 points when it comes to providing public digital services to citizens (EC DG-CONNECT,2024). The gap in providing public digital services to business seems to be even larger, with a score of 50.0 for Romania and 85.4 the EU average. Only 60% percent of service are online, compared with 88% at EU level. Just 12% of the services accept electronic identification (eID) in contrast to the EU average of 76%. When it comes to regular business operations (which includes 11 services related to regular business operations, such as administrative and tax requirements, human resources and refund of VAT. etc.) the score obtained by Romania is also abysmally low, 51.5, against the EU average of 83.9. Starting a business is also far from easy in Romania. Assessing 16 services, both mandatory services as well as information needs, that allows an entrepreneur to start his business, Romania acquires a score of 48.7, while the EU average is 83.1.

Digital skills

Looking at the most recent DESI values that includes data from 2023 (EC DG-CONNECT,2024), Romania is positioned well below the EU average when it comes to the digital skills acquired by individuals or the share of ITC specialists in the labour force. There is a large gap in terms of basic digital skills (27.7% vs. 55.6% EU average) or above average digital skills (9.0% vs. 27.3% EU average) while the Romania target is 50%.

The share of ICT specialists as part of the workforce is 2.6% (compared to the EU average of 4.8%), which is surprising, given that Romania ranks sixth in the EU both in terms of ICT graduates (6 .8% among all higher education graduates in 2022). Given that Romania does have a relatively strong population of ICT graduates, this hints that they are not employed in ITC positions, they work for employers abroad or are leaving the country to work abroad.

The gender gap is lower in Romania, given that it holds the second position in terms of the number of female ICT specialists (2.4% compared to 1% the EU average, in 2022). Furthermore, Romania is advanced in terms of the presence of women in the digital sector: female ICT specialists represent 26% of ICT specialists, exceeding the EU average of 19.4%. The gender gap in terms of digital skills is not high, but the digital literacy is low, given that the share of individuals with at least basic digital skills is

just half of the EU average (29.1% of males and 26.5% of females have at least basic digital skills, compared with the EU average where the percentages are 56.7% and 54.5%, respectively – see Table A1 in Appendix A which reflects gender differences in Romania and EU).

Zooming in to the territorial level, Bucharest, Cluj-Napoca, Timisoara, Iasi and Brasov are the main IT hubs in Romania. If Bucharest host over 12 thousand IT[2] firms summing up to a total turnover of 35 billion RON, Cluj-Napoca, the second hub, hosts over 3000 companies with a turnover of almost 10 billion RON. With about 1500 firms each, Timisoara and Iasi host IT activities valued at 6.49 billion (0.39 billion in Timisoara). The same ranking holds true when looking at the employees, with about 90 thousand in Bucharest, around 30 thousand in Cluj-Napoca and over 10 thousand in Timisoara and Iasi (See Figure 1 and Figures B2 and B3 in Appendix B for the geographical distribution of the indicators).

Figure 1. Share of IT firms in Romania by Local Administrative Unit (LAU) in 2022
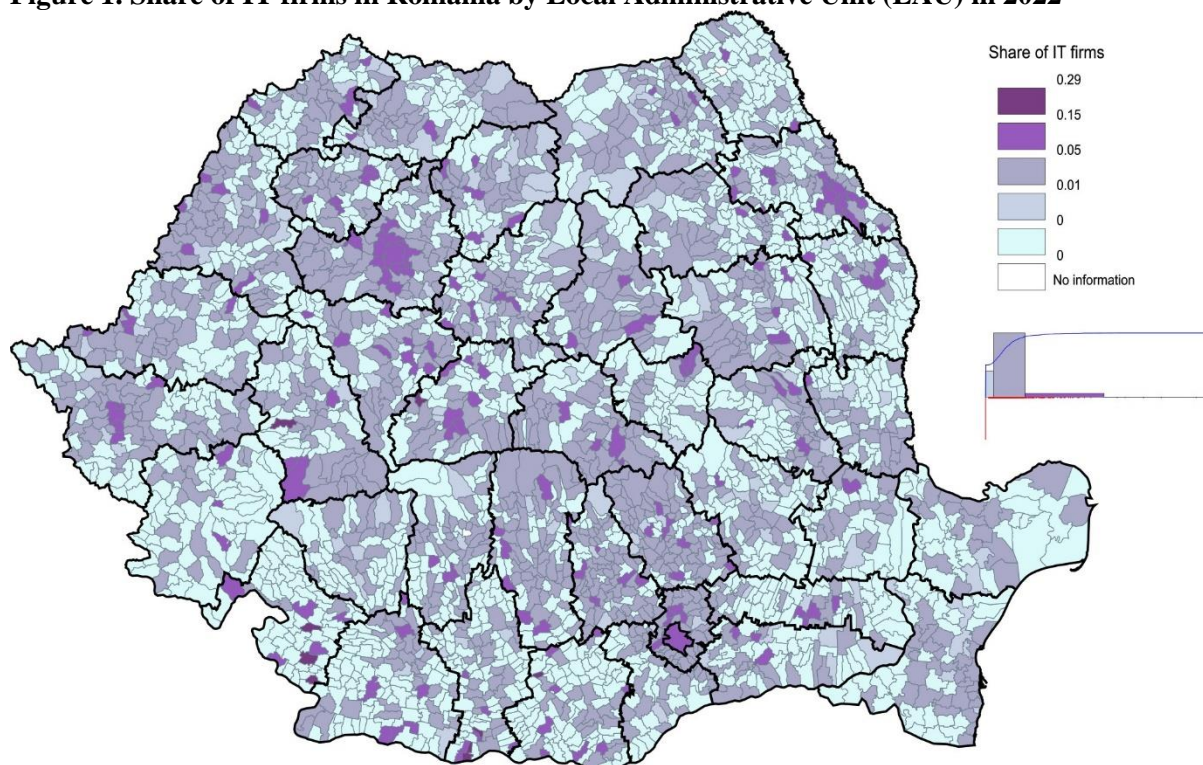
Source: National Trade Register Office in Romania (ONRC)

