



Rural Development and Digitalization: Perspectives and Economic Impact in Romania

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ABSTRACT

The paper presents an analysis of rural development in Romania within the broader European context, focusing on the impact of digitization. Drawing from scientific databases and official sources, the study collected and interpreted data from both European and national statistical systems. The research results showed a significant evolution of digitization in the rural environment, but also the continued existence of significant gaps compared to urban areas. The significant increase in internet access rates in Romanian villages, the use of modern digital technologies in local public administration, or a high level of interest in accessing Smart Village funds are aspects highlighted in the article. The conclusions of the study can be useful to public authorities for the development of strategies aimed at rural development. The research conducted is preliminary in nature, being carried out within doctoral studies.

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1. Introduction

Rural development is one of the European Union's priorities. Digitization and internet access in rural areas are essential for connecting communities to resources, opportunities, and services, playing a crucial role in stimulating sustainable economic and social development in these regions.

Digitization is a complex process that involves transforming activities and processes into digital formats, with internet access being a specific aspect of this process, related to the ability to connect to the global internet network to access and share information and services online. The effects of digitization can be quantified in terms of improved quality of life for the population and the development of opportunities for progress.

Although internet access and digitization have become increasingly important in rural areas in recent years, there are still many challenges related to infrastructure quality and accessibility to high-speed internet services. Thus, in many rural areas, telecommunications infrastructure is either absent or underdeveloped, making it difficult to provide stable, high-speed internet connections. In many cases, expanding internet infrastructure in rural areas can be costly for service providers, and internet subscription costs may be higher compared to urban areas. Additionally, in some rural communities, access to the devices and technologies needed to use the internet may be limited due to high costs or reduced availability.

2. Literature review

According to official data, around 80% of the European Union's territory is occupied by rural areas, and over 30% of the total European population lives in these communities. Rural areas are predominantly inhabited by an older population compared to the European average. While urban areas have experienced rapid development, offering diverse opportunities and a high standard of living, many rural areas have faced significant economic and social disparities. Depopulation has affected rural communities as people moved to urban areas in search of education, job opportunities, and more accessible healthcare. This migration has led to declining rural populations and economies, and consequently, a decrease in investments in infrastructure and public services. Thus, the gap between rural and urban areas has continued to widen, with cities being favoured over villages. In community interventions to support rural development, it is recommended to adopt a holistic and comprehensive approach to rural territories, a vision that allows for the analysis of the full spectrum of these communities' needs, rather than limiting the perspective to a specific sector, such as tourism or agriculture (European Commission EC, 2023).

Rural development constitutes the second pillar of the Common Agricultural Policy, complementing the First Pillar (based on income support and market measures) by enhancing the social, economic, and environmental sustainability of rural areas. The main objectives for the long-term development of rural areas at the European level focus on stimulating competitiveness in agriculture and forestry, sustainable management of natural resources, actions to combat climate change, and promoting balanced territorial development of rural economies and communities, including through the creation and maintenance of jobs (EC, 2024).

Digital connectivity in rural areas is essential for business development and economic growth, enhancing educational and public health services, and improving local and regional administration. Improving the quality of life in rural areas to match urban standards, fostering stronger, connected, resilient, and prosperous rural communities is a long-term vision at the community level. Bridging the digital divide between urban and rural areas is a complex process that requires more than just developing physical infrastructure. To implement technological solutions for digitization more effectively, collaboration between localities and communities through information platforms is essential. This collaboration facilitates knowledge exchange and can even lead to joint investments in solutions tailored to the specific needs of each area (EC, 2023).

At the European level, local authorities and non-governmental organizations are working to develop and expand internet infrastructure in rural areas, with initiatives and funds allocated to provide high-speed internet connections and reduce the digital gap between environments. Digitization can bring numerous benefits to rural areas, including improved access to education, better healthcare services, and business opportunities for local entrepreneurs. Lack of internet access can create digital divides and affect the economic competitiveness of rural communities (EC, 2009).

