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## USE OF PUBLIC REGISTERS FOR SELECTED SOLUTIONS WITHIN THE SMART VILLAGES CONCEPT

**Abstract:** The concept of Smart Villages is essential for the development of rural areas, in terms of both creating new job opportunities and the quality of life in the countryside. It is based on modern tools and technologies improving the quality of life with better resources and a lower environmental impact. Many different solutions can be implemented within the Smart Villages concept, depending on the needs and potential of a given area. The article aims at the determination of the possibility of using data obtained from public registers for the needs of Smart Villages solutions. The research was carried out in the Mazowieckie Voivodeship in Poland. Selected solutions for rural development in the Smart Villages approach were indicated. The structure of farms, registration plots, and land use were determined. Areas requiring remedial processes such as agricultural land consolidation were marked. Data necessary to implement measures in rural areas were identified, and the possibilities of obtaining them from public registers were indicated. The data is necessary to diagnose the current state and determine further actions, including analyses aimed at taking measures for the sustainable development of rural areas. It was assumed that their acquisition would reduce the costs and time needed to implement the selected solutions within Smart Villages.

**Keywords:** Smart Villages, public registers, rural land development

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## Introduction

The well-established Smart City concept has given rise to formulating the assumptions for the concept of Smart Villages. Although the Smart Village concept is based on the broader Smart City concept, the problems faced by urban and rural areas appear to be completely different, and therefore require different solutions.

The Smart Villages concept has emerged to address the need to implement the EUROPE 2020 agenda in the rural development policy. The implementation of the concept should align with the objectives and recommendations of Cork 2.0 (2016). The declaration addresses the expectations and aspirations of rural areas, and identifies ten policy orientations for the use of their potential (Fig. 1).

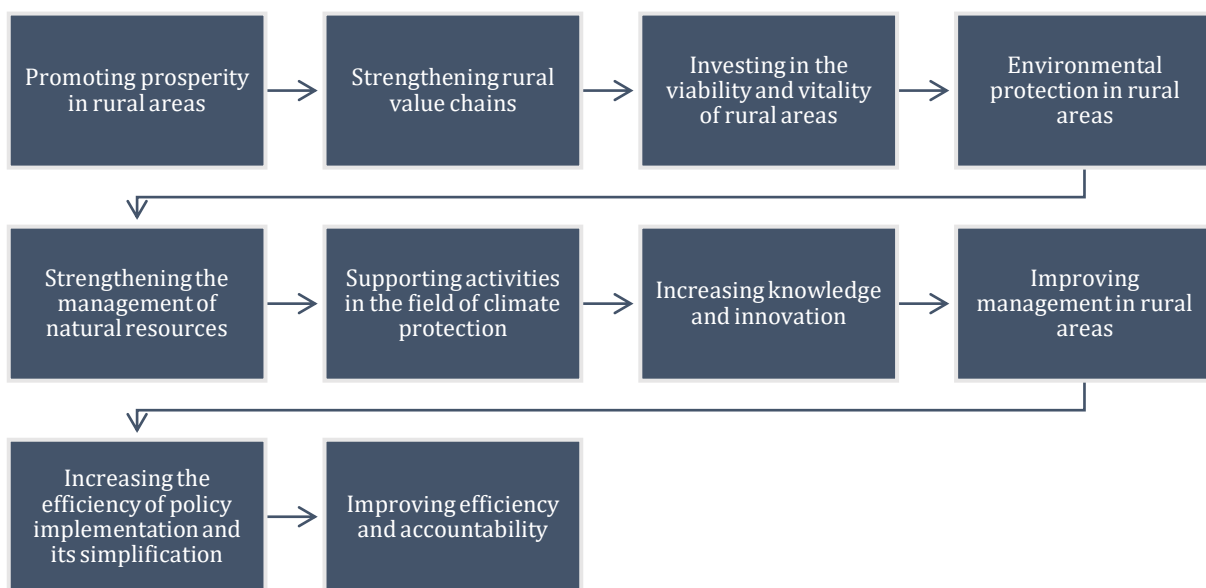


Fig. 1. Strategic directions of the rural areas policy using their potential

Source: Own study based on the Cork 2.0 Declaration (2016)