If we classify municipalities by the share of IT companies, there small municipalities with a small number of IT firms, but higher shares (for instance, in Poroina Mare from Mehedinti county seems to be hosting 7 firms, 2 from IT sector, the share being 28.5% - see Figure 1). If we set a threshold and explore territories with at least 10 companies, the territorial units with the highest shares are two municipalities from the periphery of Cluj and Iasi, namely Feleacu and Miroslava with 11% of IT companies (178 firms in Miroslava and 50 in Feleacu).

Looking at the share of the IT sector in total local turnover, there seems to be 28 municipalities with at least 10% in the IT sector (see Figure B3 in Appendix B). In absolute terms, just 20 have a turnover higher than 1 million Lei, with Cluj-Napoca and Iasi cumulating the highest turnover among them. In relative terms, Ciurla, from Cluj County, is ranked the first, with over 45% of turnover being in the IT (over 40 million Lei).

Digital infrastructure

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[2] Please see Table B1 in Appendix B2 how the IT sector was defined and what economic sectors includes.

The objective referring to digital infrastructure is the only one where Romania position itself above the EU average. Fixed connectivity is an objective that Romania has almost fully achieved. Looking at 2023 data, Romania benefits from a VHCN (Very High Capacity Network) coverage of 95% compared to the EU average of 78.8%. Romania is also displaying a good performance in terms of FTTP (Fiber To The Premises) with 95% compared to the EU average of 64%. 94% of people have subscriptions of at least 100 Mbps (compared to 65.9% of the EU average) and 30.5% of people have access to connections of at least 1 Gbps (compared to 18.5% in the EU). The main vulnerability in terms of connectivity relates with the 5G technology, which cover just 32.8 of the households, compared with 89.3 at the EU level.

Reasons for the low demand for 5G services may include the already good coverage of FTTP, low digital literacy among the population and businesses and a poor understanding of the benefits brought by the 5G technology, restrictive legal obligations imposed on 5G operators, lack of up-to-date information on the Geographical Information System (GIS) map regarding the 5G cold spots, bureaucratic challenges at the local administrative level on the authorization of construction projects related to 5G network support infrastructure, the lack of alignment between the legislation governing electricity and that governing electronic communications that hampers the procedure for authorization and connection to the electricity grid of 5G network (MCID, 2024).

Digital transformations of business

Romania is also lagging behind in the adoption of digital technologies by businesses when compared to both the EU average and the established EU targets. Overall, in 2023, just 26.8% of Romanian SMEs were found to have at least a basic level of digital intensity, compared to an EU average of 57.7% (EC DG CONNECT, 2024). Specifically, looking at 2023 data, AI adoption stands at a mere 1% compared to the EU average of 8%, cloud services utilization is at 11% compared to the EU average of 34%, and Big Data adoption is limited to 5% of companies, contrasting sharply with the EU level of 14%.

The digitalization of Romanian SMEs is hindered by a confluence of factors, including knowledge deficits, underinvestment, a constrained venture capital ecosystem, and limited access to finance (EIB, 2023, June). SMEs often lack knowledge of how to digitalise and how this may help their business. Asides from the low level digital literacy of employees, and the general population, SMEs often exhibit a reluctance to allocate resources to digital transformation, either due to a perceived lack of strategic importance or financial constraints. The constrained access to financial resources, both from traditional banking channels and venture capital markets, adversely impact the Romanian SMEs. This scarcity not only hinders innovation but may also result in products that are tailored to international investors rather than the needs of the Romanian market.