A study by Brunori, Rolandi, and Arcuri (2022), based on official European Union information, shows that limited access to essential services and infrastructures, as well as the lack of high-speed internet connections, are key characteristics of rural and peripheral areas. These factors increase the risk of exacerbating issues related to depopulation, external migration, aging, education, general and digital skills shortages, and gender gaps in employment. The risk of social exclusion and poverty is higher in rural areas than in cities and urban agglomerations. Digitization has the potential to mitigate these problems and support ecological transition and sustainable growth. The digitization process was accelerated by COVID-19, reaching a high level in daily activities, being used for work, education, shopping, communication, or socialization. In rural areas, where distances between communities are generally greater, isolation can be alleviated through higher online connectivity. By shortening distances, digitization can change the way of life in rural and peripheral areas, enabling not only work and learning but also interaction with public administrations, managing payments and finances, participating in debates, and facilitating access to digital health systems (Stanciu, 2022).

3. Smart Village Initiatives in the EU

At the European level, rural local authorities can access community funds and develop "Smart Villages" projects, based on innovative solutions to improve their resilience, relying on local strengths and opportunities. Through these projects, villagers can benefit from a modern lifestyle with high standards while preserving the values, traditions, and customs of rural communities. The advantages of a sustainable and friendly environment can thus be leveraged, eliminating digital gaps between urban and rural areas, and using community data to understand strengths and weaknesses, capitalize on local opportunities, and mitigate or reduce threats.

In Romania, rural areas cover about 87% of the national territory, with a rural population of 8,959,096 persons, representing about 46.14% of Romania's population in 2019 (population density of 43.15 inhabitants/km²). The local rural environment is characterized by strong social and economic heterogeneity, with differences between regions affecting demographic levels. Rural localities around municipalities and cities or in tourist areas are characterized by positive demographic trends, mainly due to urban-rural migration movements. In isolated localities or those located more than 30 km from urban centres, negative demographic trends are recorded, mainly due to socio-economic conditions. The decline of the rural population, perceived because of societal modernization, has become a permanent phenomenon, associated with the continuous degradation of the age structure, caused by the aging process of the population, much more pronounced in rural areas than in urban ones. Significant reductions in the rural population were recorded in the 0-34 years, 35-39 years, and 55-59 years segments, while the population aged 65 years increased by approximately 40.4 thousand persons in 2018 (Ministry of Development, Public Works, and Administration, 2020).

In 2022, about 88.9% of people aged 16 to 74 in Romania used internet services in the past year. The national value is 2.2 percentage points below the European Union average. In 2023, internet usage in Romania increased by 2.7 percentage points in the same age category (National Institute of Statistics NIS, 2023a).

According to NEOS (2024), two significant vulnerabilities in Romania's digitization process can pose major obstacles to effective digital transformation: electronic identity/interoperability and limited digital skills. In the first scenario, significant disparities in internet access between rural and urban areas are observed. In rural areas, only 77% of households have internet access, and this figure drops to just 60% for poor families. The costs associated with internet services remain inaccessible for these households, even though subscription

fees have decreased in recent years. Another major issue is the lack of interconnectivity between various public administration databases, a phenomenon that has led to increased bureaucracy at the national level. According to the mentioned source, Romania ranks 27th out of 29 Member States in the European Union in terms of the adoption of digital public services and the level of digital skills among the population, as well as in certain companies and public institutions.

Furthermore, a study conducted by Șandor et al. (2020) shows that approximately 48.2% of households in the studied rural area do not have internet access because they do not consider it useful or interesting. A barrier to connecting households to internet services is the relatively high cost of access. Of the total people who accessed the internet in the last 12 months, the proportion who interacted with authorities or public services for personal purposes was 14.6%. Of these, about 74.7% searched for information on public authority websites, 55.6% requested official form downloads, and 47.8% wanted to submit completed forms, activities predominantly requested in urban rather than rural areas (18.3% vs. 9.1%).

Research on needs analysis in rural areas conducted by the Ministry of Agriculture and Rural Development (MADR) (2020), in the National Strategic Plan 2021-2027, reveals that reducing disparities between urban and rural areas is essential for Romanian villages and can be supported through the implementation of digital technologies. The benefits brought by digitization and online infrastructure in developing information exchange and expertise can support local farmers in producing safe food, respecting the environment, and guaranteeing product quality. The use of these technologies is crucial as it facilitates increased agricultural production with reduced resources, and at the same time, can contribute to the fight against climate change by promoting high-quality products with minimal environmental impact (Ionescu et al., 2019).

