

SMART INFRASTRUCTURES FOR RURAL AREAS - BEST PRACTICES AND SUGGESTED ACTIONS FOR MOLDOVA

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Abstract

Our research is devoted to stimulating the processes of adaptation of digital innovative concepts of "Smart Village" and the operation of smart infrastructure - spatial data, in order to contribute in rural economic development and improve economic situation in rural area. In paper we describes the potential for achieving synergy in rural areas, between the projects of the programs «National Fund for Regional Development» and «National Research and Development Program» (2020-2023), through the implementation of ArcGIS - ESRI best practices and approaches to ICT adoption based on programmatic approach. Finally, our research is devoted to the recommended activities proposed to public local authorities and to local initiative groups for the digital transformation of rural villages in Moldova. This article will discuss about these issues providing examples of good practices founded in the world.

1. Introduction and context

Following the «Decision of the EU Commission for the Implementation of the Annual Action Program in favor of the Republic of Moldova for 2020» [3], non-agricultural individual activities in Moldova account for only 5% of income in rural areas and a quarter of the income of the rural population is provided with social benefits. In this regard, there is a real need for efficient digital solutions for business continuity.

The first part of our research is devoted to stimulating the processes of adaptation of digital innovative concepts of "Smart Village" and the operation of smart infrastructure - spatial data, in order to attract credit funds to finance investments.

The tasks of top and middle managers to intensify integration into the Single digital market of the EU and the digital space of Eurasia, as well as into the «European Research Area» (ERA), are caused by the emergency COVID-19, which blocks and restricts the activities of rural local governments, organizing businesses and households.

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The second part describes the potential for achieving synergy in rural areas, between the projects of the programs «National Fund for Regional Development» and «National Research and Development Program» (2020-2023), through the implementation of ArcGIS - ESRI best practices and approaches to ICT adoption based on programmatic approach.

This combination of internet-based digital tools and advanced programmatic approaches in the management of EU funds will create jobs in non-agricultural sectors, increase household income in rural areas and create rural well-being.

The third part of our research is devoted to the recommended activities proposed to «Local initiative groups» for the digital transformation of rural villages in Moldova.

Villages and rural settlements in the development regions of the Republic of Moldova are experiencing the effects of demographic changes and a decline in the population of rural areas. This trend raises several important questions for the future: What will villages look like as population's age? Will young people and families move to rural villages? Will the villages be able to maintain their infrastructure (transport, shops, healthcare, etc.)? Will there be more business in the countryside? What concepts will help revitalize villages and rural areas and keep them attractive to residents, young and old? The «Single digital market» is a planned economic zone of the EU countries with a focus on telecommunications and the digital economy. The need to integrate the development regions of the Republic of Moldova into the EU's Single Digital Market is to bring the developing national digital market of the Republic of Moldova in line with the digital age, namely: it is necessary to reduce the digital divide between the regions within the country and the EU / Eurasia regions, eliminating unnecessary regulatory barriers and move from separate local / regional, national markets to a single pan-European set of rules. The goal set by the EU is to catch up with the United States, Japan and South Korea in the Internet economy, for which it will be necessary to expand access to digital goods and services, better conditions for digital networks and services, their expansion, and a greater digitization of the economy. The need to integrate the Development Regions of the Republic of Moldova into the European Research Area (ERA) is caused by the need to eliminate fragmentation in territorial scientific research through programming / planning the integration of national scientific resources within the framework of research programs of the European Union.

The ERA is part of the more developed European Knowledge area, focused on research, education and innovation, and is part of the broader Lisbon Development Strategy, which unites these three areas in a “scientific triangle”.

The best way to develop ERA is to share strategies at the national and regional levels. The key point in this progress should be that the interested regions will exchange experience, gain practical knowledge, and create interconnections between strategies to ensure the social security of researchers, additional incentives for private research and innovation, scientific cooperation with third countries, and the like.