Other vulnerabilities

In order to monitor the evolution of digitalization in time across the EU countries, the data from EU surveys on access to and use of information and communication technologies (ICT) by households and individuals were used to design the Digital Vulnerability Index (DVI). This tool provides a broader picture of the level of digitization, by capturing various aspects in terms of internet use among EU households and individuals. It includes both general information, such as the accessibility and frequency of internet use, but also its purposes. Internet uses cover a variety of reasons such as reading news articles, using social networks, purchasing goods and services, but also interacting with various public authorities (e-Government) or managing bank accounts (e-Banking).

Figure 1. Digital vulnerability in Romania and different EU country groups by year
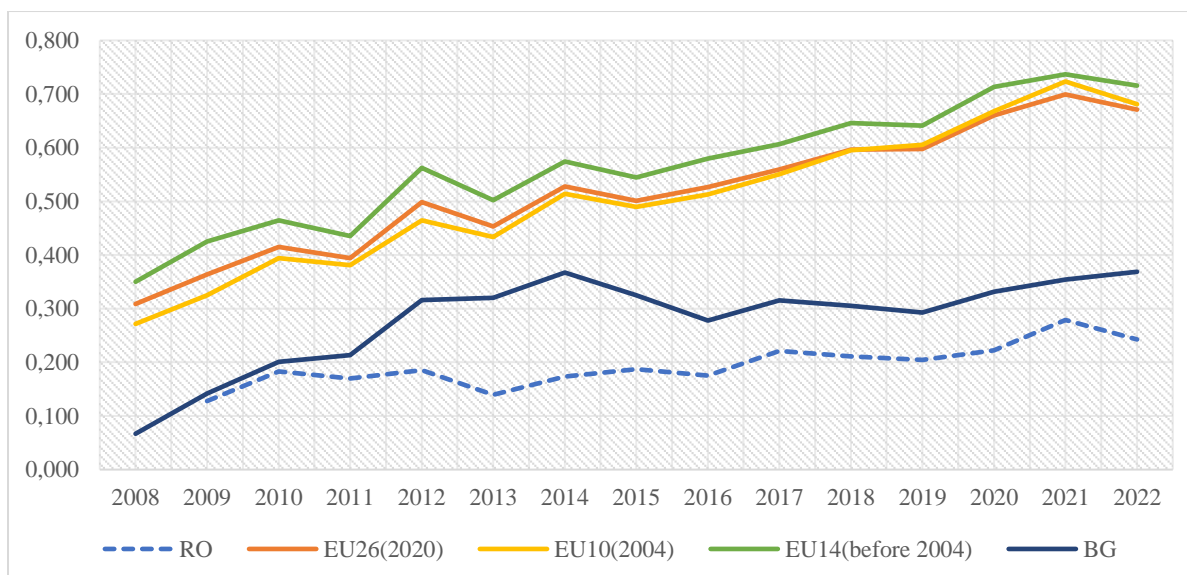
Notes: EU26(2020) excludes data for UK and HR. EU10(2004) refers to countries that accessed the EU in 2004. EU14(before 2004) includes countries that were members before 2004, excluding UK. The aggregate indices were computed by using averages of country level indices: Czechia: 2008, 2017; Germany: 2008-2013; France: 2020; Latvia: 2009; Poland and Romania: 2008.
Source: INDI-DeR project

The DVI dynamics clearly indicates that Romania is lagging behind other EU countries, no matter that we look at the overall EU average, the average of the countries accessed in 2004 or the ones that were already member States before the 2004 enlarging wave (Figure 1). While the older member states (EU14 before 2004) display the highest digitalisation level, the countries becoming members in 2004 seem to be reducing the digital gap. Conversely, Romania seems to remain much behind the EU countries, with the gap considerably increasing, particularly after 2015. The progress reported by Romania seems to be poor, with a slow increasing pace from 0.128 in 2009 to 0.243 in 2022. Over the same period, Bulgaria increased from 0.142 to 0.369.

Figure 2. Digital vulnerability in Romanian NUTS1 regions by year
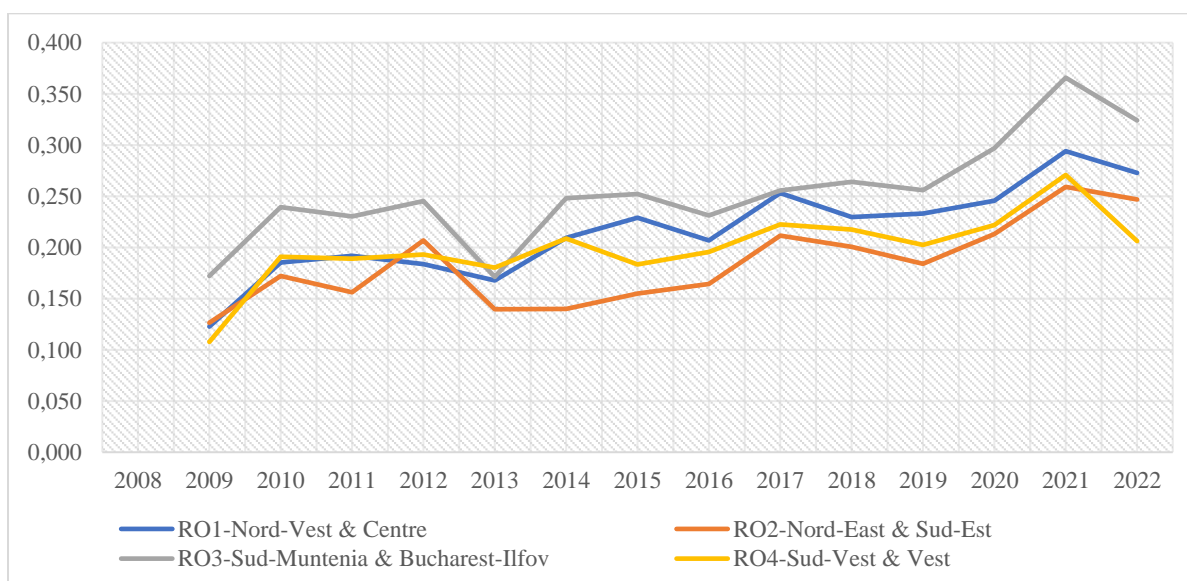
Source: INDI-DeR project