According to the document of the European Commission (2017), “Smart villages are rural areas and communities that build on their existing strengths and assets, as well as new opportunities to develop added value, and where traditional and new networks are enhanced by means of digital communications technologies, innovations, and better use of knowledge for the benefit of inhabitants”. Therefore, the concept proposes no single solution, but is based on the needs and potential of each territory, the desires of the community, and cultural environments. Ultimately, the initiators of changes are members of the local community cooperating with local authorities. Smart Villages can therefore be understood as communities that do not want to wait for changes, but want to take initiative. The innovativeness of Smart Villages involves among others changing and shaping attitudes – from reactive (surrendering to events, lack of commitment) to proactive (setting and achieving goals). The concept of Smart Villages is based on solutions tailored to the needs and potential of a given territory. It includes

technological investment in infrastructure, business development, human capital, possibility and community building, good governance, and citizen engagement. The implemented intelligent solutions may refer to several issues (Fig. 2).

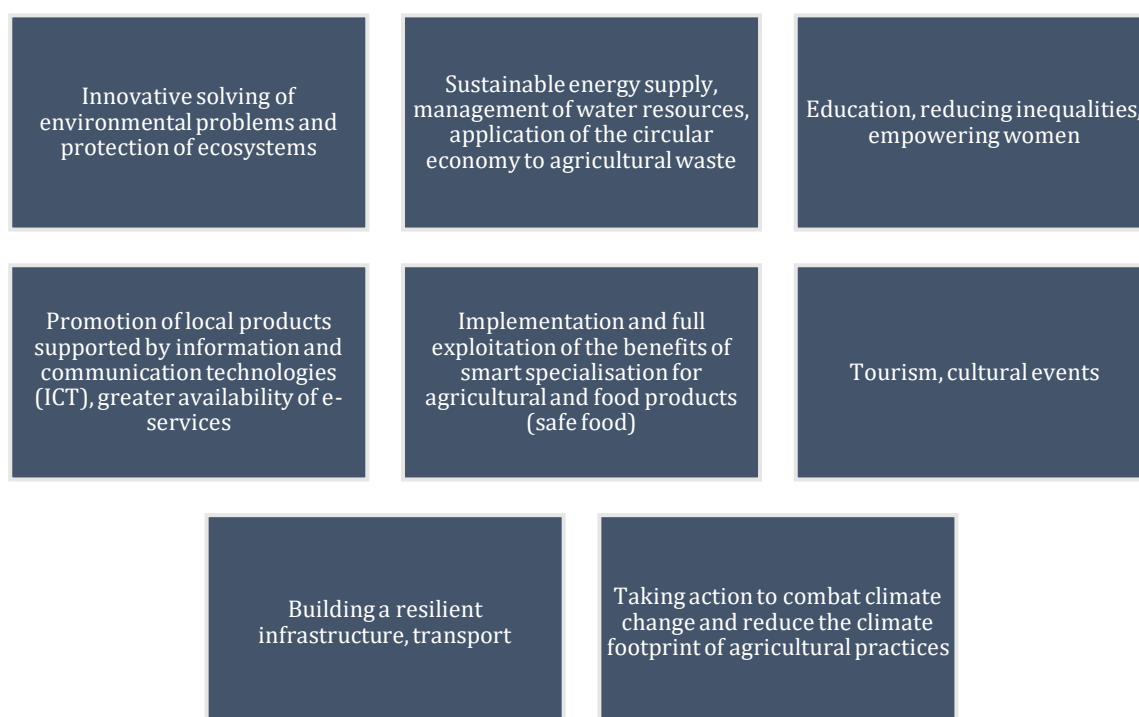


Fig. 2. Scope of smart solutions in rural areas

Source: Own study

The Smart Villages concept therefore covers three main areas of intelligent solutions, and examples of areas of activities within them (Table 1).