The development of logistics, facilitating access to modern equipment and digital tools, online platforms for continuous training programs in agriculture for farmers, partnerships between agricultural farms and alumni/student associations of agricultural educational institutions, online events for connecting stakeholders and efficient information exchange (Ferțu et al., 2019).

Dumitru et al. (2021) mention that depopulation is one of the main problems facing rural Romania. Young adults often choose to migrate to urban centers or leave the country altogether to meet their economic and/or social aspirations. By analysing data obtained from an online survey, the authors estimate that a solution for the sustainable development of rural areas in Romania could be represented by the development of a digital tool, which would create synergy between local authorities, researchers, and the private sector. To address these issues, the Romanian Government should provide the necessary funds to local authorities, based on identified needs, to resolve the identified problems.

In an analysis regarding the modernization of agriculture and the impact of digitization on rural areas, Rodino et al. (2023) estimate that the current level of agricultural development is characterized by significant transformation of management and production processes due to the introduction of digital technologies. Traditional forms of agricultural production development are no longer efficient, and digital transformation has a significant impact on material and human resources, increasing crop productivity, improving the quality of agricultural and livestock products. Agricultural digitization can represent a source of agricultural economic growth and a strong stimulus for innovative sector development. Investments in developing digital infrastructure in rural areas can improve living conditions for the rural population, and local authorities can more effectively manage issues within their jurisdiction. Digital transformation in agriculture will promote the development of small farms in rural areas and can contribute to the diversification of the rural economy.

Increasing access to high-speed internet for the rural population is a priority for Romanian authorities, especially for the Ministry of Research, Innovation, and Digitalization. According to the Digital Transformation component of the National Recovery and Resilience Plan, projects can be submitted for the call "Implementation of a support scheme for the use of communication services through various types of instruments for beneficiaries, with a focus on white areas". For these project proposals, funds of 94 million euros are allocated for developing high-speed internet connections in communities where internet access is absent or existing fixed/mobile networks are insufficient. The aim is to ensure access to very high-speed internet in areas where market operators cannot independently provide these services (villages, including disadvantaged areas). The minimum internet service speed will be at least 100 Mbps, with the possibility of future increases, and the networks will include FTTB/H and/or 5G technologies (Biz, 2024).

The target group within the call consists of 945 localities, divided into zones based on regions, counties, geographic dispersion, etc. A project will need to cover an area including between 90 and 160 localities. Applications can receive funding for a maximum of 2 projects from 2 zones, with allocated funding per project ranging from 9.3 to 9.9 million euros. Any categories of enterprises (micro-enterprises, small, medium, or large enterprises), including through partnerships, if certified as electronic communications providers, with at least 3 years of seniority at the date of submitting the funding application, can apply for funding.

Rural development is also a priority for other regions of the world. Thus, a study commissioned by Amazon to the Chamber Technology Engagement Center (2019) shows the important role of digitization in the rural development of the US. American villages comprise approximately 18 million households, inhabited by over 37 million individuals (15% of the adult population), distributed across over 72% of the territory.

However, the annual combined incomes of businesses in rural areas represent approximately \$3.1 trillion, less than 10% of the American economy. Due to limited employment opportunities in the rural labour market, many rural residents have migrated to urban areas. Additionally, 17.5 million adults in rural areas (approximately 47% of the total) are unemployed or not actively seeking employment. The use of digital technologies, including access to high-speed internet and online tools, can create opportunities for small business owners in rural America. A survey conducted among 5,300 small business owners in rural America regarding the economic impact of online tools and technology on businesses highlighted that digital technology boosts sales and reduces costs in rural areas, mainly by expanding the customer base locally, nationally, or internationally. Online tools drive sales for 55% of rural small business owners and reduce acquisition costs for products/materials for 29% of them, but there is a slow adoption rate of modern digital tools and technologies. Approximately 20% of rural small business owners generate at least 80% of revenues through online product and service sales, and 22% of rural entrepreneurs purchase at least 80% of goods and services online. Around 33% of rural small business owners sell their products and services through their own websites, and 13% sell their products and services through third-party websites. Over 58% of rural small business owners have social media accounts, and nearly 36% use online advertising services. Rural small business owners also use online tools for banking, accounting, virtual/online meetings, cloud, and others (U.S. Chamber Technology Engagement Center, 2019).