Figure 2 reveals important disparities in terms of digitalization at regional level. The Macroregion 3, which includes the capital city, Bucharest, shows the best performance in terms of digitalisation. One

needs to mention that while the other macroregions were displaying similar performances in terms of digitalization, since 2015, the Macroregion 1 have consolidated the second position. While the pandemic seems to be tempered the surge in digitalization, the Macroregion 4 dropped on the last position in 2022.

Rural vs urban disparities

Romania faces significant gaps between urban and rural areas, with several levels of differentiation that are not yet fully resolved. The gap is visible in terms of internet access, interaction with public authorities, or electronic identification being some examples (NISR, 2024).

In urban areas, 89.8% of households are connected to the internet, 9.5 percentage points more than the 80.3% share of rural households. The percentage of population who have never used the internet is also larger in rural areas (11%) compared to urban spaces (4.3%). In the same vein, in urban areas, the proportion of people who used electronic identification to access some online services for personal purposes was 15.8%, 8.3 percentage points higher than in rural areas.

The gap is also important when it comes to public services access (NISR, 2024). Of all people who accessed the internet in the last 12 months, 19.0% from urban areas interacted with public authorities or services for personal purposes, unlike rural areas with just 10.9%. Of individuals aged 16 to 74 who have used the internet in the last 12 months, 10.9% have downloaded or printed official forms from a website or application of public authorities or public services for personal use. An analysis by area of residence shows that urban areas clearly stand out from rural areas, with 5.9 percentage points.

Furthermore, besides low accessibility, a significant territorial disparity also exists within public services, separating high-performing authorities and Local Administrative Units (LAU) from those with limited resources and technological access. While some regions benefit from advanced digital services, others lack the resources to implement such innovations (Durach et al., 2021).

Another example relates to the share of people who have ordered goods or services over the internet (NISR, 2024). There seems to be a significant difference between the two areas of residence, of 12.3 percentage points (73.7% in urban and 61.4% in rural areas, if we look at individuals aged 16 to 74 who have used the internet in the last 12 months). If we analyze more recent trends, disparities in terms of online commerce seems to vanish, with rural areas taking advantage of the higher accessibility provided by the online commerce. Thus, internet users aged 16-74 in rural areas who had used online commerce in the last 3 months preceding the interview outnumbered those in urban areas in the purchase of clothing, footwear or accessories (80.8% in rural compared to 78.9% in urban areas) and when buying cleaning and personal hygiene products (18.2% in rural areas compared to 16.2% in urban areas).

4. Policy recommendations

The accelerated pace of digital transformation offers wide-ranging opportunities for societies to improve competitiveness, efficiency of policy initiatives and regain trust in institutions. As funds have also been provided for digital transition, this is a favourable context for Romania to boost its tradition by improving digital infrastructure, widen digital competences, and support digitalisation of business and public services. Except for digital infrastructure endowments, Romania is following behind the other European countries in most of the monitored digital transformation.

In order to unleash its full potential in advancing social and economic well-being, Romania's current trajectory in digital transformation demands a more cohesive, user-centered, and unified framework.

First, the digital maturity of public administration continues to pose significant challenges, being at varying stages of advancement. While significant strides have been made in recent years (See the Key IT platforms in Romania directly serving citizens and businesses - Appendix C), both in qualitative and quantitative terms, challenges remain in achieving the stated objectives. Nonetheless, the process of institutional digitization is irreversible and requires ongoing evaluation and improvement. Essential legal frameworks and operational government platforms have been established, but the digital

ecosystem needs further refinement to ensure functionality, interoperability, and user-friendliness. The digitization process must be centered on citizens and their needs, aligning with the principles of the Digital Decade and the Declaration on Digital Rights. Despite progress, challenges persist, such as a lack of digitization at the local level and insufficient digital skills among public servants. Addressing these issues through targeted training and skill development is crucial for successful digital transformation.

