European Research Studies Journal
Volume XXVIII, Issue 1, 2025

pp. 138-161

ICT and Local Peripheral Territorial Systems' Resilience in Crisis Conditions: A Study of Urban-Rural Communes in Poland

Submitted 15/12/24, 1st revision 21/12/24, 2nd revision 11/01/25, accepted 15/02/25

Magdalena Anna Zwolińska-Ligaj[1]; Danuta Jolanta Guzal-Dec[2]

Abstract:

Purpose: *The aim of the paper is to draw attention to the imperative of resilience in the context of following a local development policy, as well as the role which technological progress plays in the process, and to characterise the assessment of the effect of ICT availability in urban-rural communes in Poland.*

Design/Methodology/Approach: *The empirical part of this study is based on the survey research carried out with regard to all 87 units urban-rural communes in Poland. The selection of urban-rural communes for the study was conditioned by the intention to capture the role of small towns in the processes of local development and resilience taking into account its links with the surrounding rural areas. Such a selection fills an important research niche. Study considers the manifestation of resilience at the level of individual actors of the local territorial systems. It was carried out among representatives of local governments.*

Findings: *Results of empirical research confirmed that access to modern ICT infrastructure proves highly relevant for territorial units during crisis, determining the unit's pro-resilience response.*

Practical Implications: *Crisis had a positive impact on the growth of diverse forms electronic communication with various groups in the local community, including residents, businesspeople and farmers. The role of ICT infrastructure was of particular significance for peripherally-located units. Research has confirmed that local entities in peripheral communes were characterised generally by an overall lower pro-resilience activity. Research showed also that in spite of relatively good access to ITC, the technologies are still employed rather narrowly.*

Originality/Value: *This finding could be explained by the reluctance of communities, especially those in rural areas, to use ITC, as well as their in-sufficient knowledge on ITC capabilities, particularly with reference to business activity.*

Keywords: *Community resilience, ICT, peripheral regions, rural areas, territorial unit, local authorities, Covid-19.*

JEL codes: *R11, O18, O31.*

Paper type: *Research article.*

[1]*John Paul II University in Biała Podlaska, Poland,*
e-mail: m.zwolinska-ligaj@dyd.akademiabialska.pl;
[2]*The same as in 1, e-mail: d.guzal-dec@dyd.akademiabialska.pl;*

1. Introduction

The heterogeneity which characterises both geographical and economic space has been shaped by the forces of nature and human activity. This diversity exerts considerable impact on the forms, methods and effects of business activity and human life (Adamowicz and Zwolińska-Ligaj, 2021; Tyagi *et al.*, 2023).

Depending on the size of the area, its social, economic and natural components are integrated into a territorial system, municipal, local, regional, supra-regional or national (Adamowicz and Zwolińska-Ligaj, 2021 p. 25). In territorial systems, development processes are shaped by multiple, complex, challenging in terms of analysis, intricate and interlinked determinants, both internal and external to these systems.

Internal determinants include e.g., business capability and local manufacturing resources, ability to form permanent relations by local actors and the local entities' ability to make decisions on shaping the development, as well as the use of knowledge and information in the process.

On the other hand, exogenous factors, i.e., the sources of which originate outside of the local system, may result from the random presence of a business which dominates the local economy, the absorption of innovation from the outside of a given territory or the development of infrastructure by external entities (Capello, 2007; Capello and Nijkamp, 2011 p. 309).

External connections allow territorial systems to make better use of their own resources when acting for the benefit of their environment (Adamowicz and Zwolińska-Ligaj, 2021 p. 26). Economists noticed the salience of connections between territorial systems and the environment in their development processes, which has been expressed in the endogenous development theory.

According to this concept, endogenous development involves finding and using resources and development mechanisms based on the local territorial system and the local community's needs, capabilities and prospects, with external entities and institutions perceived as potential participants in the development process (Ray, 2006 pp. 278-279).

Long-term and self-sustaining development should be a locally rooted process which, at the same time, is open to the environment (Stöhr, 1990 p. 21). Today's increased need to open up to exogenous development factors is a derivative of the general processes of modernisation of economic structures and responding to the challenges of external competition, as well as opportunities which arise in the context of globalisation (Best Practices in Local…, 2001 pp. 24-29; Isaksen, 2001; Wilson, 2010).

The process of opening socio-economic systems to their environment is dependent e.g., on the availability of infrastructure ensuring efficient communication and information flow processes, i.e., Information and Communication Technologies (ICT) (Thalassinos *et al.,* 2023; Grima *et al.,* 2023; Auzina *et al.,* 2023).

In the face of the growing, deepening interdependences of the economic, social, natural environment spheres of territorial systems and their external determinants, their increasing variability and turbulence generating both development opportunities and threats, often occurring suddenly, without the possibility of preparing for them, multidimensional actions to strengthen their resilience are becoming a priority to ensure the sustainable development of territorial systems.

In the broader sense, resilience can be defined as "the capacity of any entity – an individual, a community, an organization or a natural system – to prepare for disruptions, to recover from shocks and stresses, and to adapt and grow from the experience" (Rodin, 2015 p. 3).

The availability and efficiency of ICT is significant in building the growth potential and resilience of territorial units. As defined by the Eurostat, ICT "covers all technical means used to handle information and aid communication. This includes both computer and network hardware, as well as their software" (Glossary: Information…, 2024).

In a broader definition offered by the OECD, adopted by the authors of the present article, ICT "refers to both different types of communications networks and the technologies used in them. The ICT sector com-bines manufacturing and services industries whose products primarily fulfil or enable the function of information processing and communication by electronic means, including transmission and display" (Information and communication…, 2024).

ICT's impact on the socio-economic growth processes, including their scale, scope and dynamics and resilience may be of key significance for a specific type of units located peripherally to metropolitan areas as centres of socio-economic growth, national borders, main transport hubs or routes. Peripheral location means that territorial units often face considerable growth challenges. For example, creating different types of links to the environment is more difficult.

In traditional perspectives, the peripherality of a given area was understood as its specific location in geographical space. Later on, the concept of peripherality was extended as regional research progressed and changes in the perception of space involving its qualities defining "territory" took place. Today, the peripherality category is heterogeneous, multidimensional and varies depending on the confluence of endo- and exogenous determinants of developmental processes (Zwolińska-Ligaj, 2018, p. 60).

There are many types of definition of peripheral area in the social sciences. Geographically distance-related approaches refer to areas located at considerable distances from economically strong urban development centres, and with limited transport links to these centres. Low levels of population density and poor urbanisation are characteristic.

Other approaches take into account economic criteria, or emphasise features of weak economic development, such as specialisation in agricultural and forestry commodities or raw material economies, reliance of production on cheap and labour-intensive labour, low levels of infrastructure development, the distinctiveness of the inhabitants of these areas (Grosse 2007, pp. 27-28).

These features characterise often rural areas. European Spatial Planning Observation Network (ESPON) research on inner peripheries in Europe show that 80% of the inner peripheries with low economic potential or poor accessibility are located in non-urban regions. Inner peripheries have in common the fact that their general performance, levels of development, access to services of general interest, and quality of life of the population are relatively worse than those of their neighbouring territories (Inner Peripheries…, 2017).

Currently, the development of telecommunication and information technologies mitigates the negative impact of the local aspect of peripherality. This also holds true for rural areas, where access to modern ICT, including investment in broadband Internet, helps overcome barriers created by difficult geographical location (Nurzyńska, 2016).