Table. 1. Fields of smart solutions and selected areas of their actions

		Fields of smart solutions		
		Public services	Public management	Entrepreneurship
Example areas of intervention	energy (RES)		e-administration	precision farming
	security (video surveillance)		waste management (container filling sensors)	online trading (local products)
	remote education		spatial planning	rural tourism (based on smart solutions)
	public transport		environmental quality monitoring (air quality sensors)	sharing equipment (specialised equipment)
	e-health		meetings and online consultations with locals	countryside incubators

Source: Own elaboration based on Inteligentna wieś, 2019

The article aims at the determination of the possibility of using data obtained from public registers for the needs of Smart Villages solutions. The research was carried out in the Mazowieckie Voivodeship in Poland. Selected solutions for rural development in the Smart Villages approach were indicated. The structure of farms, registration plots, and land use were determined. Areas requiring remedial processes such as agricultural land consolidation were marked. Data necessary to implement measures in rural areas were identified, and the possibilities of obtaining them from public registers were indicated. The data is necessary to diagnose the current state and determine further actions, including analyses aimed at taking measures for the sustainable development of rural areas. It was assumed that their acquisition would reduce costs and shorten the time needed to implement selected solutions within Smart Villages.

### **Selected public systems and registers**

The introduction of solutions related to the implementation of the concept of Smart Villages is closely associated with the acquisition of data on rural areas, collected at various levels of government and local government administration and in numerous databases and public registers. Below is a brief description of selected systems that in the author's opinion are essential for the discussed topic.

**Real estate cadastre** – an information system maintained for the entire country by starosts, ensuring the collection, updates, and sharing, uniformly for the country, information on land, buildings, and premises, their owners, and other entities that own or manage such land, buildings, or premises (Act, 1989).

The real estate cadastre includes information regarding:

- land – its location, boundaries, areas, types of land use and their valuation classes, designation of land and mortgage registers, or collections of documents, if they were established for the property that includes land;
- buildings – their location, purpose, utility functions, and general technical data;
- premises – their location, utility functions, and usable space (Act, 1989).

**Soil science classification of land** – dividing soils into valuation classes according to their production quality, determined based on soil genetic characteristics, conducted by starosts (Act, 1989).

**Cadastral map** – data from the land and building register database are visualised in the form of a cadastral map with the following content:

- boundaries and numbers of registration plots;
- border points;
- contours of buildings with an indication of the type of building or their blocks, if any, as well as the numbers of the top storeys of structures or their unions, or the lowest storeys of underground buildings or their blocks marked with a negative number;
- contours of land use and their markings;
- classification contours and their designations;
- boundaries of the units of the primary three-tier territorial division of the state and registration precincts, along with their markings, occurring in the area of the map;

- other elements that do not conflict with the registration data but improve the legibility of the content of the map;
- names of streets and squares and the corresponding order numbers, as well as names of watercourses, water reservoirs, and other physiographic objects;
- graphic symbols of a square grid, at least two of which, visible in the map area, should be described with coordinates (Regulation, 2021).

**Basic map** – large-scale cartographic study prepared for the entire country by starosts, containing information on the spatial location of geodetic control points, cadastral plots, buildings, land contours, classification contours, network of utilities, structures, construction devices, and other topographic objects, as well as selected descriptive information about these objects (Act, 1989).

**Geoportal** (<https://www.geoportal.gov.pl/>) – a website run by the Head Office of Geodesy and Cartography serving as the central node for the Spatial Information Infrastructure, and mediating access to spatial data and related services. The geoportal provides access to data from the following databases:

