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# Smart and Age-Friendly Communities in Poland. An Analysis of Institutional and Individual Conditions for a New Concept of Smart Development of Ageing Communities

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Received: 18 March 2020; Accepted: 30 April 2020; Published: 4 May 2020



**Abstract:** In the face of the dynamic ageing of local communities, smart cities and smart villages programs should seek to ensure meeting the needs of the elderly and promoting solutions tailored to their computer literacy, digital skills, and perception capabilities. In this context we propose to approach local smart and age-friendly communities initiatives in a way that would provide responses to two contemporary megatrends: digitalization and demographic transition. We assumed that the deployment of such initiatives in local planning and governance depends on at least two conditions: demand for smart everyday products and services represented by older adults and the perspective of the local decision-makers. The paper aims to examine whether the smart city/smart village idea focused on meeting the needs of the elderly and seeking to shape age-friendly local communities and the environment could be implemented in the municipalities in Poland. The analysis of the elderly Poles' capabilities to absorb the ICT solutions demonstrated that the smart and age-friendly community approach may face implementation difficulties, especially in the oldest groups of the Polish rural population. Results of the quantitative study conducted in 1236 municipalities revealed that local authorities perceive local policy goals, such as pursuing smart and age-friendly development as low priority ones. A citizen-centered approach of village heads and mayors to the local policy is critical for integrating these two priorities of being smart and age-friendly.

**Keywords:** smart city; smart village; ageing; age-friendly community

## 1. Introduction

The EU Member States are facing a serious demographic challenge, i.e., their population is ageing. In principle, the problem tackles most European regions. In accordance with forecasts presented by the Eurostat, by 2050 the share of people aged over 65 in the total EU population will grow from 17% to 30%, while the share of population aged below 24 will drop from 30% to 23%. The current demographic situation of Poland is quite good, however, it exhibits unfavorable tendencies. Indicators such as the median age, the share of people aged 65+ in the total population, as well as the age dependency ratio have substantially deteriorated in recent years. In addition, the ageing process advances which can be seen in the growing share of very old people, aged 85+ (2.0% in 2018 compared to 1.2% in 2009; with the EU-28 average—2.7%).

Population ageing is more apparent in rural European regions [1]. Remarkably, Poland—together with Slovakia and Belgium—belongs to a rather small group of the EU Member States with a higher

than average proportion of older adults living in predominantly urban regions and in Poland this indicator is the highest (over 110 in 2018). In most countries a higher proportion can be found in predominantly rural regions (in Spain this indicator exceeds 140) [2]. In Poland in 2018 people aged 65+ accounted for 19.2% of urban and 15.1% of rural populations. This proportion is expected to be maintained. That does not mean, however, that Polish villages will not suffer from population ageing. According to the estimates, by 2030 people aged 65+ will account for 20.4% of the rural population (with their share in cities being 25.3%) while in 2050 their share is to increase to 30.2% in villages and 34.7% in cities.

In the Declaration on Policies for Building Better Futures for Regions, Cities and Rural Areas of 2019 the OECD countries considered ageing one of the megatrends inflicting deep changes on regions [3]. Population ageing surely impacts the quality of life in local communities (urban and rural alike) and dictates the directions of economic and social policy transformations at national, regional, and local levels. A Thematic Group on Smart Villages of the European Network for Rural Development argues that many rural areas in the EU (in particular in countries of Eastern and Southern Europe or in scarcely populated Nordic and Baltic states [4]) are trapped in a perpetuating ‘vicious circle of decline’ created by two mutually reinforcing tendencies: firstly, the lack of jobs and sustainable business; secondly, the insufficient and shrinking scope of services [5]. The outflow of people from villages and ageing are amongst the major factors deepening the process. Similar reflections of demographic, social and economic decline can be observed in degraded central areas of European cities, especially in Central and Eastern Europe, including Poland [6].