In 2020, the Authority for the Digitalisation of Romania (ADR), a public sector entity within the Ministry of Research, Innovation and Digitalization (MCID), was established with the primary task of driving the digitalisation of government and government services. However, while its actual configuration limits its ability to secure the political support and legitimacy essential for its effectiveness, strategically positioning it within the General Secretariat of the Government (GSG) might provide the required empowerment (OECD, 2023).

A strategic roadmap to facilitate the transition from e-government to digital government is necessary (OECD, 2023). Shifting from the initial legal compliance to practical implementation, which requires a better resource alignment and a collaborative culture, is imperative. Prioritizing open government data is fundamental to unlocking its potential for social and economic progress. Also, implementing effective management and coordination to facilitate the deployment of core infrastructure elements such as government cloud, data interoperability, and digital identity will ease administrative burden of citizens. Not last, designing a solid and sustainable digital public infrastructure ecosystem, encompassing standard components such as notification and payment systems will increase users accessibility.

Feedback is essential for monitoring the effectiveness of public sector services and facilitate a continuous improving process (OECD, 2023). Thus, establishing a knowledge-sharing platform for public sector practitioners to foster inter-institutional trust and facilitate collaboration and learning. In addition, implementing a comprehensive user satisfaction system to capture citizen feedback, inform policy decisions, and improve service design and delivery will also be helpful.

Second, in order to both implement and facilitate deployment of digital technologies infrastructure in both private and public sector, increasing the number of ITC specialist and the population digital literacy is essential. Several measures have already been put in place. For instance, studies evidenced that the tax exemption to IT implemented in Romania in 2001 and expanded in 2013 (to include more eligible firms and workers by introducing additional NACE codes and bachelor's degree specializations), induced strong and long-lasting growth in this sector at faster pace than in otherwise similar countries (Manelici and Pantea, 2021). Also, in line with the framework for digitalizing the education system, in 2022, Romania established a digital skill profile for education professionals and a mechanism for validating their digital competencies. An optional high school discipline, "Digital education and media skills"[3], was launched in the 2022/2023 academic year. Policy initiatives may further support the learning process. For instance, in terms of private training, it is notable that only 7.9% of businesses offer ICT training to their personnel, well below the EU average of 20.9% (Eurostat, 2024a). When it comes to the public sector, designing targeted training programs and upskilling initiatives to address the capacity gap in key digital government initiatives like government cloud and interoperability will enhance the capabilities of public sector institutions (OECD, 2023).

Third, the SMEs which represents the backbone of the European economies also received special attention within the Digital Decade policy programme. As Romania is also lagging behind in the adoption of digital technologies by businesses, policy interventions may strengthen their capacities to attract, retain and develop digital talent and skills, as well as to facilitate digital transition.

Among the funding programmes aiming to improve digitalisation, including within SMEs, we can enumerate the ESIF funded Competitiveness and Human Capital Operational Programmes, the StartUp Nation programme or the'Digital transformation' pillar within the Romanian Recovery and Resilience plan.

Other policy interventions may stimulate the supply of ITC specialists, consolidate the ITC SME ecosystem and by adaptation of the normative and institutional framework to the development requirements of the ITC industry (ANIS, 2021). On the supply side, providing students the opportunity

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[3] In Romanian, „Educația digitală și abilități media".

to early engage in the labour market, by revitalizing the post-secondary education in Romania or the development of professional retraining programs, the recognition and certification of training in industry (to reduce the gap between the share of graduates in ITC and the share of employees in this sector). In addition, measures aimed at retaining ITC specialist or foreign recruitment might also be helpful in increasing the supply of ITC specialists. When it comes to ITC sector, this may also be supported by strengthening access to capital for SMEs, prioritizing key strategic areas of platform technology development (for example, artificial intelligence, robotics, IoT/ Internet of Things), or promoting the technological companies from Romania on global markets. Accelerating the digitization of public administration or the implementation of a sustainable fiscal framework with additional facilities to stimulate investments in the software industry and IT services may further boost the ITC sector.