In Australia, the development of digitization in rural areas has been relatively slow due to the lack of telecommunication and broadband infrastructure. The vast distances in rural areas, the small number of customers, and other factors have hindered investments in broadband infrastructure compared to other utilities such as roads, water, and energy. Before the COVID-19 pandemic, government authorities set an ambitious agenda for digital development in key regional and rural industries such as agriculture, manufacturing, and mining. However, research conducted by Marshall, Babacan & Dale (2021) indicates that these objectives are unlikely to be achieved without significant strategy and additional investments in digital connectivity infrastructure (beyond the funds committed through previous programs such as the Mobile Black Spot Program). There is a real commitment to connecting the regions from the authorities, but a lack of awareness of the work that is still needed to support present and future digital development. Federal policy and future regulations need to support the implementation of infrastructure for digital connectivity, addressing current deficiencies and meeting the future requirements of communities and industries regarding data transfer and internet speed.

Research conducted by Hilmawan et al. (2023) shows that in Indonesia, government funds allocated to villages are a priority for government policy, according to the National Medium-Term Development Plan 2020–2024. The paper quantifies the differentiated impact of government funds, rural company incomes, and rural community incomes on rural development. The research results, based on data collected in 361 districts in Indonesia, demonstrate the significant impact of village original income on rural development, both directly and as co-financing for government funds. However, government funds allocated to rural development represent the main factor of progress in Indonesian villages.

4. Materials and Methods

For documentation, Google Scholar, ResearchGate, and Clarivate databases were utilized, along with reports from the European Commission, official communications from the Government of Romania, Ministry of Agriculture and Rural Development, national legislation, and other public documents from national or European institutions. Where necessary, information from scientific articles has been supplemented with data from specialized publications. For research, data provided by the National Institute of Statistics (NIS) and Eurostat was selected. The data were processed using tabular methods, analysed, and graphically represented. The resulting graphs allowed for clear and easily understandable visual interpretation of the analysed data.

The research findings were compared with relevant scientific papers for validation, ensuring alignment with current discoveries in the field. This process provided a robust foundation for the presented conclusions.

4. Results

4.1. Access to Internet Services in Romania

According to NIS data (2024), the proportion of households in Romania with access to the Internet at home has seen significant growth from 2007 to 2023, increasing by over 400% during the evaluated period, from 20.5% in 2007 to 85.7% in 2023 (Figure 1).

Forbes Romania study (2023), mentioned that internet connectivity was more widespread among households in the Bucharest-Ilfov Region (92.9% of households have home internet access), followed by the North-West Region (89.1%) and West Region (87.7%), with the lowest proportions recorded in the Regions South-East (81.7%) and South-Muntenia (82.9%).

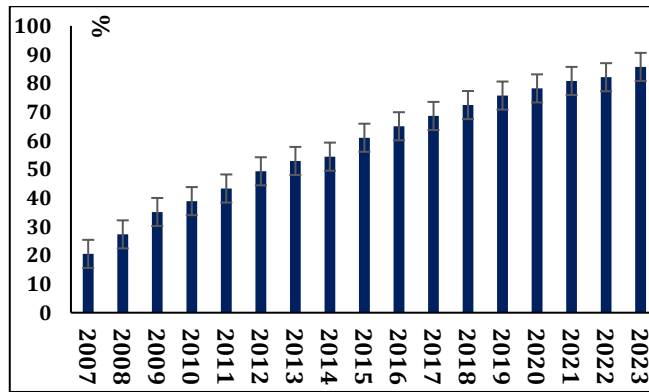


Figure 1. Households access to internet services in Romania
Source: Author, by using NIS (2024)

The study mentions important influencing factors such as the number of individuals in a household and the age of household members, particularly those between 55 and 74 years old. In 2023, the proportion of individuals who use or have ever used the internet among the total population aged 16-74 was 92.5%, while for the age group between 55 and 74 years old, the indicator reached 81.4%. Compared to the previous year, in 2023, there was a 3.6 percentage point increase in household internet access, a trend supported by frequent internet usage, with 70.4% of individuals aged 16 to 74 using the internet multiple times per day (Sima, 2023).