«Roadmap for the integration of the Republic of Moldova into the European Research Area» [2] is a unique program document that innovative organizations of development regions can use for the exclusive adaptation of rural local communities to planning sustainable innovative development. The habitual expectations of rural residents of centralized approaches to solving social and economic problems are becoming a thing of the past. How can we make life in the countryside more attractive and close the gap between town and country? This question periodically forces our group of researchers to turn to the study of «Best European Practice» to develop joint solutions,

recommendations and testing of the implemented tools of the «Digital Economy» in pilot, experimental settlements, and our potential partners in innovation. The Smart village (EU) concept, referring to rural areas and communities that rely on their existing resources and assets, clearly demonstrates to us that European countries are rethinking and redefining the adopted concepts of smart cities and villages. They emphasize the need to implement Smart Specialization approaches starting with local communities, ensuring synergy of funds, local resources, technological innovation solutions and spatial planning as a basis for achieving the Sustainable Development Goals.

The United Nations «Sustainable Development Goals» (SDGs), adopted in 2015, committed the global development community to 17 interlinked goals and 169 targets aimed at improving the quality of life for all. The SDGs and their targets also aim to revitalize rural communities and their links to urban centers [15].

The Smart Village model, based on an integrated approach to digital development, is delivering accelerated impact on multiple SDGs such as health, trade, education and agriculture by expanding access to Smart Infrastructure and ensuring that the right digital solutions reach people, households, small and medium enterprises (farms), public administration. The main characteristic underlying most of these components is their interconnectedness and the generation of data, that can be used rationally to ensure optimal resources.

The main components of «Smart infrastructure» [4] of settlements «Smart village» include: smart buildings; rational mobility; rational energy consumption; rational water supply; rational waste management; rational health care; rational digital layers. It is proposed to consider the feasibility of the deployment of the specified infrastructure, within the framework of the competition for projects of the «Regional Development Fund» and the possibilities of organizing the appropriate management, through analytical processing of the generated data on the specified components, within the framework of the information systems being created in settlements - the beneficiaries of the projects, ensuring the collection, storage, processing, access, visualization and dissemination of spatial data.

Such an information system is called «Geographic Information System» (GIS). According to the territorial coverage, global GIS, sub-continental GIS, national GIS, often having the status of state, regional GIS, sub - regional GIS and local GIS are distinguished [9]. The problem orientation of GIS is determined by the tasks solved in it (scientific and applied), among them the inventory of resources (including the cadaster), analysis, assessment, monitoring, management and planning, decision support.

2. Best practices

To open up new opportunities in the area of Smart Specialization, regions and local leaders in rural areas need to analyze their position in national, regional and European value chains. Based on this analysis, the implementation of local priorities / plans for «Smart Specialization» should be coordinated with not only regional, national priorities and programs, but also with regions of other countries, since no region has complete and complex information about all opportunities for cooperation in the regional, national and European level in their areas of «Smart specialization». As potential partners for interregional cooperation of Smart Specialization, we propose to the public authorities of the Republic of Moldova for consideration, the EU project «Digital Villages» (DE) [6], coordinated by the Institute of Experimental Software Engineering. Fraunhofer (IESE), aimed

at finding digital solutions for people living in agricultural areas, with a focus primarily on rare settlements. In district centers / cities, where many people live together in relatively small spaces, different problems need to be addressed than in rural areas. The challenge here is primarily to cover distances among a small number of people. As a result, rural digitization requires different concepts, solutions and business models.

European practice shows that indicators of sustainable development are actively used in the statistical systems of some countries, not only at the level of cities, regions, but also at the levels of settlements (villages). The use of indicators provides an opportunity to assess the performance of settlements, so that specific measures can be recommended that they will subsequently take. And the indicators can be used as a tool for monitoring the progress of settlements on the way to their sustainable innovative development based on the tools of the Digital Economy in the regional, national, European framework of the «Sustainable Development Goals» (SDGs) - the «European Sustainable Development Network» [12].

The software product of the American company ESRI - ArcGIS will be helpful for visualize large amounts of geo-referenced statistical information (generated data). A wide range of spatial information analysis tools are built into *ArcGIS*, which are used in a variety of areas: land cadasters, land management; registration of real estate objects; engineering Communication; telecommunications; ecology; transport; water resources; forestry; finance and banking; education; trade and services; public safety.

The ArcGIS tools applied in process of «localization of smart infrastructure», will empower synergies between the programmatic approaches of the «Regional Development Fund» [17], «National Fund for the Development of Agriculture and Rural Areas» [13], «National Research and Innovation Program for 2020–2023» [19] and «Roadmap for the integration of the Republic of Moldova into the European Research Area 2019-2021».