The role of ICT in building the resilience of territorial units, including peripherally-located ones, remains an intriguing niche topic in studies on rural geography (Roberts *et al.*, 2017).

In spite of the development studies conducted in this field, it is postulated that they should continue to be intensified, in reference, e.g., to individual and community resilience (Ashmore *et al.*, 2015; Daniel and Fernandes, 2024; Levesque *et al.*, 2024), or as a concept used in the systematic approach to rural area growth planning and management (Dacko and Dacko, 2018 p. 61), in the area of interrelation between cutting-edge technologies (e.g., machine learning, Internet of Things, and artificial intelligence) and community resilience (Nguyen and Akerkar, 2020).

The type (urban, urban-rural, rural), size, spatial structure and location of a territorial unit are identified as determinants of its resilience capabilities. Another important determinant is its location (peripheral vs. non-peripheral) (Naldi *et al.*, 2020; Zhang *et al.*, 2022; Guzal-Dec, Zwolińska-Ligaj 2023). The type of territorial unit is an important determinant of resilience in the context of rural resilience research.

Ongoing research on community resilience provide evidences that community resilience differs among community types (Zhang *et al.*, 2023, Rapaport *et al.*, 2018). Rapaport's *et al.* research (2018), for example, indicates that rural communities showed the highest levels of community resilience factors. These results suggest that rural communities translate their strong social resources into perceived resilience.

With regard to urban-rural units the subject of small cities' potential role in the development of its surrounding areas is has been discussed in the literature. Interactions between farmers and urban communities are seen as vital for maintaining rural population and services, strengthening local economy and the natural environment, thus contributing to building local resilience potential (McManus *et al.*, 2012).

Results reported in studies on the significance of cities for rural area development are varied and their evaluation often proves challenging (Satterthwaite and Tacoli, 2003; Tacoli, 2017).

The present study fits into the trend of research on the role of ICT in building resilience of local, peripheral systems with particular emphasis on urban-rural units. In the article, the resilience was referred to the context of the economic shock situation of the Covid-19 pandemic.

On a theoretical level its aim is to draw attention to the imperative of resilience in the context of following a local (and regional) development policy, as well as the role which technological progress plays in the process. In the empirical part, the aim of the study is to characterise the assessment of the effect of ICT availability in urban-rural communes in Poland on its resilience to crises, as well as the scale and type of steps taken in those communes to adapt to the crisis brought about by the Covid-19 pandemic with the application of information and communication technologies.

The shock of the Covid-19 pandemic caused by the SARS-CoV-2 virus had its source outside the economy (Guzal-Dec and Zwolińska-Ligaj, 2023). The pandemic affected all aspects of economic and social life, including all sectors and all forms of economic activity. It increased disease incidence, while preventative measures lead to reduced consumption – consumer spending dropped particularly in the transportation, tourism and entertainment sectors.

On the other hand, we could see a reduction in supply as a result of reduced economic activity, reduced labour and employment, while costs remained fixed. The outbreak of the pandemic led to the imposition of various bans, quarantines, restrictions in and face-to-face human interaction, and disruptions in businesses and public institutions (Adamowicz, 2023).

The Covid-19 pandemic and the social and economic crisis it caused made it necessary for local territorial systems to quickly adapt to functioning in the new reality. Local entities, including governments, were forced to take steps to reorganize their operations, as well as additional measures to minimize the negative effects. Services provided by local governments had to be provided using electronic tools and distance communication (Kusto and Klepacki, 2022).

In the face of these challenges, ICT tools offered the possibility of compensating for the restrictions on direct human interaction in social and economic areas (Yang *et al.*, 2020).

2. The Resilience of Community as a Local Territorial System

Communes are complex local socio-economic systems of specific territorial range. They encompass the social, economic and environmental, as well as institutional and organisational spheres, and key actors which impact their structure and functioning include the authorities, entire local administration, businesses, non-governmental organisation and residents.

Local authorities play a special role in shaping the adaptive potential of local socio-economic systems, primarily due to the possibility of defining the rules for other actors, but also due to the impact which the activities of local administration exert on the components of the whole system (Celińska-Janowicz and Płoszaj, 2015 p. 7).

According to Wilson, "implementation of pathways of resilience can only find its most direct expression at the level of the individual/household and the community, as it is only at the most local level that outcomes of policies and decisions are experienced" (Wilson, 2012 p. 1219). Taking this into consideration community resilience can be seen as the capability of people and communities to retain optimal performance in the event of various natural and anthropogenic crises (Sharifi 2016).

General attempts at defining community resilience show that the concept refers to "the collective ability of a neighbourhood or geographically defined area to deal with stressors and efficiently resume the rhythms of daily life through cooperation following shocks" (Aldrich and Meyer, 2015; Aldrich, 2012). According to a different approach, community resilience describes collective efforts aimed at improving the entire community's response to and recovery from disasters (Guzal-Dec and Zwolińska-Ligaj, 2023).

Multi-faceted definition by Rapaport *et al.* (2018) states that "community resilience identifies community's ability to utilize its current resources in order to adapt to an adversity or sudden disturbance, and eventually to be able to absorb the disturbance, get back to routine, and even perform better in comparison with the pre-disturbance situation."

The concept of "community resilience" is almost universally perceived as positive and associated with the ability to increase local capacity, social support and resources, and decrease risks, miscommunication and trauma (Patel *et al.,* 2017). The extensive literature on the subject lacks a widely accepted definition of resilience. What does exist, however, are attempts to define the concept of "smart community resilience" (Niu *et al.,* 2024; Smart Resilient…, 2024).

Enhancing community resilience can be accomplished by fostering essential adaptive abilities, including economic growth, social capital, information and communication, and community skills (Daniel and Fernandes, 2024; Guzal-Dec and Zwolińska-Ligaj, 2023). Generally, the core element that fosters community resilience is community vitality, which encourages change and serves as a platform for innovation, allowing problems to be tackled progressively through the active involvement of various social participants (Dale *et al.,* 2010).

Patel *et al.* (2020) highlighted nine key components of community resilience, local knowledge, community networks and relationships, communication, health, governance and leadership, resources, economic investment, preparedness, and mental outlook.

Resilience can be defined from the perspective of rural communities. It means a rural area's ability to adapt to changing external circumstances so as to maintain a satisfactory living standard, as well as its ability to recover, if necessary. Rural resilience indicates how well the rural area can balance its ecosystemic, economic and cultural functions, i.e., its capability to address economic, ecological and cultural vulnerabilities (Rapaport *et al.,* 2018).

The specific nature of rural areas determines their resilience. Typical problems of rural areas, especially peripheral ones, such as insufficient level of infrastructure development and difficulties in its development, demographic problems, difficulty in accessing public and market services, long distances and communication difficulties, reduce the attractiveness of rural areas as places for developing entrepreneurship and places of life (Zwolińska-Ligaj and Guzal-Dec, 2024).

Rural areas are the place where direct interdependencies in the natural environment-economy-society system are revealed, which requires care in the pursuit of sustainable models of socio-economic development. So, resilience may also be perceived as a balance between economic, environmental and social needs of rural communities. Accordingly, sustainable and economically, socially and environmentally resilient rural communities must develop strong multifunctional characteristics (Wilson, 2010).