In comparison to 2022, the proportion of households with internet access in the European Union did not see significant changes in 2023, remaining at approximately 93%, indicating a positive trend (Figure 2).

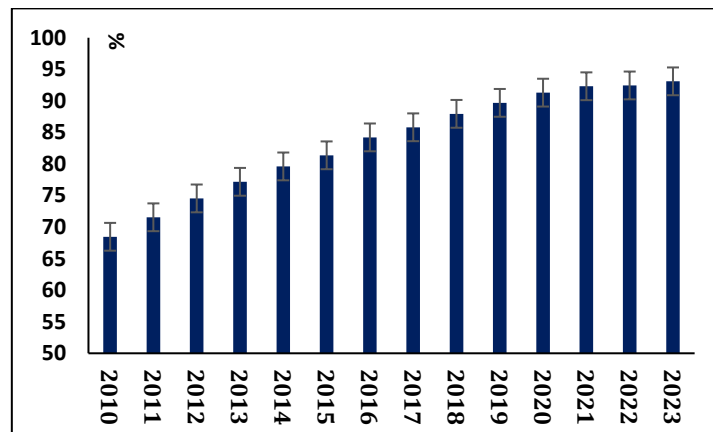


Figure 2. European households' access to internet services
Source: Author, by using Statistica (2024)

Significant differences exist between European regions, with Western and Northern areas having a higher level of internet access compared to Eastern and Southern regions, but where more pronounced increases have been recorded in recent years (Figure 3). This trend of uniformity reflects European efforts to improve digital infrastructure and population accessibility to the internet, with a particular focus on expanding networks in rural and less developed areas (European Commission, 2024).

In 2023, high proportions of household internet connection were reported by Luxembourg and the Netherlands (both 99%), Finland (97%), Spain and Denmark (both 96%), while the lowest internet access rates among EU member states were reported by Greece (87%), Bulgaria, and Lithuania (both 89%). Compared to 2010, only a few member states reported a single digit increase in the proportion of households connected to the internet: Sweden (7%), the Netherlands (8%), Luxembourg, and Germany (both 9%). The highest increase in the rate of households connected to the internet was reported by Bulgaria - 56% (33% in 2010 to 89% in 2023). In Romania, the increase in the proportion of internet access was 50%. In Switzerland, the increase in household internet access was 100% in 2023 (or data for 2010 was not reported), according to Eurostat data (2024).

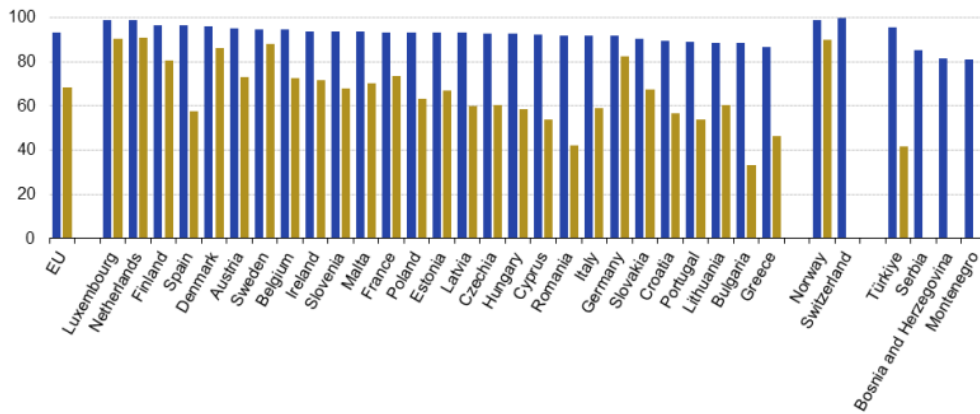


Figure 3. European households with access to internet services

Source: Eurostat (2024)

4.2 Rural Household Access to Internet in Romania

The Share of European Rural Population with Access to Internet has shown significant growth but still remains a major challenge for many regions. By 2023, approximately 90.5% of rural households in the European Union had internet access, which, although high, still lags the coverage level in urban areas (EC, 2024).