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Appendix A

Table A1. Women in Digital Scoreboard 2024, Romania

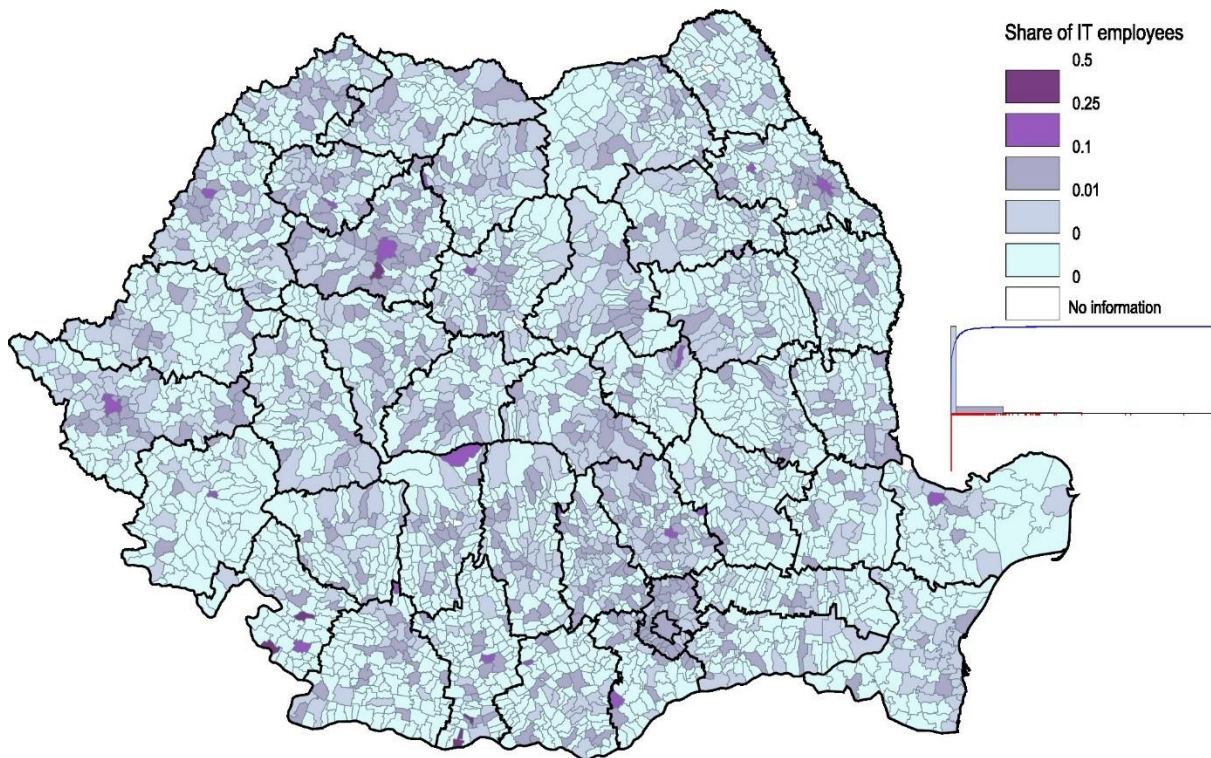|	Romania			EU	
	Women		**Men**	**Women**	**Men**
	Value	Rank	Value	Value	Value
1 Use of internet					
1.1 Internet users % individuals, 2023	**87%**	**20**	*89%*	**90%**	91%
1.2 People who have never used the internet % individuals, 2023	**8%**	**19**	*7%*	**6%**	6%
1.3 Online banking % internet users, 2023	**24%**	**27**	*25%*	**69%**	71%
1.4 Doing an online course % internet users, 2023	**4%**	**27**	*3%*	**17%**	16%
1.5 Online consultations or voting % internet users, 2023	**4%**	**25**	*5%*	**9%**	9%
1.6 e-Government users % internet users, 2023	**23%**	**27**	*26%*	**75%**	75%
1 Use of internet Score (0-100)	**39**	**27**		**65**	
2 Internet user skills					
2.1 At least basic digital skills % individuals, 2023	**26%**	**27**	*29%*	**54%**	57%
2.2 Above basic digital skills % individuals, 2023	**8%**	**26**	*10%*	**25%**	29%
2.3 At least basic digital content creation skills % individuals, 2023	**39%**	**27**	*42%*	**67%**	69%
2 Internet user skills Score (0-100)	**27**	**27**		**55**	
3 Specialist skills and employment					
3.1 STEM graduates Per 1000 individuals aged 20-29, 2021	**17**	**6**	21	**15**	29
3.2 ICT specialists % total employment, 2022	**1.6%**	**20**	*3.6%*	**1.9%**	7.0%
3.3 ICT graduates % individuals with ICT degree, 2021	**2.4%**	**2**	*4.5%*	**0.9%**	3.3%
3.4 Unadjusted gender pay gap % difference in pay, 2022	**20%**	**17**		**19%**	
3 Specialist skills and employment Score (0-100)	**57**	**6**		**45**	
Women in Digital Index Score (0-100)	**41.0**	**27**		**54.8**	

Source: EC DG CONNECT, 2024b

Appendix B

Table B1. ITC activities classification

| Macro-sector		Sub-sector/Industry	Included activities (CAEN rev. 2)	
Information and Communications Technology(ICT)	IT sector	Software and IT services industry	J582 (J5821, J5829)	Software publishing activities
			J6201, J6202, J6209 (J620 excl. J6203)	Information technology service activities, excluding management activities of computing equipment
		Other IT activities	J6203	Computer facilities management activities
			J631 (J6311, J6312)	Web portal, data processing, web page management and related activities
			J6399	Other information service activities (not elsewhere classified)
	Telecommunications		J61	Telecommunications
	Media/ publishing/ Other creative activities		J581	Book, newspaper, magazine and other publishing activities
			J59	Motion picture, video and television program production, sound recording and music publishing activities
			J60	Broadcast and program transmission activities
			J6391	News agency activities