The goal of Program No. 3, «Regional Infrastructure» (RDF) [20], is to create basic infrastructural conditions for improving living conditions and creating prerequisites for attracting investment to the regions, inclusive rural localities.

Exclusive digital solutions developed by potential residents of innovation incubators with the coordination of research organizations, as part of the initiation of public-private partnership projects «National Program for Research and Innovation 2020-2023», will make economic mechanisms available for various target groups in rural areas: public administration; innovative organizations; business (farms; cluster initiatives); civil society organizations.

How innovative organizations can help to local communities, villages? Within the framework of the powers established by law, the region can search for credit funds to finance investments. In the same time, as it mentioned in [1], local legislation establishes volume limits of the loan and provides the system for ensuring.

One of the forms of attracting external investments to the regions is the participation of interested local organizations in the EU Programs to which the Republic of Moldova is associated: Horizon Europe, Erasmus+, Cross-border cooperation programs and others.

From this point of view, public administrations, private farms (SMEs), civil society organizations need to be aware that the European Commission Services have identified synergies between

different EU funds. Increased innovational partnership and their impact, for combination of different forms of innovation and support for competitiveness, or promoting innovative ideas along the innovation cycle or value chain to bring them to domestic and foreign markets.

Thus, synergy is to gain a greater impact on competitiveness, job creation, including for academics and growth in the European Regions, by combining Structural Funds with Horizon Europe and other EU instruments in a strategic as well as cohesion-oriented manner. To achieve this synergy, the services of the Commission paved the way for a strategic approach in the medium and long term, starting with the stage of stakeholder engagement (the «process of entrepreneurial discovery» [7]) to form strategies for smart specialization (RIS3 - Research and Innovation Strategies for Smart specialization). Such RIS3 strategies establish a national or regional framework for investment in research and innovation not only from ESIF, but also from all funding sources. Organizations directly interested in participating in Horizon Europe and other EU programs in territories using synergies through building «*Innovative Partnerships*» [16] during the planning of «*Public Procurements*» and «*Public-Private Partnership*» projects, thus, will be able to build an incentive system local innovation. Commission Services strongly encourage synergies by combining Horizon Europe Finance and ESIFs in one project (only possible for the National Research and Innovation Program and Horizon Europe), or through sequential projects that build on each other or parallel projects, roadmaps that complement each other. In the case of the Republic of Moldova, the consolidation of financial flows can be achieved by solving local development problems in joint projects with research organizations. Thus, local communities will have the opportunity to combine the efforts of interdisciplinary, inter sectorial groups (cluster initiatives) of farms, small and medium enterprises, and several local communities in order to attract local resources and assets to provide investment in specific economic activities, increasing welfare and living conditions in the villages.

The needs to build synergy within the framework of initiation a «Public-private partnership» and organizing joint «Public procurement» with the initiation of a coordinated «Innovation partnership» between organizations located in the «Down-stream» are clear presented in the Figure 1. In addition to the established criteria, that characterize innovation, there are also new ones that are not completely established. In [8] were mentioned that M. Porter and G. Bond distinguish upstream and downstream innovations. The first combine scientific research, the second - the processes associated with making a profit. It is proposed to separate the factors that form the innovation environment in a corresponding way. In this case, the pilot territories, the project concepts of which have been selected for participation in the second stage of the competition of the National Fund for Regional Development.