One of the successful strategies in some rural regions of Europe is the community network model, local initiatives where residents collaborate to build and maintain internet networks, often with the support of public authorities, providing co-financing or logistical support. These technical systems for ensuring internet access are particularly effective in rural regions, where purely commercial models are not always economically viable (Internet Society, 2018). While European authorities continue to invest in improving internet access, there are significant issues related to the high costs of installing infrastructure in areas with challenging terrain and the lack of skilled labour in construction. Initiatives like WIFI4EU have been implemented to support connectivity, but there are opinions suggesting that these programs could do more to encourage local community involvement and diversify the services offered by the telecommunications sector.

Access to internet for households in rural areas of Romania has significantly increased in recent years. According to data provided by the National Institute of Statistics (NIS) (2024), in 2023, approximately 80.3% of households in rural areas had internet access, compared to 89.8% in urban areas (Figure 4).

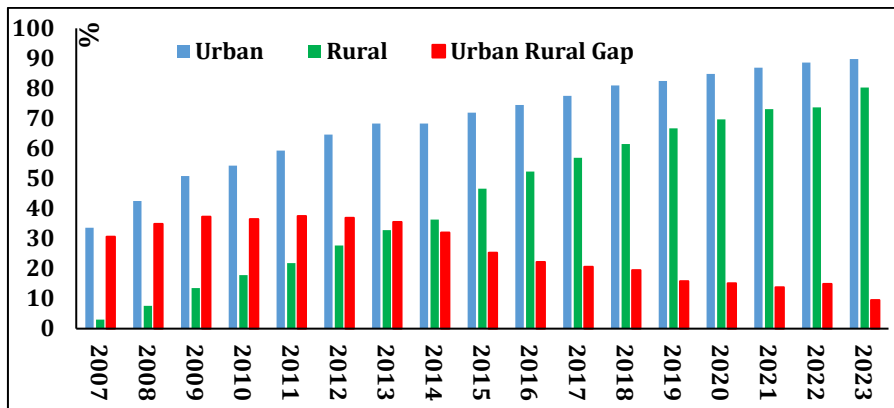


Figure 4. Household access to Internet services in Romania, by residential area

Source: Author, by using NIS (2024)

Compared to the reference year of 2007, when only 3% of households were connected, 2023 brought an increase of over 2,500%, reaching a rate of 80.3%. Similarly, during the analysed period, there was a reduction in the gap between rural and urban areas by 21.1 percentage points in terms of household internet access rate (from 30.6% in 2007 to only 9.5% in 2023), according to NIS (2024).

In 2023, regarding the use of mobile phones/smartphones by individuals aged 16-74 for accessing internet services, there were no significant differences between rural and urban areas (Figure 5). Other devices showed higher proportions in urban areas compared to rural areas, but much lower than the proportion of mobile phone or smartphone usage in both residential settings (NIS 2023b).

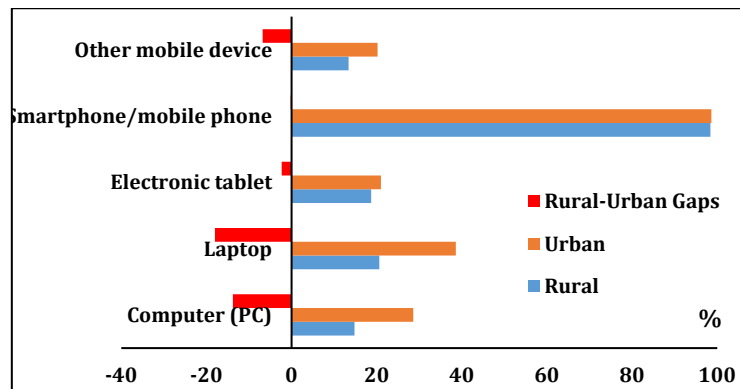


Figure 5. Ways of accessing Internet services by residential areas

Source: Author, by using NIS (2023b)

The main aspects highlighted by the NIS study (2023) were as follows: similar proportions between men and women across age groups in terms of internet usage; the proportion of individuals who interacted with authorities/public services for personal purposes: 19.0% rural - 10.9% urban; electronic identification for accessing certain online services for personal purposes (15.8% urban - 7.5% rural); ordering goods or services online: 73.7% urban - 61.4% rural; e-commerce: 54.1% urban - 46.2% rural localities; data privacy: preventing access to personal information on websites: 57.1% rural - 45.6% urban.