Source: ANIS, 2021

Figure B2. Share of IT employees in Romania by Local Administrative Unit (LAU) in 2022

Source: National Trade Register Office in Romania (ONRC)

Figure B3. Share of IT employees in Romania by Local Administrative Unit (LAU) in 2022
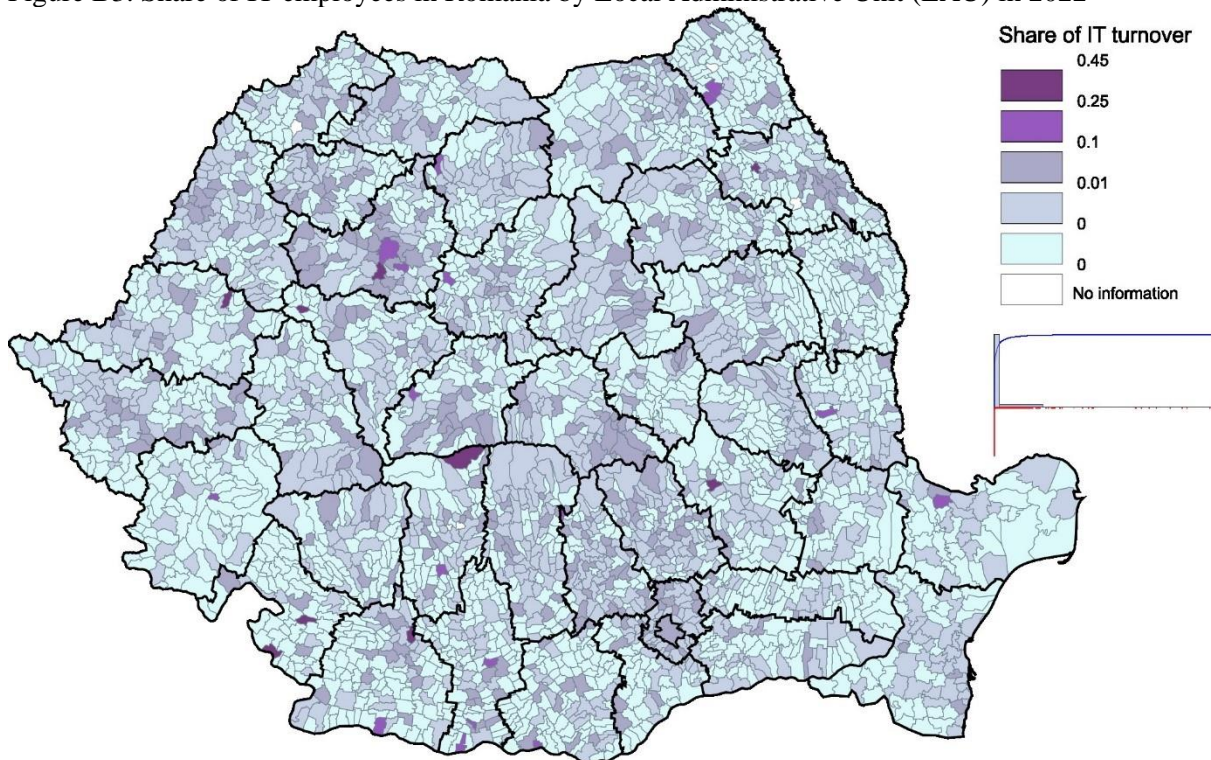
Source: National Trade Register Office in Romania (ONRC)

Appendix C - Key IT platforms in Romania directly serving citizens and businesses