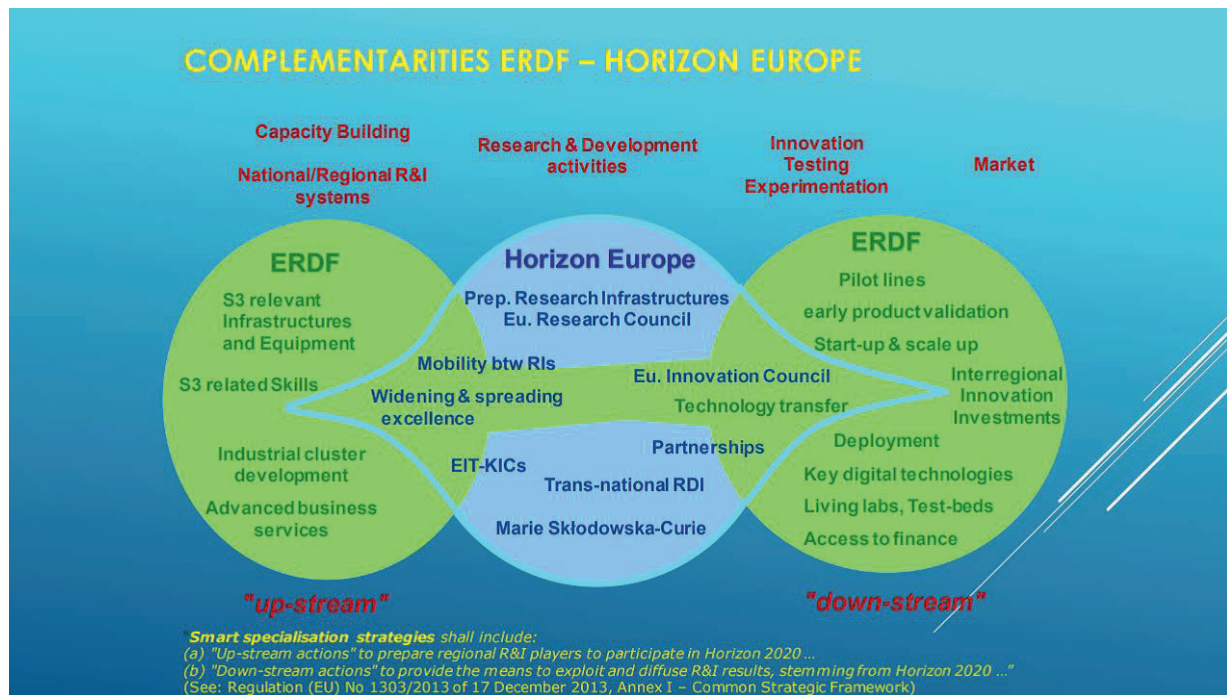


Figure 1: Complementarity between funds of “Regional development” and “Research & Development [13]

The «Stairway to Excellence» (S2E) [22] project was launched in 2014 as a pilot project in the European Parliament, carried out by DG-JRC in cooperation with DG-REGIO. It is currently being marketed as part of JRC Smart Specialization targeted support.

Opportunities for ensuring synergy between national funding and European structural and investment funds, within the framework of integration in «Digital Single Market EU», national and European programs related to research, innovation and competitiveness Horizon Europe, COSME, ERASMUS+, Creative Europe, should stimulate cooperation between public administration and research organizations to develop sectorial programs or work plans. The degree to which they comply with the implementation conditions, adequate management and the needs of the innovation infrastructure in order to conduct research, expertise, will affect the availability of villages (settlements) to international technical support tools, the formats of projects being developed, reporting requirements, auditing systems, as well as drafting and interpretation of structural funds. Thus, the effectiveness of planning the acceleration of indicators of sustainable development of smart villages by local public administrations, based on the localization of smart infrastructure, will create conditions for the formation of digital ecosystems of settlements.

The synthesis of the concept of Digital Business Ecosystem emerged in 2002 by adding “Digital” in front of Moore’s (1996) “Business ecosystem” in the Unit ICT for Business of the Directorate General Information Society of the European Commission (Nachira, 2002). In truth, Moore (2003) himself used the term Digital Business Ecosystem in 2003, but with a focus exclusively on developing countries. The generalization of the term to refer to a new interpretation of what “socio-economic development catalyzed by ICTs” means was new, emphasizing the coevolution between the business ecosystem and its partial digital representation: the digital ecosystem [11].