Ageing of population in municipalities is seen as a driver for the development of programs for smart and inclusive sustainable local development [5]. Solutions should be planned in an integrated way and their underpinning assumptions need to reveal demographic challenges and opportunities offered by technological revolution [7]. In policy making, smart city means very different things to different cities and varies across local economic, geographic, demographic and technological settings [8,9]. For many scholars [10,11], smart cities are largely about integrating high-tech information technologies to arrive at intelligent solutions and achieve a better quality of life. Several comprehensive literature reviews converge on an understanding that the smart city concept is multi-faceted, complex, confusing, ambiguous, contingent, fragmented, and lacks cohesion [12]. “Interest in smart cities is motivated by major challenges, including climate change, economic restructuring, retail and entertainment services moving online, ageing populations, and pressures on public finances” [13]. Its implementation should lead to the effective use of available resources, especially technical and technological, improvement of the quality of life in the city and ensuring its sustainable development [14]. The idea behind the concept is to strive to increase innovation and flexibility of the urban economy and to respond quickly to local and global challenges. A smart city is also an inclusive city with educated citizens, a city that employs new channels of communication between the local administration and the inhabitants [15]. Besides a widely propagated smart city concept, the European Commission realizes the earlier described problems relating to the ageing of rural communities and depopulation of villages. In response to them, the idea of smart villages is promoted, which, to some extent, is an analogy to the concept of the smart city. In the European Union, the concept of smart villages arises with reference to cohesion and strengthening of the rural development, while in the US intelligent rural development is related to the spatial planning and relies on actions which suppress the spontaneous growth of cities (urban sprawl) [16].

In this context the following questions are important:

- What are possible common platforms between the concepts of smart city/village and age-friendly city? Is there any theoretical framework for the integration of the two above mentioned concepts?
- Does current research indicate effective smart solutions that create environments for active ageing and respond to the limitations and needs of older people?
- What barriers do older adults face in using smart city solutions?

Our literature review concentrates on the abovementioned issues, which outline the scope of the conducted empirical analysis.

The main aim of this paper is to examine whether the smart city/village concept, expected to meet the needs of the elderly population and, ultimately, shape local age-friendly communities/environments, could be implemented in Polish municipalities. When studying the conditions conducive to the development of smart and age-friendly communities in Poland we adopted two perspectives: a demand and a supply one. Demand for solutions built around the smart city/village framework is to a large extent conditioned by the skills (capabilities) of the recipients of new, technologically advanced products and services. This is why one of the elements in our analysis focuses on the assessment of the capacity of older Poles to absorb ICT-based solutions. We have assumed that the absorption capacity of older adults will inform us about the demand for products and services offered by smart and age-friendly cities and villages. On the other hand, the development of local smart and age-friendly environments connects with the perception of demographic and technological challenges by local authorities. By drafting their programs and strategies, as well as by delivering tasks entrusted to them (in particular, in the area of public services) they indirectly impact the supply on the silver and smart local markets.

The paper is structured as follows: Section 2 reviews literature on the smart city and village concept and its focus on the needs of the elderly population. We also propose in it a theoretical approach to a smart and age-friendly community. Section 3 discusses fundamental methodological issues connected with research assumptions, data sources and methods of statistical analysis deployed in this paper. Next, we present the results concerning the absorption capacity of older adults in Poland broken down into cities and villages (Section 4.1) and the results of questionnaire studies conducted among local authorities in Poland and devoted to their perception of demographic and technological challenges and the building of smart cities and villages (Section 4.2, Section 4.3, Section 4.4). Presented results are discussed in Section 5. The paper closes with conclusions.

## **2. Smart City/Village Concept as a Response to Challenges of the Ageing Society: Costs and Benefits**

The current dominance of supply-driven smart city solutions often results in smart city strategies that are disconnected from their social context and fail to tackle a city's problems in a cohesive way. Such an approach often leads to a situation where smart urban technologies are designed and implemented disregarding end-user opinions, which produces fears and frustration among people expected to use these solutions [17]. Urban technologies may even turn into barriers to older adults' active participation in everyday life, especially when such technologies fail to match their needs and capabilities. Vending and other machines needed by citizens to enjoy public services can be an example or limited options to pay with cash on public transport, or visual accessibility associated with small print (signage) [18]. Issues with adoption and acceptance may be expected, since some older adults are slower to adopt and use new technologies compared to younger people [19]. Creating a smart city may incur some social cost, such as exclusion caused by the inability to participate in the advanced smart city services because of digital illiteracy [20].