The determinant factor in the development and resilience of rural areas can be small and medium-sized towns. They in all areas display a tendency to generate multiplier effects. The economic development in small and medium-sized cities and their

surrounding areas is best promoted by those national and regional policies which focus on larger commercial cities (15,000 to 20,000 residents) (Mayfield *et al.*, 2005).

Small and medium-sized cities, can develop a certain economic dynamics different from that of large cities (Mayer and Motoyama, 2020), yield positive development results by becoming local growth centres, the stimuli of which may positively impact the immediate surroundings (Servillo *et al*, 2017; Hamdouch *et al.*, 2017). Still, one should bear in mind that peripherally located small cities are in a particularly challenging developmental situation (Naldi *et al.*, 2020).

3. The Role of ICT in Building Rural Areas' Resilience – A Literature Review

The Internet and other information and communication technologies have a profound effect on developmental capabilities, especially those of rural and peripherally located areas. Digitisation helps information traverse physical distance to ensure capabilities and provide access to various services regardless of one's place of residence.

Nevertheless, we may notice that the growing importance of digital connectivity, digital services and digital literacy has widened the gap between urban and rural areas for several decades, creating the danger of depopulation in the latter. In 2019, in urban areas, 90% of European Union citizens enjoyed Internet accessed at a bandwidth of 30 Mb/s. However, in rural areas, inhabited by 30% of population, only 60% were able to access the Internet at such a bandwidth. Differences between individual countries also exist (Harnessing innovation…, 2021).

Geographically speaking, providing services to rural population is both more challenging and costly (Roberts *et al.*, 2017). Furthermore, it is not only Internet access itself but also connection quality which has recently gained relevance (Roberts *et al.*, 2017).

Rural community resilience is a product of interactions, relationships, actors and resources in various scales, which depend on, among other things, the existing digital potential of a given unit (Roberts *et al.*, 2017). Creating and using a higher number of external linkages, especially in reference to information and markets, may be the only feasible alternative for some industrious entrepreneurs and fast-growing companies in rural and peripheral areas. Yet, to leverage ICT fully, rural businesses must be deter-mined to use them in their growth strategies (Labrianidis, 2006).

Authors argue that the implementation of even cheap digital technologies may positively impact businesses, particularly ones located in rural and suburban areas. Lack of access to fast digital infrastructure such as broadband networks may prove a

limitation to digitisation capabilities in rural areas and contribute to increasing the inequalities between regions.

Even the accelerated digitisation ushered by the Covid-19 pandemic revealed an unequal spatial distribution, with a more robust response in better economically developed locations. European small and medium-sized enterprises which show the least interest in digitalization tend to be situated in rural areas. One potential explanation for this could be insufficient knowledge about digitalisation (Holl and Rama, 2023).

Geographical knowledge dissemination patterns and barriers to access to knowledge are crucial for regional development in a modern, global and open land management and planning, hence the key task of gaining access to ICT (Nijkamp and Abreu, 2009). Nevertheless, the mere presence of ICT should not be directly associated with a high level of innovation and technological supremacy but, rather, a mindset of change, being open to opportunities and ready for innovation injections (ICT readiness), as well as greater adaptability (Aswegen and Retief, 2020).

The ability to perceive benefits from ICT development is linked to an EU priority such digital convergence. It leads to a recommendation to implement digital competence development programmes in countries where the Internet is used less widely, particularly in rural areas, which are characteristic of the peripheral regions.

As regards rural areas, it is important to raise awareness and emphasise the benefits of using the Internet, including but not limited to the role of education, health care and community development, as well as benefit for the natural environment (Piekut and Rybaltowicz, 2024).

For villages, ICT constitutes a valuable development tool which offers a wealth of beneficial opportunities for rural areas of Europe. Since the EU's rural development policy acknowledges potential capabilities of these technologies, member states have included financial assistance for ICT projects in their operational programmes focused on rural development (Europejski Fundusz Rolny…, 2011).

Information and communication technologies have a potentially beneficial effect across all sectors of the economy, areas of social life and the condition of the natural environment. Investments in ICT infrastructure in rural areas contribute to favourable conditions for creating jobs in the services sector, primarily with regard to remote services (Nurzyńska, 2016), with a special role played by the creative industry.

Creative practitioners leverage digital tools and adaptive approaches to remove obstacles to connectivity and stay in rural areas; they're deeply engaged in their communities and rural life, boosting community resilience by nurturing cultural

capital in various forms and creating positive knock-on effects through their online endeavours (Roberts and Townsend, 2016).

Aside from the non-agricultural sectors of the economy in rural areas, we should see ICT's impact on the agriculture sector. The use of ICT has already led to "diverse types of innovations taking place in the agriculture sector, which include commodity and stock market price information and analysis, meteorological data collection, advisory services to farmers for agricultural extension, early warning systems for disaster prevention and control, financial services, traceability of agricultural products, agricultural statistical data gathering, etc." (Information and Communication…, 2024).

Increased use and access to ICT may prove beneficial to small farmers and agricultural communities thanks to easily available information about food and agriculture, better access to financial services, other risk management tools and creating new business opportunities in rural areas (Lioutas and Charatsari, 2021; Marsden *et al.,* 2023).

ICT contributes to bolstering rural individual and community resilience in multiple dimensions, including the use of services related to video content and other services characterised by high capacity requirements. Gaining control over daily tasks can boost empowerment and build personal capacity both at home and in business, with speed playing a crucial role in decision-making.

Finally, the Internet is "perceived as an individualised tool, having links primarily with the individual household and business scale, which can enhance individuals' social connectivity and perceived empowerment, as well as skill building and economic empowerment" (Ashmore *et al.,* 2015).

As mentioned before, local governments have an integrating and activating role in the development of local communities and local economies – residents and economic operators in their jurisdiction. This role requires making effective use of opportunities generated by ICT.

Authorities which provide information and services to residents via digital platforms can meet their citizens' needs in more ways in the context of crisis. Rural communities utilise digital platforms, offering digital information, conducting transactions and fostering digital democracy.

Research demonstrates positive link between higher levels of digital services, larger community populations and more representative methods of government. At the same time, researchers still argue that "a range of technological and cultural barriers also determine the degree to which a municipality engages with and adapts their digital services", reporting "a link between municipal digital services and rural resilience" (Levesque *et al.,* 2024).

The use of a breakthrough change in remote services triggered by the pandemic had a long-term effect on sustainable social growth of rural communities ("Harnessing innovation to unlock the potential of rural and remote areas," 2021). The coronavirus pandemic spurred communities to quickly enhance and implement digital services in some regions. This crisis response capability is vital for the resilience of rural areas (Levesque *et al.*, 2024; Guzal-Dec and Zwolińska-Ligaj, 2023).

4. Materials and Methods

The empirical part of this study is based on the survey research carried out with regard to all 87 units urban-rural communes in Poland which have (or had – during the research) their seat in a small city (with up to 20,000 inhabitants, according to the Polish Central Statistical Office, as of 31 December 2020) with district rights.

The selection of urban-rural communes for the study was conditioned by the intention to capture the role of small towns in the processes of local development and resilience taking into account its links with the surrounding rural areas. In these specific units, the manifestations of pro-resilience actions were studied. This study considers the manifestation of resilience at the level of individual actors of the local territorial systems.