The prototypes of the digital business ecosystem of smart settlements with spatial data infrastructure for generating, visualizing and updating data in order to make adequate decisions on financing spatial development projects in rural areas could be applied for the territories of the regions of

Gagauzia and the South of the Republic of Moldova. In the results of participation in the EU project «Trans Danube» [24] of an organization from Republic of Moldova These areas almost are prepared to implementation having a better level of readiness. The projects selected by the National Regional Development Fund at February 2021 are needed to «localize smart infrastructure» ([4], p.3.1) within the framework of the integration of cluster initiatives of farms, small and medium-sized enterprises in the «InnovFin» [14] and «COSME» [5] programs it was mentioned. After a planned and carried out feasibility study, the Association for the Development of Tourism in Moldova of the project participant identified several beneficial directions for the development of tourism on the Danube, which can be further developed at the transnational level, due to the innovative support of «S2B» [21]:

- improvement of tourist transport logistics;
- accommodation facilities for tourists;
- traditional power supplies;
- tourist information centers in museums;
- expansion of balneal-sanatorium services.

At the first stage of support, the needs for technologies, innovative management methods in settlements are investigated, based on the methodological approach of «Smart acceleration», the development of which a group of ASEM researchers can offer to «Local Initiative Groups» of selected project concepts, regional administrations within the framework of projects of the «National Program for Research and Innovation 2020-2023» with the development of exclusive local plans, roadmaps for the modernization of public electronic services in the sectors of Smart infrastructure. Innovation centers of regional universities, which are still operating in the «Start-ups». «External Offices for Knowledge Transfer» are national level organizations accredited by the European competent authorities. With the integration of regions into the «European Research Area» with the adaptation of regional dimensions adopted at the European level, the creation and exchange of data on innovative development of human settlements, between regional, national and European levels, also becomes easier.

At the second stage, using the results of «Synergy» in the initiated thematic projects of the National Program, the consortia will be able to enter the European / international networks Horizon Europe and test / demonstrate the selected Best Practice within the framework of symmetric or integrated participation in the implementation of large European infrastructure projects of the national and the «European Regional Development Fund» (as well as other national financial instruments).

Based on features of the «exclusive approach, Smart acceleration» national research organizations, responsible, according to the National legislation for the organization and accounting of technology transfer, innovation, knowledge transfer, will develop individual standards and indicators, as well as innovative and integrated strategies to maintain or improve the quality of life and social inclusion for all generations in shrinking and aging settlements, areas of development regions through the development of transnational and cross-border approaches.

3. Summary and suggested strategy for R. Moldova

Following ENRD seminar on Smart Villages [18] possible steps to solve the problems of integration into the "Single digital market" of rural areas, which should be reflected in Regional development programs to support Regional, Innovation and Agricultural policies:

1st step: Compare the existing levels (landscape) of political support for the digitization of agriculture and rural areas in your region / local initiative group.

2nd step: Determine opportunities and needs for using digitalization / localization of smart infrastructure to achieve some specific objectives of National Strategies and Regional Operational Sector Plans, through SWOT / PESTLE analysis.

3rd step: Prioritize the main types of interventions available in the Regional Operational Plans (Regional and Agricultural Policies) to meet the needs of these objectives. For instance:

- investments in small infrastructure and local public services (services) to solve problems;
- sharing knowledge and information for learning, advice and bridging skills and the digital divide;
- cooperation - including "LEADER" - for stakeholder engagement, joint capacity building, feasibility studies, pilot projects and digital centers;

4th step: formulate the necessary budget and, finally, design and implement the need for intervention.

The implementation of the LEADER approach [23] in the Republic of Moldova began in 2016. This is a European Union program, which provides the instruments for rural development, with aims to support local economic development and valorize the potential of rural areas based on the use of local resources. «*Local Action Groups*» (LAG) were created as an institutionalized local partnership. LAG members are organizations, institutions, local leaders, that are representatives of the public, business and civil sector, who jointly manage local development processes. The model of LAG functioning in Moldova was developed within the framework of the EU SARD program. At list, 32 LAGs have been created in the country.

At this stage of the scientific and technical support of the selected projects of the «National Regional Development Fund» promoted by our research group, it is proposed to consider the methodology of «Green transition and digital transformation» of villages in the context of the «LEADER» program [10].

To conclude this study, we would like to guide project leaders on the importance of planning synergy between the programs of the National Regional Development Fund (structural funds) and the «*National Program for Research and Innovation 2020-2023*», «Roadmap for the integration of the Republic of Moldova into the European Research Area» as a necessary to use an approach to the design and implementation of «*Smart villages*» oriented towards the achievement of the «*Sustainable Development Goals*». Design and implementation methods:

- analysis and planning;
- design and development;
- deployment and implementation;
- monitoring and evaluation.