Studies on the multi-dimensional nature of Old Age Social Exclusion [21] demonstrate that digital exclusion is a dominant form of exclusion. For that reason, elderly people are seen as a 'digital underclass' [22]. These results remain in agreement with earlier studies that revealed a generally low involvement of the elderly population with the digital world and their specific needs as users of ICT technologies [23,24]. Significant and growing relevance of the absence of interest as a reason for not using the ICT technologies by older adults in Sweden and the United Kingdom was also evidenced [22]. Interestingly, this observation relates, among others, to people who lost interest in ICT after they have retired although they were using these technological solutions in the workplace context. Based on the above-mentioned findings we have concluded that smart solutions offered by cities or villages can be embraced by older adults if they were designed to match psycho-physical, perceptive or cognitive capabilities of this group of users. Besides access to adequate technologies, when developing a smart

and age-friendly city one must consider other important aspects, such as: education, promotion, digital training courses, and social integration [25].

On the other hand, we need to stress that the most successful smart cities have opted for a demand-driven rather than a supply-driven approach, or at least have sought to balance the two approaches [26]. The success of smart city projects and apps to a large extent depends on how much the citizens have approved and used them, on the support to the decision-making process expressed in user opinions, and on stimulating changes in user behavior. Therefore, residents are at the heart of designing smart city solutions. As the end users of such solutions, they must be able to reap unquestionable benefits in everyday life [20]. The integrated model of the smart city presented by Angelidou [27] on the basis of previous research, works towards the following assets:

1. Advancement of human capital: citizen empowerment (informed, educated, and participatory citizens), intellectual capital and knowledge creation.
2. Advancement of social capital: social sustainability and digital inclusion.
3. Behavioral change—sense of agency and meaning (i.e., the feeling that we are all owners and equally responsible for our city).
4. Humane approach: technology responsive to needs, skills and interests of users, respecting their diversity and individuality.

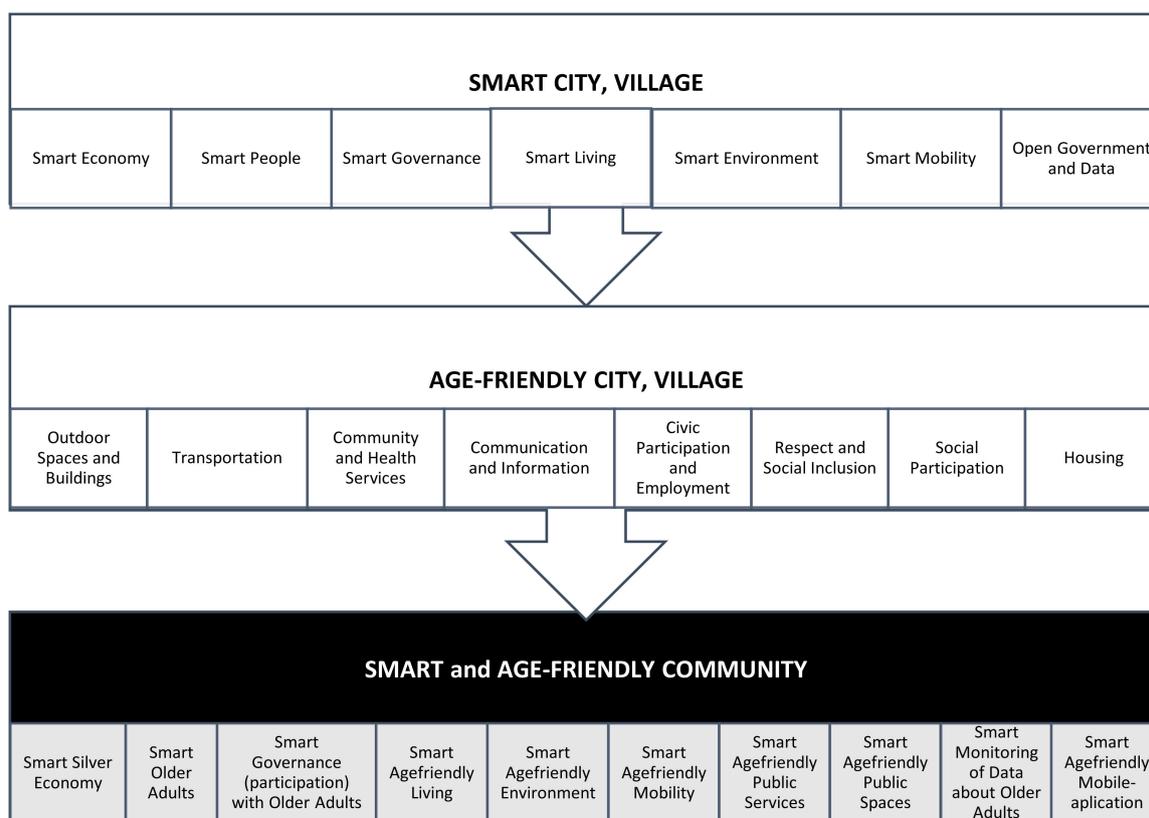
The above model is considered inclusive and we see it as a cornerstone of our research approach based on the synergy of smart city/village and age-friendly city/village assumptions. In addition, we assume that smart city research is scalable, and its findings can be extended to cover villages [28]. We strongly argue in favor of the demand-driven perspective and assume that technology should meet the needs and expectations of diverse generations focusing, however, on older adults for reasons pertaining to demographic transition. The effectiveness of such approach rests on absorption capabilities of older adults, the factor that we are seeking to estimate for the Polish context (see Section 4).