Pro-resilience activities undertaken by farmers, entrepreneurs and, within the framework of local development policy, by local self-governing authorities were presented. Of a total of 87 interviews, one was incomplete; however, as its filled-in portion was substantially correct, it was decided that it would be included in the study (Zwolińska-Ligaj and Guzal-Dec, 2024).

The survey used in this study was based on a structured questionnaire, which contained 10 extensive semi-open questions. In the semi-open questions, respondents were able to provide examples or elaborate on the answer indicated in the survey questionnaire. The respondents were surveyed in a computer-assisted telephone inter-view (CATI) / a computer-assisted web interview (CAWI) or a mixed-mode (CATI+CAWI) interview.

They included individuals in managerial positions: mayor/deputy mayor/secretary (in some cases) (Zwolińska-Ligaj and Guzal-Dec, 2024). As reported by other authors, resilience studies employ diagnostic surveys as a useful method which allows researchers to test the effect of broadband on businesses, households, and communities and the links between such scales (Ashmore *et al.*, 2015).

The purpose of the survey was to assess the effect of the availability of ICT in the commune on resilience to crises, as well as the scale and type of steps taken in urban-rural communes to adapt to the crisis brought about by the Covid-19 pandemic with the application of information and communication technologies.

The results of the survey were presented by means of basic descriptive statistical tools, including comparative analysis of communes situated in peripheral regions and other communes. In this study, peripheral communes (20 units) are defined as those located in the five provinces of Eastern Poland Macroregion: Lubelskie, Podlaskie, Podkarpackie, Warminsko-Mazurskie and Swietokrzyskie (from 16 all provinces of Poland).

These provinces met the Lagging Regions criterion introduced by the European Commission in 2015. This stemmed from the European Commission's implementation of the so-called Lagging Regions Initiative to identify and assist EU regions "whose level of development was significantly lower than the EU average"(EU lagging regions…, 2020). These criteria warranted treating the regions studied as peripheral.

The results of the empirical studies were supplemented by the characteristics of the growth of ICT in Poland in the analysed period 2015-2021 (availability of data for a given year depended on the type of economic operator) including peripheral regions, focusing on the availability of ICT in a group of households, businesses and local government based on data sourced from the public statistics of the Central Statistical Office (GUS) in Warsaw. These results form the background to the empirical part.

Empirical part of the research is developed based on the findings presented in previous publications (Guzal-Dec and Zwolińska-Ligaj, 2023; Zwolińska-Ligaj and Guzal-Dec, 2024).

Because the empirical part was a study/description of the entire population of the selected type of local territorial units (urban-rural type), the analyses did not employ statistical inference methods, instead relying on descriptive statistics. Calculations were performed in Statistica 13.3 software.

Empirical research was performed from September to October 2021 by the company ASM Centrum Badań i Analiz Rynku Sp. z o.o as part of research project PB4/2020: "Rezyliencja gmin miejsko-wiejskich w Polsce. Operacjonalizacja, pomiar, diagnoza mechanizmów adaptacyjnych" ("Resilience of urban-rural communes in Poland. Operationalization, measurement, diagnosis of adaptive mechanisms") financed from the University Staff Development Fund (at John Paul II University of Applied Sciences in Biała Podlaska).

5. Accessibility of ICT in Eastern Poland Macroregion

In 2019, 86.7% of households in Poland had Internet access. Internet accessibility in households according to data for 2019 did not present any geographical variation by province location – in Eastern Poland in comparison to other regions. In the first group, access was 2.1 pp. lower compared to the group of households located in other regions. In the analysed period (2015-2019), an increase in percentage of

household with Internet access took place on a much larger scale in areas which did not have peripheral location. This increase was reported at 7.9 pp. in Eastern Poland and 11.8 pp elsewhere (Wykorzystanie technologii informacyjno-komunikacyjnych…, 2015; 2019).

To a large extent, Internet access determines the competitive abilities of businesses. In Poland, this principle is reflected in a high (96.3%) Internet access ratio for businesses in 2019 and throughout the period from 2015 to 2019, when the ratio went up by 3.6 pp. Like for Internet access in households, there are no clear disparities in accessibility between Eastern Poland and other regions. In 2019, the difference equalled 0.5 pp., which means a 0.5 pp. decrease relative to year 2015.

In the analysed period, businesses accessed the Internet mainly via broadband connections (96.3%). Slight differences in accessibility were reported between Eastern Poland and other regions, to the disadvantage of the former (difference of 0.4 pp.) (Wykorzystanie technologii informacyjno-komunikacyjnych…,2015; 2019).

In Poland, Internet access via permanent broadband connections in public administration is a universal phenomenon which does not show any differences across regions. However, with regards to connection bandwidth, public administration institutions rarely use connections with a minimum bandwidth of 1Gbit/s. In 2021, according to reports filed by public administration, such connections were used only by 5.1% of public administrative units. Still, the number of high-speed connections had increased by 1.8 pp. compared to 2019 (Wykorzystanie technologii informacyjno-komunikacyjnych…, 2019, 2021).

Considering the type of public administrative units, we should notice significant differentiation in the accessibility of the fastest Internet connections between national and local administration to the disadvantage of the latter.

As regards local administration, the lowest accessibility of high-speed connections (2.3%) was reported for communes, the basic administrative units of the local government. For district executive offices, the said accessibility was 12.9%, and provincial executive offices (at regional level) it was 50% (Wykorzystanie technologii informacyjno-komunikacyjnych…, 2021).

It should be noted that there has been a dramatic improvement in Eastern Poland Region over the start of the 1st decade of the 21st century, when the provinces of Eastern Poland were amongst regions with the lowest percentage of ICTs users (Adam Płoszaj, 2013). The support of the European Union funding made it possible to carry out a number of digital development programmes and significantly improve the situation.

The years 2007-2013 and 2014-2020 saw the implementation of Eastern Poland Development Programmes which involved e.g., supraregional projects intended to

ensure broadband Internet access. Program Polska Cyfrowa (The Digital Poland Programme) 2014-2020 played an important role in improving Internet access in Eastern Poland (Wolański *et al.,* 2023).

The follow-up was provided by Program Fundusze Europejskie na Rozwój Cyfrowy (European Funds for Digital Development Programme) 2021-2027, another step in Poland's digital transformation (Fundusze Europejskie na Rozwój Cyfrowy). The scheme creates development tools for, among other things, popular access to ultra-high-speed Internet, effective and advanced pub-lic e-services, supporting digital solutions to socio-economic issues (Centrum Projektów Polska Cyfrowa).

From 2014 to 2020, Eastern Poland provinces were given greater per capita support than other provinces in Poland. Numerous project designed to improve Internet accessibility secured Internet access (to broadband networks of minimum bandwidth of 100 Mb/s) for more than 60,000 households in Eastern Poland, and 500,000 households in other regions in Poland (Wolański and et.al., 2023). Nevertheless, the challenge of developing infrastructure in terms of qualitative improvement, still stands.