- topographic map – cartographic elaboration at scales from 1:10 000 to 1:100 000 with general geographic content, with particular emphasis on topographic objects;
- state register of borders – an official reference database that uses data on the territorial divisions of the country;
- state register of geographical names – official reference database using data on geographical names;
- state register of basic geodetic, gravimetric, and magnetic networks – contains information, data (including archival ones), as well as collections of observations and studies of observation results concerning points of the basic geodetic, gravimetric, and magnetic network for the area;
- general geographic object database – a vector (object) database containing the spatial location of the most important topographic objects along with their basic descriptive characteristics;
- orthophotomap – a raster image of the terrain surface, created as a result of processing of aerial or satellite images;
- numerical terrain model – a point representation of the height of the terrain, along with an interpolation algorithm that allows for calculating height at any point in the area for which the model was built;
- numerical model of land cover – representation of land surface along with objects protruding above such surface such as: buildings, trees, bridges, viaducts, and other infrastructure elements;
- LIDAR (Light Detection and Ranging) – measurement data from ALS (Airborne Laser Scanning) – representation of the terrain in the form of a cloud of measurement points with specific XYZ coordinates;
- database of topographic objects – a vector database containing the spatial location of topographic objects along with their basic descriptive characteristics; the content

and detail of the BDOT10k database generally corresponds to a traditional 1:10 000 scale topographic map;

- real estate cadastre;
- land utilities databases – information on the existing and planned land utilities, cables, and related devices;
- BDOT500 – topographic objects collected in databases, together with among others the objects of land and building records, as well as with utilities objects, constituting the content of the basic map;
- database of detailed geodetic control networks – contains information on the points of detailed horizontal and altitude geodetic control networks;
- other databases, not included in the National Geodetic Resource – presented in the form of WMS services.

**Land and mortgage registers** – kept to establish the legal status of real estate. Keeping land and mortgage registers is within the competence of district courts. The land and mortgage register contains the following four sections:

- the first one includes the designation of real estate and entries of rights related to its ownership;
- the second one includes entries on ownership and perpetual usufruct;
- the third one is intended for entries on limited property rights, except for mortgages, entries of restrictions on the disposal of real estate or perpetual usufruct, and entries of other rights and claims, except for claims related to mortgages;
- the fourth one is intended for mortgage entries (Act, 1982a).

**Central Statistical Office (CSO)** (<https://stat.gov.pl/>) – Portal of Public Statistics, containing among others information on the results of the National Census of Population and Housing, Agricultural Census, and results of other statistical surveys.

The scope of the National Census of Population and Housing includes the following information:

- natural persons permanently residing and temporarily staying in apartments, buildings, and other inhabited premises that are not apartments in Poland;
- natural persons not constituting residents;
- apartments, buildings, collective accommodation establishments, and other inhabited non-dwellings.

**General agricultural census** – includes all farms of natural persons (individual farms), and legal persons, as well as organizational units without legal personality, and covers the following topics: land use, sown area, farm animals, fertilization, plant protection, farm buildings, tractors, agricultural machinery and equipment, economic activity, structure of household income with the user of an individual farm, economic activity, fish farming, and breeding.

**List of beneficiaries of the common agricultural policy** (<http://beneficjenciwpr.minrol.gov.pl/>) – contains data on the beneficiaries of the Common Agricultural Policy 9 and all undertakings related to the agricultural sector

undertaken by the European Union to fulfil the provisions of the Treaty on the Functioning of the European Union, and information on received payments.

## Materials and methods

The following materials were used in the study:

- Cadastre – data on the number of registration plots, area of cadastral precincts in the voivodship (source: district collective statements from 2021);
- Database of land and building records – vector layer of the plot (source: Poviats Geodetic and Cartographic Documentation Centres and <https://www.geoportal.gov.pl/rejstry>);
- State Register of Borders (source: <http://www.gugik.gov.pl/pzgif/dane-bez-oplat/dane-z-panstwowego-rereses-granic-i-powierzchni-jednostek-podzialow-terytorialnych-kraju-prg>);
- Statistical data from CSO (2010; 2020) (source: Local Data Bank).

The research was employed the following methods: literature review, observation methods, spatial and multi-criteria analyses.

The determination of the needs of land consolidation in communes of the Mazowieckie Voivodship employed qualitative and quantitative assessment. The qualitative assessment included the determination of factors and parameters influencing the needs of land consolidation. The quantitative assessment involved quantifying parameters characterising the factors and determining the amount of the land consolidation needs index. The study used the basic and advanced functionalities of ESRI's ArcGIS Desktop software package, allowing for the collection, analysis, and processing of spatial data.