The wish to apply smart solutions to improve the quality of life of ageing societies resonates also in the OECD approach [29], which provides a synthetic list of challenges and opportunities emerging from demographic trends. It highlights, among others, that innovation and new technologies could be harnessed to maintain the autonomy of older people. Moreover, the integration of information and communication technologies could be pursued in various policy fields, in particular, in the health sector. Similarly, the WHO in the latest report on age-friendly cities stressed the role of technology in the elimination of physical and social barriers to older adults in cities [30]. In addition, the WHO advocates cooperation with transnational (urban) networks, such as smart cities networks, for which dealing with the issue of ageing may contribute to the successful accomplishment of priority objectives [31]. In its opinion on the Revitalization of rural areas through Smart Villages, the Committee of the Regions (CoR) recommended that the revival of rural areas should serve to address the long-term challenge of depopulation via actions to encourage and support sustainability, generation renewal, and the ability of rural areas to attract newcomers. The CoR also supports the provision of training for different population age brackets on how to use digital technologies and adapt the teaching to the target audience [32]. The potential of the Smart Villages Initiative as a means to support rural areas particularly affected by demographic problems is also stressed by the European Parliament [33].

The need to adapt smart cities to the context of ageing societies is also increasingly more often expressed by researchers [34–36]. Along these lines, H. Marston and J. van Hoof proposed a framework for a smart age-friendly eco-system, which has modified the assumptions of the age-friendly city idea by expanding it with, inter alia, technological solutions [18]. The heart of the system lies in the ‘age-friendly living environment’, connected with older adults’ place of residence. In addition, there are the ‘age-friendly physical space’ and the ‘Technology and associated ICTs’ spheres. V. Righi, S. Sayago and J. Blat [37] have drawn upon the lessons learned in the case studies in order to propose a different conceptualization of smart cities for older people that leverages on specific approaches along three main dimensions: technologies, agency and community. A literature review has brought us

to the conclusion that the idea to integrate the smart city/village concept with the age-friendly city framework was advocated by only a handful of authors, mainly as a response to the demographic ageing issue. Proposed theoretical approaches call for further analyses and more precise models. We have also identified a gap in studies on the integration of the two concepts. Researchers' attention focuses on either smart city/village projects or age-friendly cities or on digital skills of the elderly people. Studies completely ignore the institutional environment, in which this integrated smart and age-friendly community approach would be implemented.