6. ICT Accessibility and Resilience of Local Territorial Systems in the Face of Crises - Results of an Empirical Study

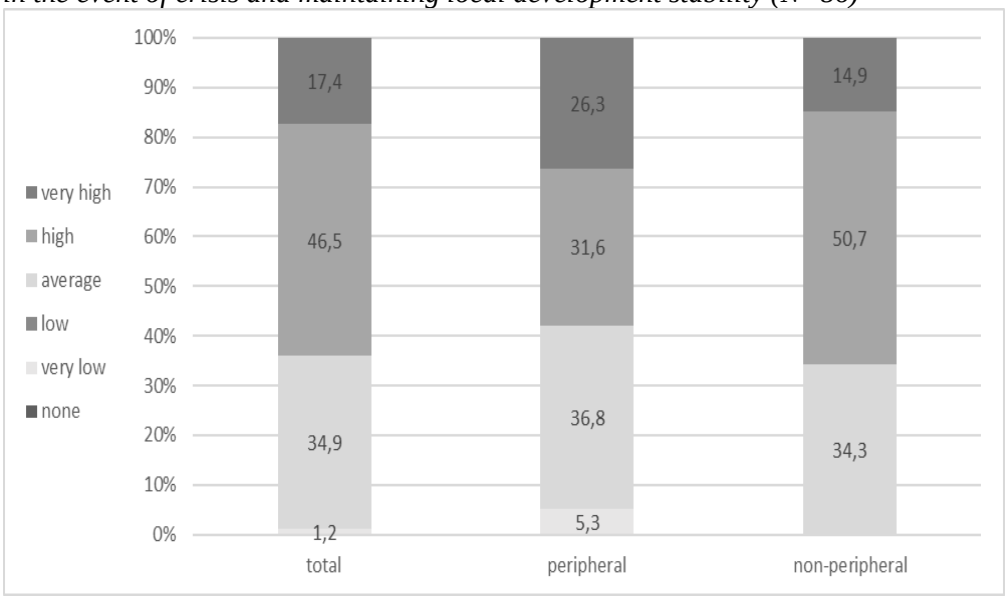
Against the backdrop of the public statistical data presented above, empirical research carried out by the authors of this study allows them to conclude that the availability of modern information and communication technologies to sustain commune resilience (Rapaport *et al.,* 2018) and stabilise local development processes was perceived as a significant or highly significant factor in over half of the surveyed local government representatives.

Interesting differences in the opinions expressed were found for respondents from communes located in peripheral and other regions. In peripheral communes, 26.3% of the surveyed rated the availability of ICT as having "very high" significance, a proportion which was 11.4 pp. greater than in non-peripheral regions (Figure 1).

Information and communication technologies exert multidimensional influence on the activities of local economic operators and, as a result, local development processes.

Considering the systematic approach, they can facilitate/streamline communication and building local relations as part of the policy implemented by local authorities, contribute to a more efficient fulfilment of goals by social and economic operators, fostering local and supralocal cooperation, bolstering the flexibility of local entities in the face of changes taking place in their environment. Access to technologies becomes more important in the face of crises.

Figure 1. *Rated significance of the availability of modern information and communication technologies (high-speed Internet) for building commune resilience in the event of crisis and maintaining local development stability (N=86)*



Source: *Authors' own research.*

With regard to the results of research on the effect of ICT on pro-resilience activities, the authors of this study found that peripheral urban-rural communes in Eastern Poland were affected by the Covid-19 crisis to a greater extent than communes in other parts of Poland. In addition, a lower level of pro-resilience activity in peripheral communities was observed (Guzal-Dec and Zwolińska-Ligaj, 2023).

From the perspective of commune administration offices, crisis had a positive impact on the growth of diverse forms electronic communication with various groups in the local community, including residents, businesspeople and farmers. Activities of this kind were reported by 59.3% of the surveyed entities. Some of local authorities (29.9% of the units surveyed) invested in the development of modern information and communication infrastructure.

At the same time, according to 65% of representatives of local government, the local community was relatively willing to transition to remote communication in their interactions with administration, as well as in developing local social and cultural activities. On the other hand, greater involvement of local government in the development of electronic communication and the community's openness to the use of modern technologies and remote communication was typical of non-peripheral regions.

The proportion of responses indicating the growth of electronic communication between administration the local community and the local community's openness to remote forms of communication was higher in communes in regions without peripheral qualities – respectively 15.3 pp. and 7.8 pp. higher compared to communes located in Easter Poland Region (Table 1).

Access to information and communication technologies is a key factor supporting competitiveness in business. The use of ICT enabled businesses to adapt to the realities of the Covid-19 pandemic. With regard to local businesses, respondents reported in-creased activity in the use of remote work (45.2%) and the growth of the e-business sector (39.5%) in the face of restrictions of existing operations during the Covid-19 cri-sis. The level of this activity was slightly higher for businesses in communes in non-peripheral areas.

Table 1. *Selected characteristics of the effect of information and communication technologies on pro-resilience activities in the analysed communes by peripheral and non-peripheral location (N=86)*

No.	Steps taken		Unit	Total	Peripheral	Non-peripheral
1.	local community readily transitioned to modern technologies/remote forms of communication in interactions with the office, social/cultural activities etc.	Community	Quantity	55	11	65.67
			%	63.95	57.89	44
2.	commune administration developed electronic communication with the local community		Quantity	51	9	42
			%	59.30	47.37	62.69
3.	commune administration developed modern information and communication infrastructure		Quantity	26	6	20
			%	29.89	30.00	29.85
4.	businesses demonstrated flexibility in transition to remote production/provision of goods and services/commerce, e.g. online retail	Businesses	Quantity	34	7	27
			%	39.53	36.84	40.30
5.	remote employment		Quantity	38	8	30
			%	45.24	44.44	45.45
6.	growth of non-agricultural operations in remote form	Farms	Quantity	1	1	-
			%	1.16	5.26	-
7.	using selected agriculture-related services remotely		Quantity	6	-	6
			%	6.98	-	8.96
8.	implementation of remote communication technologies		Quantity	11	2	9
			%	12.94	11.11	13.43
9.	finding more leads by means of		Quantity	13	4	9

	IT tools more often		%	15.12	21.05	13.43
10.	growth of remote interactions with goods and service suppliers and purchasers		Quantity	12	3	9
			%	13.95	15.79	13.43
11.	growth of remote interactions with administration		Quantity	27	5	22
			%	31.40	26.32	32.84

Source: *Authors' own research.*

In nearly a third of the surveyed local authorities (31.4%), representatives report-ed farmers' increased remote interaction with local administration. Moreover, local farmers slightly intensified (15.1%) their search for leads by means of IT solutions.

Other measures designed to adapt farms to the conditions prevailing during the pandemic included the development of remote technologies enabling a more effective communication with the environment (12.9%) and, thus, developing remote interactions with the suppliers and consumers of product and services offered by the farm (14.0%). Farmers rarely used remote non-agricultural services (7.0%) or developed remote non-agricultural business activity (1.2%).

Taking commune location into account, farmers intensified their search for new leads by means of IT solutions more often in peripherally-located communes, with every fifth commune (21.1%) reporting this type of activity. This proportion was 7.6 pp. higher than in non-peripheral communes. Lastly, with regard to remote interactions between farmers and the local administration, farmers in non-peripheral communes were somewhat more active.

7. Discussion

Results of empirical research carried out from the perspective of local authorities confirmed that access to modern information and communication technologies proves highly relevant for territorial units during crisis, determining the unit's pro-resilience/proactive/adaptive response (e.g., Maclaren and Philip, 2021 Morris *et al.*, 2022). The role of ICT infrastructure was of particular significance for peripherally-located units.