## Study area

The Mazowieckie voivodship, selected as the study area (Fig. 3), is a significant food producer. The sown area in the Mazowieckie Voivodship covers 11.8% of the total sown area in the country. Livestock production accounts for 18.5% of the national production for cattle, 13.4% for pigs, and 21.6% for poultry, respectively (CSO, 2021). Out of the total number of farms, 62% are farms with only plant production, and 37.5% are farms with plant and animal production (CSO, 2021). Agriculture in Mazowieckie is particularly characterised by a high share in the national production of fruit and vegetables (18% of the total vegetable production in the country), fodder crops, potatoes, milk, meat, and eggs (CSO, 2021). Territorial specialisation is observed in agricultural production. The southwest and central part of the voivodeship are areas with dynamically developing vegetable and orchard production, the northwest part specialises in poultry production, and the north-eastern part – dairy production (Sulmicka, 2013; CSO, 2017;2019).

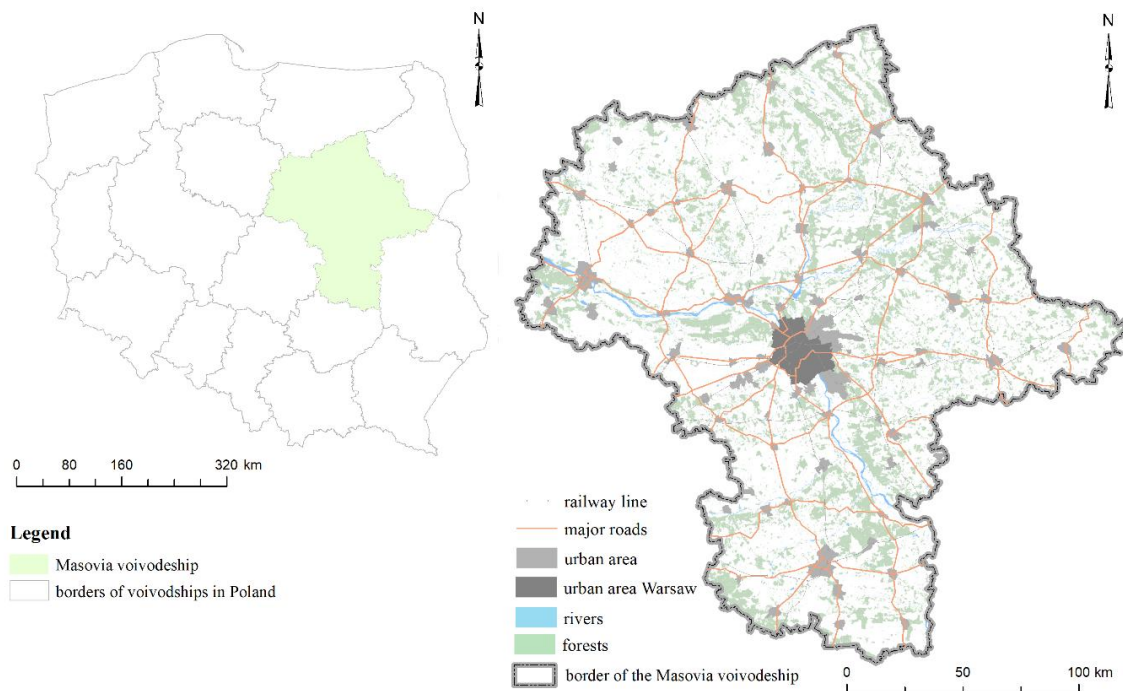


Fig. 3. Location of the study area

Source: Own study based on the Database of Topographic Objects and the State Register of Borders