Considering the above quoted guidelines formulated by global institutions and organizations, as well as research achievements in this area we also believe that an approach tapping the smart city/village and age-friendly city potentials (Figure 1) is feasible in real life. Conditions that must be fulfilled to implement it in Poland are validated in the next sections of the paper.



**Figure 1.** Smart and age-friendly community integrated approach.

Gerontechnology is the source of solutions available within smart city/village projects adapted to the needs of older adults. This interdisciplinary field is seeking to ensure full social participation and independent living to older adults through technological support. A comprehensive approach of gerontechnology to the needs of the elderly population is reflected in adequately designed products and services in five the following areas (i) health and self-esteem ('autonomy') (ii) housing and daily living, (iii) mobility and transport, (iv) communication and governance, and (v) work and leisure [38]. Innovations in areas such as remote sensors, embedded systems, robotics or wireless mobile networks provide building blocks for intelligent ambient systems that can support elderly people and allow them to stay in their home environment [39]. Furthermore, gerontechnology argues in favor of the modification of the external macro-environment (cities, districts, rural areas), in particular the improved accessibility of infrastructural establishments, buildings, transportation, and functional reconstruction of places where people live or stay also in the public space, to make them accessible and safe to older adults [37,40].

There are concrete examples of already existing smart urban solutions meeting the needs of older adults, which, if implemented in cities, could help overcome many mobility, visual and cognitive hurdles (Table 1). Actions in this area are also co-financed by the EU. For instance, the City4Age project financed under the Horizon 2020, which aims to facilitate new smart city technology solutions to maximize independence in older people, supports healthy ageing focusing particularly on those at risk of frailty and mild cognitive impairment [41].

**Table 1.** Smart city solutions targeting older adults.

Visual Problems	Hearings Problems	Cognitive Problems	Mobility Problems	Health Problems
Audible and vibrotactile signals for pedestrian augmented with systems able to tell people where they are	Systems which translate voice to text or which convert and reproduce sign language	Devices that can guide the elderly through their everyday tasks	Wandering detection technology	Home-based health monitoring
Accessible shopping for visually impaired people through mobile technologies: navigation system and a product recognition system	Emergency text messages	Rehabilitation systems and video games to enhance cognitive functions	Risk information system that improves safety at home and prevents threats	Emergency response systems
Assisted city apps adapted to blind users	Video interpreting services at public institutions	Automated assessment of the need for assistance in activities of daily living Simplified menus of city's Apps		Night vision cameras that monitor health condition

Source: own elaboration based on [39].

Literature analysis reveals the lack of knowledge about policy directions and instruments applied by local authorities, the principal initiators and executors of smart city/village projects designed to meet the needs of the elderly, and the ignorance as to the conditions ensuring effective implementation of such projects. Local authorities offer diverse solutions, projects and strategies for the transformation of cities [35,42], which are often developed and implemented in line with the citizen-centered governance approach [43]. The examination of such interventions does not include the assessment of their technological advancement and the ability of older adults to embrace them. Some researchers have made attempts to shift the current perspectives towards the increased use of technology and towards being more open to an understanding of policy makers in their engaging in adequate actions to make this environment as friendly as possible for all ages [35]. In the literature we can find opinions advocating the need to ensure the availability of specific information (such as feasible strategies of building smart and age-friendly cities, priorities of local authorities, and resources required for the implementation) which could provide more meaningful guidance for professional practice in smart and age-friendly communities. For the abovementioned reasons, our studies focus on the perception of three fundamental components of the approach to local development that we promote: smart city/village, age-friendly community, and citizen-centered governance style. They allow assessing the chances for successful implementation of integrated projects in Poland.

### 3. Materials and Methods

#### 3.1. Research Approach

In empirical part of this paper we try to identify conditions conducive to the implementation of smart and age-friendly development concept in Polish municipalities. Research efforts were designed to provide responses to the following research questions:

RQ1. What is the capacity of older adults in Poland to absorb ICT-based solutions decisive for stimulating demand for technological solutions that promote and facilitate living healthily and happily in cities and villages?