- **The IT system of the Ministry of Public Finance and the National Agency for Tax Administration** (includes several components: SPV, OSS and, more recently, *RO e-Factura* and *RO-eTransport*. *Virtual Private Space (SPV)*[4] is a portal offering a suite of digital services, including tax liability information, social security payment details, visualization of tax assessment decisions, and electronic access to administrative-fiscal acts and other documents); *One-Stop-Shop (OSS)*[5] provides electronic services for Value Added Tax (VAT); the system allows businesses to access electronic services for VAT registration and reporting in all EU Member States); *RO e-Factura* (national electronic invoicing system) was created to provide economic operators with an electronic service for issuing and receiving invoices. The system is integrated and can be accessed using the SPV credentials, and will be interconnected with other systems held by EU Member States. *RO-eTransport* (the national integrated electronic system for the monitoring of road transportation of goods with high tax risk) monitors in real time the movement of goods with high tax risk on Romanian territory, such as: the transportation of goods purchased and delivered intra-Community, the transportation of goods subject to customs operations, the transportation of goods between two locations within the national territory. The system is integrated and can be accessed using the SPV credentials.
- **The National Electronic Public Procurement System (SEAP)[6]** is a centralized platform managed by the Authority for the Digitalisation of Romania (ADR), which simplifies procedures for both suppliers and contracting authorities, acting as a national focal point for the transmission of procurement notices to the EU Official Journal (as OJS eSender); it also offers interactive and transactional services aimed at making the public procurement process as easy as possible;
- **The Courts Portal[7]** is managed by the Ministry of Justice and provides information on every court in Romania, at all levels, including their websites, court calendars and information on the judgments rendered;
- **The Portal of the National Agency for Cadastre and Land Registration (ANCPI)**[8] was implemented for issuing land register extracts; it allows both citizens and businesses to access cadastral plan extracts for information purposes, provides orthophoto plans and global navigation satellite system services;
- **The Online Trade Register (ONRC portal)**[9] reduced the time needed to start up a company from 72 hours to just 24 and facilitated the submission and release of different documents regarding business activity.
- **The National electronic system for online payment of taxes (Ghiseul.ro)**[10] is a platform that allows citizens to pay their taxes, fees and fines imposed by the enrolled public institutions. In addition, as of March 2023, the platform has expanded its functionality to allow the issuance of criminal records at no cost.
- **The electronic single point of contact (PCUe)**[11] is a platform for the integration of e-government services into the national electronic system, providing citizens and companies with electronic services, regardless of the country of origin of the beneficiaries. It provides access to electronic services and information through a single electronic point, as well as a centralized

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[4] https://www.anaf.ro/anaf/internet/ANAF/ servicii_online/inreg_inrol_pf_pj_spv

[5] https://www. anaf.ro/anaf/internet/ANAF/ANAF/servicii_online/one_stop_shop

[6] https://www.e-licitatie.ro/pub

[7] https://portal.just.ro/SitePages/acasa.aspx

[8] https://geoportal.ancpi.ro/geoportal/imobile/Harta.html

[9] https://myportal.onrc.ro/home

[10] https://www.ghiseul.ro/ghiseul/public

[11] https://edirect.e-guvernare.ro/SitePages/landingpage.aspx

history of communication between citizens and the competent authority. It is also possible to obtain electronically: opinions, authorizations, certifications, qualifications. The PCUe is also used by public institutions to communicate bidirectionally in order to transmit administrative files.

- **The aici.gov.ro platform is** a digital tool acting as an intermediary for the registration of documents addressed to public institutions that do not have their own online registration system. The objective of the platform is to streamline and technologize communication processes at national level, so that all public institutions in Romania are enrolled in a digital system, capable of responding to citizens' requests in electronic format, in the shortest possible time.

- **The data.gov.ro platform** provides open access to datasets delivered by public administration authorities and institutions, helping the public to find, download and use information generated and held by administrative structures.

- **ROeID**[12] - software platform and digital identification application - aims to provide secure identification mechanisms to facilitate citizen interaction with public institutions.

- **ROeIDAS**[13] is an interoperability system with the EU Member States that facilitates interconnection with the eIDAS nodes of the other Member States and with the Romanian eID and e-Services providers.

- **The Ministry of Internal Affairs Platform**[14] allows citizens to obtain criminal records, to schedule for obtaining or renewing their passport and to obtain approval for urban planning documentation as well as for building/demolition permits.

- **The IMM MENTOR Platform** is structured on several pillars, as follows: Entrepreneurship Education, SME Financing, Firm Legislation and Competent Institutions. The Financing pillar identifies all financing lines - from the state budget, European grants, other financing funds (Norwegian, Swiss, World Bank, etc), existing financial platforms (crowdfunding, crowdsourcing, etc), as well as business support structures (incubators, accelerators, etc). The platform also includes a Marketplace application, which maintains the register of all Romanian companies and gives companies the possibility to manage their invoices within the application;

- **SITUR Platform**[15] is an IT system that replaces the traditional procedures of physical submission of documents for obtaining authorizations in the field of tourism, allowing easy access to all stages of this process.

- **RUTI Platform**[16] (the Single Register of Transparency of Interests) is a governmental online system through which decision-makers register meetings between themselves and specialized groups that express, on their own initiative, an interest in a specific area falling under the regulatory competence of the central and/or local public administration in order to promote a public policy initiative. The register establishes a framework for collaboration that is complementary to and prior to the legal procedure for transparent decision-making.

- **E-CONSULTARE**[17] is an online governmental platform that gathers draft normative acts launched for public consultation at central government level. Its aim is to enable civil society to participate effectively in the decision-making process and it was conceived as a solution to increase predictability in the process of drafting normative acts at the executive level.

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[12] https://www.roeid.ro/
[13] https://eidas.gov.ro/roeidas/
[14] https://hub.mai.gov.ro/
[15] https://turism.gov.ro/web/situr-gov-ro/
[16] http://ruti.gov.ro/
[17] https://e-consultare.gov.ro/w/

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