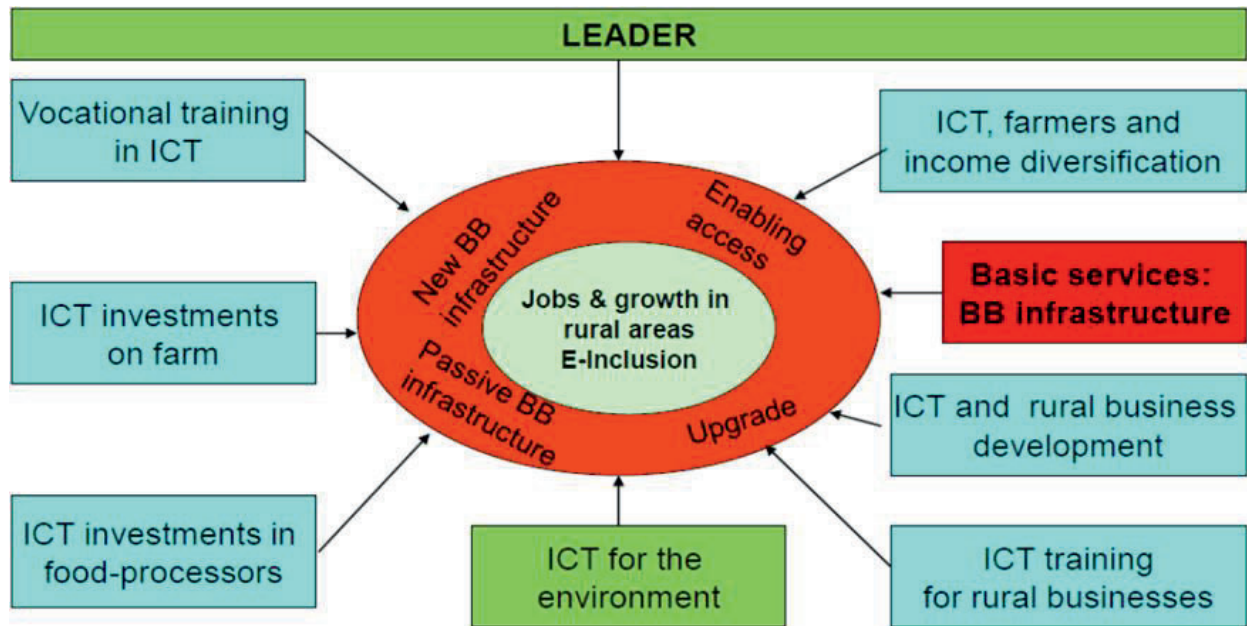


Figure 2: EU Rural Development Policy: Targeting ICT development [23]

In order for managers and leaders of potential «Smart villages» to make effective decisions, they need fast and efficient access to accurate data, which provides ArcGIS - a family of software products of the American company ESRI. Data is a strategic asset for all decision makers. This means that you need to localize the Smart Infrastructure and implement effective data systems that will be an integral part of the Smart Village system. It also involves leveraging existing systems, data, and continually improving them. Equally important, this means that the process of designing and generating data must be universally accessible for everyone to understand. Thus, there is a need to be creative in the use of visualization tools and to ensure regular data exchange with all citizens, organizations and institutions. In addition, it also means investing in developing the capacity of all policymakers to ensure their competence in generating and using data.

4. References

- [1] AER Declaration on Regionalism in Europe, 30 August 1996, <https://aer.eu/aer-declaration-regionalism>, p. 5-6.
- [2] Anexa nr.1 la Hotărîrea Guvernului nr. 1081 din 8 noiembrie 2018 «FOAIA NAȚIONALĂ DE PARCURS pentru integrarea Republicii Moldova în Spațiul European de cercetare pe 2019-2021» from https://mecc.gov.md/ro/content/era_
- [3] ANNEX 1 of the Commission Implementing Decision on the on the Annual Action Programme in favor of the Republic of Moldova for 2020, Action Document for EU4Moldova: Local Communities, p. 13.
- [4] Commission on Science and Technology for Development, Nineteenth session, Geneva, 9-13 May 2016, «Smart cities and infrastructure».
- [5] COSME - Loan Guarantee Facility (LGF - <https://ec.europa.eu/easme/en/cosme-0>).