Research has confirmed that local entities in peripheral communes were characterised by an overall lower pro-resilience activity, with the exception of those farmers in peripheral areas who were, for instance, more actively looking for new leads by means of ICT tools.

In the light of the findings, communication technologies may be considered an important factor facilitating various steps taken by local entities to adapt to crises. During the Covid-19 pandemic, local authorities were far more active in response to the ensuing crisis. The venue of their activity was available information and communication infrastructure. Like in cities, rural areas took many measures

intended to en-sure continuity of operations and services provided by local administration, as well as support for residents.

The authorities were faced with new challenges, such as the need for internal communication improvement, administrative employees' remote work and the provision of e-services for the residents and economic operators (Papińska-Kacperek and Wasiliew, 2021). The coronavirus epidemic triggered creative steps taken directly for the benefit of local communities.

Those steps frequently went beyond the local administration's basic competences (Dąbkowka *et al.*, 2020; Silva, 2021). Note that it is important to develop information technologies not only for communication purposes but also with a view to using them in building relations and education, which is crucial from the perspective of reinforcing local resilience (Silva, 2021). As indicated by research in peripheral areas, key obstacles to remote work included the low digitisation level in offices, insufficient hardware and software and lack of staff competence (Kusto and Klepacki, 2022).

The residents responded by a more common use of modern technologies to communicate online, as proved necessary in the situation, or increased support for the most vulnerable members of the community. In such conditions, the local government units were more than timely information providers – they invested in connecting with the population, knowing that a health crisis could easily escalate into a social crisis (Silva, 2021).

Businesses did not commonly change their existing paths of development; however, they responded by actively using technologies to enable remote work and e-commerce. In peripheral communes, businesses developed new of improved products and services to meet the needs of consumers outside their commune area.

Farmers displayed a greater extent of adaptive measures in peripheral areas. In those areas, the pandemic often became an impulse to take self-help measures, necessitating non-agricultural operations outside the farm, including remote work or ser-vices. Searching for new leads by means of information technologies and remote interactions with suppliers and purchasers became noticeably more widespread.

Other researchers found that farmers who increased the use of online sales and marketing in the first year of the pandemic had larger farms and greater on-farm crop and livestock diversity, which boosted their resilience to pandemic-related shocks (Durant *et al.*, 2023).

With regard to farmers, existing ICT solutions hold the potential to enhance resilience and sustainability – economical, social and environmental – within agri-food supply chains (Cimino *et al.*, 2024). Additional agricultural and ICT support via policy and investment may be necessary to improve productivity (Govender,

2023). Moreover, studies suggest that raising educational levels is crucial to fully leverage ICT benefits in the agricultural sector (Audu, 2022).

8. Conclusions

The present findings based on public statistics on Internet accessibility in Poland confirm that in the analysed period Polish household, businesses and public administration made noticeable progress. In 2019, disparities between peripheral and non-peripheral regions, in terms of Internet access for the aforementioned entities were not significant. With regard to peripheral versus non-peripheral locations, surveyed entities in the latter regions were characterised by more dynamic changes and greater Internet accessibility.

This study showed e.g., poorer availability of high-speed internet connections for basic local government units, i.e., communes, which may limit the development of online services provided to businesses and residents. However, the situation could be improved by intensive investment processes supported by projects co-financed from by the European Union.

Empirical research showed that in spite of relatively good access to ITC, the technologies are still employed rather narrowly. This finding could be explained by the reluctance of communities, especially those in rural areas, to use ITC, as well as their in-sufficient knowledge on ITC capabilities, particularly with reference to business activity.

The present study had some limitations. First of all, our research was conducted in the first phase of the pandemic and represent the local authorities' perspective. It is therefore difficult to carry out an in-depth discussion of the results of the study. Another limitation of this study was a shortage of sources on community resilience in post-pandemic conditions. The need for similar studies abroad in other peripheral regions to enrich the theory and practice of regional development in terms of providing an explanation of the low level of the use of ICT can be postulated.

Apart from crisis situations, the growth of ICT enables bolstering resilience in the economic dimension by creating favourable conditions for remote work. East Poland is an attractive region for those who work remotely, which may contribute to lowering the pressure on the local labour market and better employability of people from various locations in Poland (Wolański *et al.*, 2023). Therefore, continued investment in the growth of ICT is recommended.

References:

Adamowicz, M. 2023. Polityka antypandemiczna i polityka antykryzysowa w czasie pandemii COVID-19 w Polsce. Economic and Regional Studies 16, 538-566. https://doi.org/10.2478/ers-2023-0035.

Adamowicz, M., Zwolińska-Ligaj, M. 2021. Lokalne Strategie Innowacji Jako Instrument Kreowania Innowacyjności i Wspierania Rozwoju, Monografie i Rozprawy. Wydawnictwo PSW im Papieża Jana Pawła II w Białej Podlaskiej.

Aldrich, D.P., Meyer, M.A. 2015. Social Capital and Community Resilience. American Behavioral Scientist 59, 254-269. https://doi.org/10.1177/0002764214550299.

Ashmore, F.H., Farrington, J.H., Skerratt, S. 2015. Superfast Broadband and Rural Community Resilience: Examining the Rural Need for Speed. Scottish Geographical Journal 131, 265-278. https://doi.org/10.1080/14702541.2014.978808.

Aswegen, M., van, Retief, F.P. 2020. The role of innovation and knowledge networks as a policy mechanism towards more resilient peripheral regions. Land Use Policy, 90, 104259. https://doi.org/10.1016/j.landusepol.2019.104259.

Audu BS. 2022. Information Communication Technologies (ICTS) utilization during COVID-19 pandemic by farmers in Taraba State, Nigeria. Int. J. Agric. Pol. Res., 10(5), 120-133.

Auzina, I., Volkova, T., Norena-Chavez, D., Kadłubek, M., Thalassinos, E. 2023. Cyber Incident Response Managerial Approaches for Enhancing Small–Medium-Size Enterprise's Cyber Maturity. In Digital Transformation, Strategic Resilience, Cyber Security and Risk Management (pp. 175-190). Emerald Publishing Limited.

Best Practices in Local Development. 2001. Local Economic and Employment Development (LEED). OECD Publishing.

Capello, R. 2007. Regional Economics. Routledge, London.

Capello, R., Nijkamp, P. 2011. Regional growth and development theories revisited. In: R.J. Stimson, R. Stough, P. Nijkamp (ed.). Endogenous regional development: perspectives, measurement and empirical investigation. New Horizons in Regional Science. Edward Elgar Publishing.

Celińska-Janowicz, D., Płoszaj, A. 2015. Rola samorządów w kształtowaniu potencjału adaptacyjnego lokalnych układów społeczno-gospodarczych – przykład Mazowsza. In: D. Celińska-Janowicz, A. Płoszaj (eds.) Rozwój Lokalny w Turbulentnym Otoczeniu: Mazowieckie Samorządy Wobec Wyzwań Adaptacyjności. MGG Conferences, Warszawa, pp. 4-52.

Centrum Projektów Polska Cyfrowa. https://www.gov.pl/web/cppc.

Cheshmehzangi, A. 2020. The City in Need: Urban Resilience and City Management in Disruptive Disease Out-break Events. Springer, Singapore.