According to the preliminary results of the General Agricultural Census in 2020 (CSO, 2021), the total number of farms in the Mazowieckie Voivodeship was 208 thousand. In comparison to the General Agricultural Census in 2010, it decreased by 21 thousand, i.e. by 9.1%. Individual farms dominating agriculture (207 thousand) accounted for 99.6% of all farms. The average area of agricultural land per 1 farm in the Mazowieckie Voivodeship in 2020 was 9.4 ha (with the national average of 11.1 ha). It is worth emphasising that the environmental potential of some communes designated as so-called Masovian granary regions is used to a low degree (no developed cultural factors), indicating areas of production reserves. Due to the high disproportion in intra-regional development, difficult situations in rural areas are particularly severe in the Mazowieckie Voivodeship. Paradoxically, traditional agriculture, until recently considered obsolete, is now becoming modern, and its products are more and more socially desirable, although its further development requires a new approach (Sulmicka, 2013). Improving the profitability of agriculture in Mazowieckie is crucial for its further development. Actions to strengthen such improvements include giving farmers better access to markets to ensure they get a more significant share of the prices of the sold goods. Another chance to increase farmers' income is by developing the local agri-food industry (Sadowski et al., 2015).



## Results and discussion

In the analysis of potential actions under Smart Villages (presented in Table 1), spatial planning was selected as a public management measure for the Mazowieckie voivodship. Due to the diversity of rural areas in the voivodship, and the need for their transformation, the land consolidation process was indicated as an example tool implementing the provisions of planning documents. In the example of this process, requiring a detailed and comprehensive approach and offering the possibility of introducing individual design solutions adapted to the area, the necessary data from systems and public registers were identified, and the chances of obtaining them were indicated. The conducted multi-criteria analyses considering the spatial structure of plots and farms show that 86 of the communes in the Mazowieckie Voivodship require land consolidation and improvement of the ownership structure of registration plots (Fig. 4). The total area of these communes is 665 216 ha, or 19% of the area of the Mazowieckie Voivodeship.

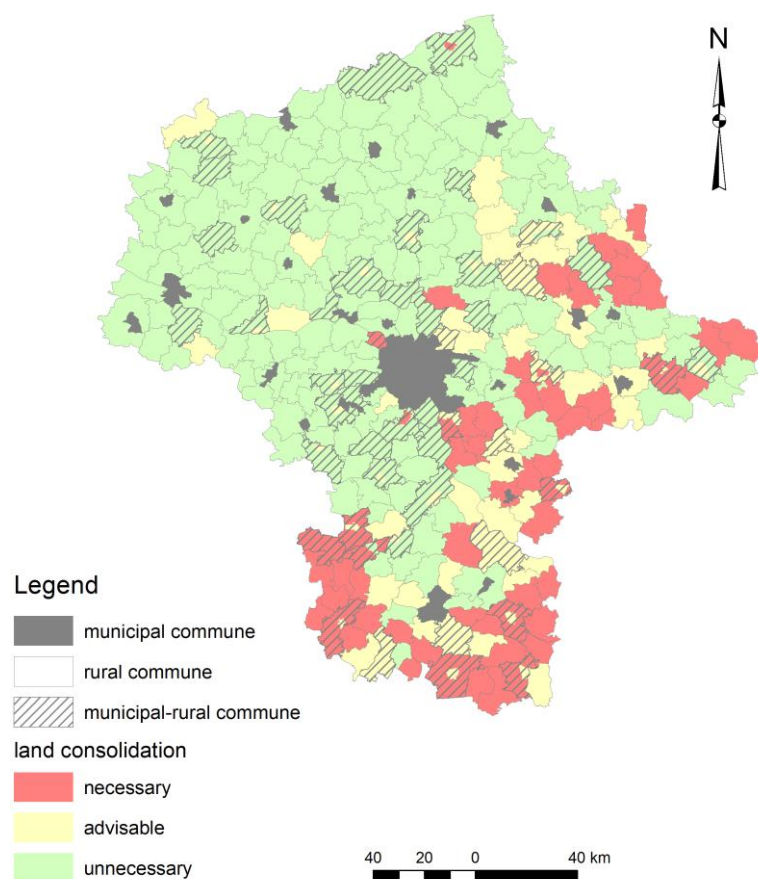


Fig. 4. Need for land consolidation in the Mazowieckie Voivodship  
Source: Own study