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- [6] Digital Villages Germany ENRD EU working document, from https://enrd.ec.europa.eu/sites/enrd/files/tg_smart-villages_case-study_de.pdf.
- [7] «Enabling synergies between European Structural application: and Investment Funds, Horizon 2020, https://ec.europa.eu/regional_policy/en/information/publications/guides/2014/enabling-synergies-between-european-structural-and-investment-funds-horizon-2020-and-other-research-innovation-and-competitiveness-related-union-programmes, page 2.
- [8] Esența și limitele conceptului de „inovație” 2012 T.F. Bareev Universitatea Federală din Kazan (Regiunea Volga), p.63, from <http://ecsocman.hse.ru/data/2013/05/30/1251214484/12.pdf>
- [9] ESRI: Mapping Small and Rural Water Systems, from <https://www.esri.com/en-us/landing-page/industry/water/2019/mapping-rural-and-small-water-systems>
- [10] EU Commissioner Phil Hogan, speech at the ENRD Seminar on Smart Villages, 22 May 2018, Brussels, Belgium, from https://enrd.ec.europa.eu/sites/enrd/files/enrd_publications/smart-villages_orientations_digital-strategies.pdf.
- [11] European Commission “Digital Business Ecosystems” Luxembourg: Office for Official Publications of the European Communities 2007 – 232 pp. 21 x 29.7 cm ISBN 92-79- 01817-5 More information about Digital Business Ecosystems is available at <http://www.digital-ecosystems.org>.
- [12] European Sustainable Development Network (ESDN): Sub-national activities, <https://www.sd-network.eu/>.
- [13] «HOTĂRÎRE Nr. 455/2017 cu privire la modul de repartizare a mijloacelor Fondului Național de Dezvoltarea Agriculturii și Mediului Rural» <http://www.madrm.gov.md/ro/content/cadrul-normativ>.
- [14] InnovFin – EU Finance for innovators, from <https://www.eib.org/en/products/mandates-partnerships/innovfin/index.htm>.
- [15] International Telecommunication Union (ITU) publication «Building Smart Villages: A blueprint. As piloted in Niger», p. 1.
- [16] LEGE Nr. 169 din 26-07-2018 pentru modificarea Legii nr. 131/2015 privind achizițiile publice „Articolul 57[1]. Parteneriatul pentru inovare, from https://www.legis.md/cautare/getResults?doc_id=105525&lang=ro.
- [17] «Manualul operational privind modul de utilizare a mijloacelor Fondului Național pentru Dezvoltare Regională» Aprobata prin decizia Consiliului Național de Coordonare a Dezvoltării Regionale nr. 4/16 din 10 martie 2016.
- [18] National LEADER Network, from <https://leaderin.md/ru/12555-2/>.

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- [19] Programul național în domeniile cercetării și inovării pentru anii 2020-2023, from <https://mecc.gov.md/ro/content/programul-national-domeniile-cercetarii-si-inovarii-pentru-anii-2020-2023>.
- [20] REGULAMENTUL Concursului de proiecte / FNDR / 2021-2023, from <http://adrcentru.md/libview.php?l=ro&idc=340&id=3719&t=/Noutati/ANUN-Apel-de-selectare-a-proiectelor-de-dezvoltare-pentru-finantare-din-Fondul-National-pentru-Dezvoltare-Regionala>.
- [21] Science-to-business marketing S2B, from <https://www.s2bn.org/>.
- [22] Stairway to Excellence (S2E). As part of the targeted support activities of the JRC, the Stairway to Excellence (S2E) project is centered on the provision of assistance to the EU, from <https://ec.europa.eu/jrc/en/research-topic/stairway-excellence-s2e>.
- [23] Support ICT rural areas DRAFT Michael Gregory ENRD Contact Point. October 12, 2011, from <https://enrd.ec.europa.eu/enrd-static/fms/pdf/D78BF27E-91F5-B948-5EC1-81D3347C8443.pdf>.
- [24] Sustainable Transport and Tourism along the Danube «TRANSDANUBE», from http://www.southeast-europe.net/en/projects/approved_projects/?id=222.