Cimino, A., Longo, F., Solina, V., Verteramo, S. 2024. A multi-actor ICT platform for increasing sustainability and resilience of small-scale farmers after pandemic crisis. British Food Journal, 126, 1870-1886. https://doi.org/10.1108/BFJ-01-2023-0049.

Dacko, M., Dacko, A. 2018. Studia nad rozwojem obszarów wiejskich – od paradygmatu wzrostu do rezyliencji. Wieś i Rolnictwo 179, 49-64. https://doi.org/10.53098/wir022018/03.

Dale, A., Ling, C., Newman, L. 2010. Community Vitality: The Role of Community-Level Resilience Adaptation and Innovation in Sustainable Development. Sustainability 2, 215-231. https://doi.org/10.3390/su2010215.

Daniel, A.D., Fernandes, J. 2024. Promotion of community resilience: Do citizens have a role to play? Local Envi-ronment 29, 987-1003. https://doi.org/10.1080/13549839.2024.2345621.

Dębkowska, K., Kłosiewicz-Górecka, U., Szymańska, A., Ważniewski, P., Zybertowicz, K. 2020. Polskie miasta w czasach pandemii, Polski Instytut Ekonomiczny, Warszawa. https://pie.net.pl/wp-content/uploads/2021/03/PIE-Raport-Polskie-miasta.pdf.

Durant, J.L., Asprooth, L., Galt, R.E., Schmulevich, S.P., Manser, G.M., Pinzón, N. 2023. Farm resilience during the COVID-19 pandemic: The case of California direct market farmers. Agricultural Systems, 204, 103532. https://doi.org/10.1016/j.agsy.2022.103532.

EU lagging regions: state of play and future challenges. 2020. https://www.europarl.europa.eu/RegData/etudes/ATAG/2020/652219/IPOL_ATA(2020)652219_EN.pdf.

Europejski Fundusz Rolny na rzecz Rozwoju Obszarów Wiejskich Przykłady projektów w dziedzinie technologii informacyjno-komunikacyjnych. 2011. https://ec.europa.eu/enrd/enrd-static/fms/pdf/45226E2B-EEC7-2BB0-A695-B42CBD546642.pdf.

Fundusze Europejskie na Rozwój Cyfrowy. https://www.rozwojcyfrowy.gov.pl/.

Glossary: Information and communication technology (ICT). 2024. Eurostat. Statistics explained. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Information_and_communication_technology_(ICT).

Govender, N. 2023. Small-Scale and Subsistence Farmers' Resilience and Sustainable Livelihoods due to COVID-19: Possibilities of Networking with ICT and WhatsApp. Alternation, 41, 407-441. https://doi.org/10.29086/2519-5476/2023/sp41a05.

Grima, S., Thalassinos, E., Cristea, M., Kadłubek, M., Maditinos, D., Peiseniece, L. (Eds.). 2023. Digital transformation, strategic resilience, cyber security and risk management. Emerald Publishing Limited.

Guzal-Dec, D.J., Zwolińska-Ligaj, M.A. 2023. How to Deal with Crisis? Place Attachment as a Factor of Resilience of Urban–Rural Communes in Poland during the COVID-19 Pandemic. Sustainability, 15(7), 6222. https://doi.org/10.3390/su15076222.

Hamdouch, A., Demaziere, C., Banovac, K. 2017. The Socio-Economic Profiles of Small and Medium-Sized Towns: Insights from European Case Studies. Tijds. Voor Econ. En Soc. Geogr., 108, 456-471.

Harnessing innovation to unlock the potential of rural and remote areas. 2021. https://digital-strategy.ec.europa.eu/en/news/harnessing-innovation-unlock-potential-rural-and-remote-areas.

Holl, A., Rama, R. 2023. Spatial Patterns and Drivers of SME Digitalisation. Journal of the Knowledge Economy. https://doi.org/10.1007/s13132-023-01257-1.

https://ec.europa.eu/eurostat/web/nuts/correspondence-tables, n.d.

Information and Communication Technologies (ICT). n.d. Agricultural Information Management Standards (AIMS). https://aims.fao.org/information-and-communication-technologies-ict.

Information and communication technology (ICT). 2024. OECD iLibrary.

Inner Peripheries: National Territories Facing Challenges of Access to Basic Services of General Interest 2017.

Isaksen, A. 2001. Building regional innovation systems: is endogenous industrial development possible in the global economy? Canadian Journal of Regional Science 24, 101-120.

Janc, K., Czapiewski, K. 2014. Internet jako czynnik poprawy sytuacji społecznej i ekonomicznej obszarów wiej-skich. Studia komitetu przestrzennego zagospodarowania kraju PAN, 195-218.

Kusto, B.A., Klepacki, B. 2022. E-services in municipal offices during the Covid-19 pandemic. JoMS, 49, 621-637. https://doi.org/10.13166/jms/156775.

Labrianidis, L. 2006. Fostering entrepreneurship as a means to overcome barriers to development of rural periph-eral areas in Europe. European Planning Studies, 14, 3-8. https://doi.org/10.1080/09654310500339067.

Levesque, V.R., Bell, K.P., Johnson, E.S. 2024. The role of municipal digital services in advancing rural resilience. Government Information Quarterly 41, 101883. https://doi.org/10.1016/j.giq.2023.101883.

Lioutas, E.D., Charatsari, C. 2021. Enhancing the Ability of Agriculture to Cope with Major Crises or Disasters: What the Experience of COVID-19 Teaches Us. Agric. Syst., 187, 103023.

Maclaren, A.S., Philip, L.J. 2021. Geographies of the Rural and the COVID-19 Pandemic. In: Andrews, G.J., Crooks, V.A., Pearce, J.R., Messina, J.P. (Eds.), COVID-19 and Similar Futures: Pandemic Geographies. Springer in-ternational Publishing, Cham, pp. 267-273. https://doi.org/10.1007/978-3-030-70179-6_35.

Marsden, A.R., Zander, K.K., Lassa, J.A. 2023. Smallholder Farming during COVID-19: A Systematic Review Concerning Impacts, Adaptations, Barriers, Policy, and Planning for Future Pandemics. Land, 12, 404.

Mayer, H., Motoyama, Y. 2020. Entrepreneurship in small and medium-sized towns. Entrep. Reg. Dev., 32, 467-472.

Mayfield, L., Courtney, P., Tranter, R., Jones, P., Susannah, F., Sheela, A., Alan, M., Bertrand, S., Maxime, J., Denis, L. 2005. The Role of Small and Medium sized Towns in Rural Development. Project Report. Centre for Agricultural Strategy, University of Reading. Available online: https://eprints.glos.ac.uk/2636/1/The%20role%20of%20small%20and%20medium-sized%20towns%20in%20rural%20development.pdf.

McManus, P., Walmsley, J., Argent, N., Baum, S., Bourke, L., Martin, J., Pritchard, B., Sorensen, T. 2012. Rural Community and Rural Resilience: What Is Important to Farmers in Keeping Their Country Towns Alive? Journal of Rural Studies, 28, 20-29. doi:https://doi.org/10.1016/j.jrurstud.2011.09.003.

Morris, J., Morris, W., Bowen, R. 2022. Implications of the digital divide on rural SME resilience. Journal of Rural Studies, 89, 369-377. https://doi.org/10.1016/j.jrurstud.2022.01.005.