Selected actions under Smart Villages, i.e. spatial planning, and an example implementation tool of the activities mentioned above, i.e. land consolidation, are presented in Fig. 5. Land consolidation aims at creating more favourable management conditions in agriculture and forestry by improving the area structure of farms, forests, and forest land, rational shaping of land layouts, and adjusting real estate boundaries to the system of water melioration devices, roads, and topography. At the same time, the land consolidation project should consider the provisions of the local spatial development plan (Act, 1982b; Bielska, 2016). Land consolidation is a tool for achieving the goals of multifunctional rural development (Sobolewska-Mikulska & Stańczuk-Gałwiaczek, 2018). The conducted consolidation proceedings resulted in the improvement of the development opportunities of rural areas in Poland (Siuta, Żukowski, 2018; Krupowicz et al., 2020). The analysed activity is part of the intelligent field of public management.

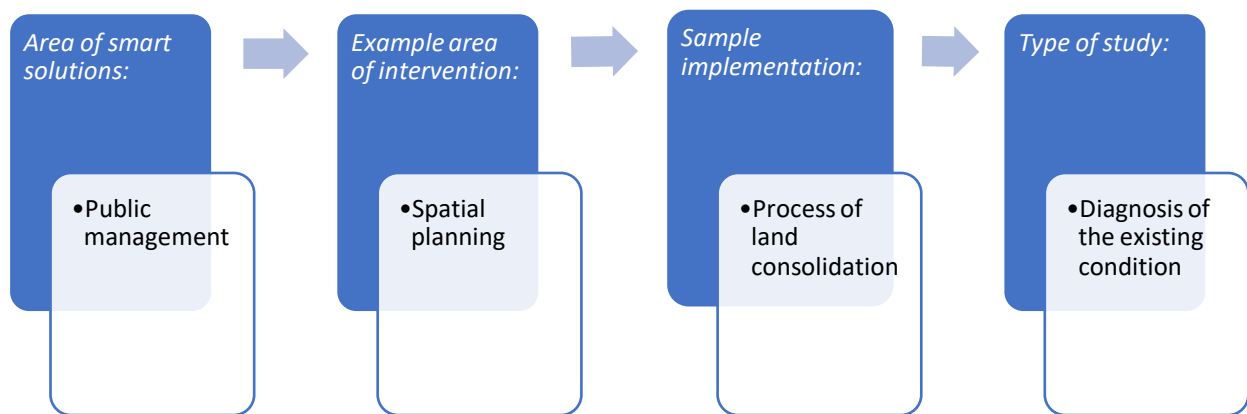


Fig. 5. Diagram showing the selected measure and its implementation

Source: Own study

The first stage of the land consolidation process should involve a diagnosis of the existing condition through the preparation of several thematic studies, including those in the field of planning conditions, socio-economic conditions, conditions of the natural environment, structure of land use and management, infrastructure, and directions of agricultural production. The aforementioned research requires obtaining up-to-date and complete data from reliable sources. Table 2 presents the summary of critical data essential to develop a diagnosis of the existing condition as part of the land consolidation process, along with determining their availability in public registers.

Table 2. Summary of data necessary to develop a diagnosis of the existing state as part of the land consolidation process with the determination of their availability in public registers