4.3 Smart Village in Romania

The concept of Smart Village proposes the modernization of European rural areas by integrating smart technologies and innovative solutions to reduce the disparities between urban and rural environments, improve the quality of life for residents, and stimulate sustainable development. This initiative was launched by the European Commission in 2017 (EC, 2017).

The action directions include the modernization of technologies and IT infrastructure (high-speed internet access and IoT systems), agricultural production and food (with smart irrigation systems, the use of drones and autonomous machinery, reducing food waste, and promoting a healthy and sustainable diet), energy and environmental-friendly policies (renewable energy sources, smart systems for waste collection and recycling), increasing access to modern public and educational services based on smart technologies (telemedicine, online education, etc.), promoting local tourism, cultural, and historical heritage (through online platforms and digital technologies, etc.) (Romanian Association for Smart City ARSC, 2024).

In Romania, this concept is gaining ground with the aim of revitalizing rural areas and reducing disparities between urban and rural environments. According to ARSC, as cited by Economica.net (2023), there are 7 counties in Romania where 147 communes are implementing 224 Smart Village initiatives as of 2022 (figure 6).

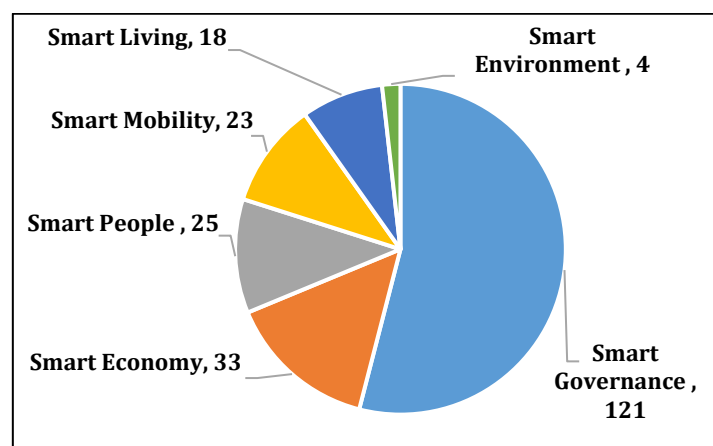


Figure 6. Smart Village Projects by categories, in Romania (2022)

Source: Author, by using (Doing.Business.ro, 2022).

In the ranking of counties with the most implemented / ongoing Smart Village projects, the top positions are occupied by Alba (40), Sibiu (36), Mureş (33), Hunedoara (10), Prahova (9), Sălaj, and Galaţi (8), Timiş (7). In 9 localities, multiple Smart Village projects have already been implemented (Table 1).

Table 1. Villages in Romania with Multiple Implemented Smart Village Projects

No.	Village/County	Projects
1	Ciugud, Alba	8
2	Aluniș, Mureș	7
3	Boghiș, Sălaj	5
4	Saschiz, Mureș	5
5	Bălășești, Galați	4
6	Corunca, Mureș	4
7	Mânăștiur, Timiș	4
8	Șelimbăr, Sibiu	4
9	Snagov, Ilfov	4

Source: Author, by using *Economice.net* (2023)

Ciugud, in Alba County, is considered the smartest village in Romania, being used by the Romanian Government as a case study for the development of this concept. Broadly speaking, Ciugud Smart Village entails the digitalization of public services, easy and fast interaction with citizens, digitalization of education, smart environmental protection, and the use of smart solutions to support the local economy. Employees of the Ciugud town hall have developed mentoring programs through which they share their experience gained in implementing smart solutions with other communities across Romania (Doing.Business.ro, 2022).

5. Conclusions

From a statistical perspective, internet access in rural Europe is improving, but there is still a significant gap compared to urban areas. The combined efforts of the public and private sectors, along with community initiatives, are essential to ensure broader and higher-quality coverage.

The rate of household internet access in rural Romania has shown significant growth in recent years, with a notable increase of over 400% in 2023 compared to 2007. Although the proportion of the rural population using the internet continues to grow, there is still sufficient room for improvement in services to ensure uniform and quality coverage nationwide.

The development of Smart Village initiatives presents an opportunity to implement the European rural agenda and to provide the recognition and attention deserved by citizens, businesses, and public authorities in the long-term vision for rural areas.

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