Naldi, L., Larsson, J.P., Westlund, H. 2020. Policy entrepreneurship and entrepreneurial orientation in vulnerable Swedish municipalities. Entrep. Reg. Dev., 32, 473-491.

Naldi, L., Larsson, J.P., Westlund, H. 2020. Policy entrepreneurship and entrepreneurial orientation in vulnerable Swedish municipalities. Entrep. Reg. Dev., 32, 473-491.

Nguyen, H.L., Akerkar, R. 2020. Modelling, Measuring, and Visualising Community Resilience: A Systematic Review. Sustainability, 12(19), 7896. https://doi.org/10.3390/su12197896.

Nijkamp, P., Abreu, M.A. 2009. Regional development theory. Vrije Universiteit, Faculty of Economics and Business Administration, Serie Research Memoranda from VU University Amsterdam, Faculty of Economics, Business Administration and Econometrics, 29.

Niu, S., Yang, X., Li, H., Zhang, J. 2024. Evaluation of smart community resilience: empirical evidence from Hei-longjiang province, China. Environment, Development and Sustainability. https://doi.org/10.1007/s10668-024-04514-8.

Nurzyńska, I. 2016. Przyczyny i przejawy peryferyjności obszarów wiejskich w Polsce. Wieś i Rolnictwo 2, 123-139. https://doi.org/10.53098/wir022016/05.

Papińska-Kacperek, J., Wasiliew, A.Z. 2021. Zastosowanie idei smart city w czasie pandemii COVID-19 i izolacji społecznej w Polsce w 2020 roku. Konwersatorium Wiedzy O Mieście 34, 63-72. https://doi.org/10.18778/2543-9421.06.06.

Patel, S.S., et al. 2017. What Do We Mean by "Community Resilience"? A Systematic Literature Review of How It Is Defined in the Literature. PLoS currents, 9. https://doi.org/10.1371/currents.dis.db775aff25efc5ac4f0660ad9c9f7db2.

Piekut, M., Rybaltowicz, J. 2024. The role of information and communication technologies in rural development. Zagadnienia Ekonomiki Rolnej / Problems of Agricultural Economics 378, 69-92. https://doi.org/10.30858/zer/181136.

Płoszaj, A. 2013. Diagnoza sytuacji społeczno-gospodarczej wraz z analizą SWOT dla Programu Operacyjnego Polska Wschodnia 2014-2020.

Rapaport, C., Hornik-Lurie, T., Cohen, O., Lahad, M., Leykin, D., Aharonson-Daniel, L. 2018. The Relationship between Community Type and Community Resilience. International Journal of Disaster Risk Reduction, 31, 470-477. doi:10.1016/j.ijdrr.2018.05.020.

Ray, Ch. 2006. Neo-endogenous rural development in the EU. In: P. Cloke, T. Marsden, P. Mooney (ed.). Handbook of rural studies. Thousand Oaks, Calif., SAGE, London.

Roberts, E., Anderson, B.A., Skerratt, S., Farrington, J. 2017. A review of the rural-digital policy agenda from a community resilience perspective. Journal of Rural Studies, 54, 372-385. https://doi.org/10.1016/j.jrurstud.2016.03.001.

Roberts, E., Townsend, L. 2016. The Contribution of the Creative Economy to the Resilience of Rural Communities: Exploring Cultural and Digital Capital. Sociologia Ruralis 56, 197-219. https://doi.org/10.1111/soru.12075.

Satterthwaite, D., Tacoli, C. 2003. The Role of Small and Intermediate Urban Centres in Regional and Rural Development: The urban part of rural development. International Institute for Environment and Development, pp. 12-33.

Servillo, L., Atkinson, R., Hamdouch, A. 2027. Small and Medium-Sized Towns in Europe: Conceptual, Methodological and Policy Issues. Tijds. Voor Econ. En Soc. Geogr., 108, 365-379.

Sharifi, A.A. 2016. Critical Review of Selected Tools for Assessing Community Resilience. Ecological Indicators, 69, 629-647. https://doi.org/10.1016/j.ecolind.2016.05.023.

Silva, S.M. 2021. Building trust, resilient regions, and educational narratives: Municipalities dealing with COVID-19 in border regions of Portugal. European Educational Research Journal, 20, 636-666. https://doi.org/10.1177/14749041211029733.

SMART Resilient Communities. https://resiliencechallenge.nz/wp-content/uploads/Webinar-SMART-Resilient-Communities_slides.pdf.

Stöhr, W.B. 1990. On the theory and practice of local development in Europe. In: W.B. Stöhr (ed.). Global challenge and local response. Initiatives for economic regeneration in contemporary Europe. The United Nations University, Mansell, London.

Tacoli, C. 2017. Why Small Towns Matter. International Institute for Environment and Development.

Thalassinos, E., Kadłubek, M., Norena-Chavez, D. 2023. Theoretical Essence of Organisational Resilience in Management. In Digital Transformation, Strategic Resilience, Cyber Security and Risk Management (pp. 133-145). Emerald Publishing Limited.

Tyagi, P., Grima, S., Sood, K., Balamurugan, B., Özen, E., Thalassinos, E. (Eds.). 2023. Smart analytics, artificial intelligence and sustainable performance management in a global digitalised economy. Emerald Publishing Limited.

Wilson, G. 2010. Multifunctional 'quality' and rural community resilience. Transactions of the Institute of British Geographers 35, 364-381. https://doi.org/10.1111/j.1475-5661.2010.00391.x.

Wilson, G.A. 2012. Community resilience, globalization, and transitional pathways of decision-making. Geoforum, 43, 1218-1231. https://doi.org/10.1016/j.geoforum.2012.03.008.

Wolański, M., et al. 2023. Wpływ funduszy europejskich 2014-2020 na rozwój społeczno-gospodarczy Polski Wschodniej. https://www.ewaluacja.gov.pl/strony/badania-i-analizy/wyniki-badan-ewaluacyjnych/badania-ewaluacyjne/wplyw-funduszy-europejskich-2014-2020-na-rozwoj-spoleczno-gospodarczy-polski-wschodniej/.

Wykorzystanie technologii informacyjno-komunikacyjnych w jednostkach administracji publicznej, przedsiębiorstwach i gospodarstwach domowych. https://stat.gov.pl/obszary-tematyczne/nauka-i-technika-spoleczenstwo-informacyjne/spoleczenstwo-informacyjne/.

Yang, S., Fichman, P., Zhu, X., Sanfilippo, M., Li, S., Fleischmann, K.R. 2020. The use of ICT during COVID-19. Proceedings of the Association for Information Science and Technology, 57, e297. https://doi.org/10.1002/pra2.297.

Zhang, R., Yuan, Y., Li, H., Hu, X. 2022. Improving the Framework for Analyzing Community Resilience to Understand Rural Revitalization Pathways in China. J. Rural Stud., 94, 287-294.

Zwolińska-Ligaj, M. 2018. Kształtowanie lokalnych systemów innowacji jako sposób realizacji koncepcji inteli-gentnego rozwoju na przykładzie regionów peryferyjnych. Wydawnictwo Państwowej Szkoły Wyższej im. Papieża Jana Pawła II.

Zwolińska-Ligaj, M.A., Guzal-Dec, D.J. 2024. Rural Area Resilience during the COVID-19 Pandemic as Exemplified by Urban–Rural Communes in Poland. Sustainability 16. https://doi.org/10.3390/su16125073.