Diagnosis of the existing condition - main thematic studies	Necessary data	Public register	Link to the website or place where the data was collected
General characteristics of the object with the analysis of planning acts	Location – geographical and administrative with a graphic presentation related to the commune and powiat	Database of Topographic Objects	<a href="https://www.geoportal.gov.pl">https://www.geoportal.gov.pl</a>
	Local spatial development plans / study	Spatial development – planning studies	<a href="https://www.geoportal.gov.pl">https://www.geoportal.gov.pl</a>
Socio-economic conditions	Basic statistical data on demography	Central Statistical Office – Local Data Bank	<a href="https://stat.gov.pl/">https://stat.gov.pl/</a>
Conditions of the natural environment	Land relief	Digital terrain model	<a href="https://www.geoportal.gov.pl">https://www.geoportal.gov.pl</a>
	Geological data	Detailed Geological Map of Poland, scale 1: 50 000	<a href="https://www.pgi.gov.pl/oferta-inst/wydawnictwa/atlas-y-i-mapy/geologiczne.html">https://www.pgi.gov.pl/oferta-inst/wydawnictwa/atlas-y-i-mapy/geologiczne.html</a>
	Protected areas	Forms of nature protection	<a href="https://geoserwis.gdos.gov.pl/mapy/">https://geoserwis.gdos.gov.pl/mapy/</a>
	Environmental resources	Data bank on natural resources	<a href="https://geoserwis.gdos.gov.pl/mapy/">https://geoserwis.gdos.gov.pl/mapy/</a>
	Data on water resources	State Water Holding – Polish Waters	<a href="https://www.geoportal.gov.pl">https://www.geoportal.gov.pl</a>
	Complexes of agricultural usefulness of soils	Soil and agricultural map	Voivodeship or Powiat Geodetic and Cartographic Documentation Center (PODGIK)
Land use structure	Type of land use	Real estate cadastre	<a href="https://www.geoportal.gov.pl">https://www.geoportal.gov.pl</a> lub PODGIK
	Soil quality class	Real estate cadastre	<a href="https://www.geoportal.gov.pl">https://www.geoportal.gov.pl</a> lub PODGIK
Land governance structure	Land owner (Registration groups)	Real estate cadastre	PODGIK
	Area of private farms	Real estate cadastre	PODGIK
	Number of farms	Real estate cadastre	PODGIK
	Number of registration plots on the farm	Real estate cadastre	PODGIK
	Legal status of the property	Real estate cadastre	<a href="https://ekw.ms.gov.pl/eukw_ogol/menu.do">https://ekw.ms.gov.pl/eukw_ogol/menu.do</a>
Infrastructure	Data on public roads	Basic map	<a href="https://www.geoportal.gov.pl">https://www.geoportal.gov.pl</a> lub PODGIK
	Condition and needs in the field of basic water melioration	State Water Holding – Polish Waters	<a href="https://www.geoportal.gov.pl">https://www.geoportal.gov.pl</a>
	State and needs in the field of specific water drainage	State Water Holding – Polish Waters	<a href="https://www.geoportal.gov.pl">https://www.geoportal.gov.pl</a>
	Technical infrastructure – water, gas, sewage	Basic map	<a href="https://www.geoportal.gov.pl">https://www.geoportal.gov.pl</a> or PODGIK
Agricultural production directions	Type and quantity of agricultural production	General Agricultural Census	<a href="https://stat.gov.pl/">https://stat.gov.pl/</a> or a commune competent for the place

Source: Own study

As evidenced above, several critical data for analysis can often be downloaded from a single source. Data integration in a single public system would undoubtedly be a good solution for streamlining several activities within the scope of intelligent actions. Such activities are undertaken, but at a smaller scale, i.e. within the competence of the authorities responsible for given systems. A single system integrating all data within intelligent solutions is a serious challenge, not only for technological, but also for administrative reasons. The above may also constitute a risk in terms of the reliability and protection of this data.

## Conclusion

The analysis involved indication of the primary data and presentation of registers in which such data are collected, together with relevant links or access places. They allow for effective and quick access to information regarding the study area. Without immediate access to up-to-date information, studies on the concept of Smart Villages would be impossible to implement. The development of a diagnosis within various fields and areas of intelligent intervention, i.e. spatial planning and process of land consolidation, is an activity that can be considered universal in obtaining data. It should however be emphasised that the specificity of regions at this stage of their development may result in the demand for information of a different qualitative and quantitative nature. The development of a diagnosis requires obtaining a lot of data on various phenomena and factors, and making them available through multiple public registers. The summary presented in the article is an excellent example of the fact that knowledge about the possibility of obtaining data can reduce the costs and time of the implemented activity, and increase its impact and the scope of solutions.

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