RQ2. What is the perception of demographic challenges among local authorities in Poland?

RQ3. What is the perception of technological challenges and the smart city/village as responses to demographic challenges among local authorities in Poland?

Finding answers to these questions called for comprehensive studies. An investigation into the demand side of the smart and age-friendly community (RQ1) approach that we propose in Section 2, was founded on the existing data on the elderly in Poland analyzed against the background of the same age group in other EU Member States and the potential of older adults examined for cities and villages in Poland. We assessed absorption capabilities of older adults based on their digital literacy, the use of computers and the Internet, etc. The analysis helped us in assessing national and local conditions necessary to put in place solutions underpinning the smart city and smart village/silver economy and age-friendly city concepts.

Demand-side analysis (RQ2–RQ3) required widely sketched field studies conducted among local authorities as local policy organizers. We have assumed that “the lack of appropriate governance arrangements for the majority of cities appears to constitute the most serious obstacle for their effective transformation into being smart” [44]. A smart city means, among other things, local authorities willing to consider the need to advance ICT implementation with a view to improve the engagement of citizens in decision-making processes, foster the effectiveness of public services—including the social ones—rendered to residents, achieve a transparent governance system and the implementation of political strategies remaining within the smart governance strand [45].

Nevertheless, few surveys have been undertaken to discover the role and motivation driving local authorities to promote smart cities. As observed by Pratama and Imawan [46] little effort has been made to examine how ready city government bureaucracies are to execute smart city policies. Perceived bureaucratic readiness for smart city initiatives is defined as civil servants’ beliefs, attitudes, and intentions regarding the extent to which smart city programs can be implemented in their jurisdiction. The authors assumed that one of important conditions for the implementation of smart city concept is strong political will of the city mayor as the political leader of the city government as well as managerial commitment from the upper echelons of the bureaucracy. With this assumption in mind, we decided to examine the opinions of village heads and mayors (and their representatives) on the feasibility of implementing smart city/village concept and growth strategy responding to the challenges of the ageing society. In addition, we use the demand-oriented approach to the shaping of local smart communities paying special attention to the inclusion of residents in designing innovative solutions. We assume that actors in the smart city ecosystem need to collaborate in a partnership to co-create value. Such collaboration is often initiated or catalyzed by local authorities and can involve regulating, convening key actors, offering subsidies, or partly financing [20]. For that reason we investigate the stance of local authorities in Poland vis-à-vis the involvement of inhabitants (including the ones who are excluded or threatened with exclusion) in municipal governance, seeing this approach as an important condition for the implementation of the integrated smart and age-friendly community concept that we advocate.

### 3.2. Data Collection

To compare absorption capabilities of older adults living in Polish cities and villages we used data of the Eurostat and of the Statistics Poland for 2019 as well as individual data from the Social Diagnosis (last edition of 2015). The analysis covers variables describing access to computers and the use of Internet by people aged 55+ residing in cities of different sizes and villages, as well as other indicators of the digitalization of older people (digital skills, internet usage in purchases, finance and e-government etc.).

An important part of our survey was devoted to the analysis of questionnaire results. The survey aims to elicit the perception of heads of villages and mayors (and their executive teams) about 11 possible policy/practice areas and interventions, that can tackle some of the main sustainability challenges facing Polish local communities [6]. Based on the literature review (Section 2) this paper investigates the perception of three practices that respond to the challenges of ageing, namely:

- Developing social policies that ensure the appropriate housing, health care, education, and cultural needs of vulnerable social groups (e.g., elderly, young, unemployed);
- Implementing the smart city/village concept;
- Responding to global trends (e.g., technological revolution).

The perceptions about the priority assigned to the 3 policy/practice areas and interventions were captured through a five-point Likert scale rating from: 1 = low priority, to 5 = high priority.

In the survey we are also looking for information about the attitude of heads of villages and mayors to the development and implementation of action strategy vis-à-vis demographic challenges and “silver economy”. The attitude is also captured through a five-point Likert scale.

Following this, we identify three groups of factors that can affect the prioritization of the above policy/practice areas and interventions and mayors’ tasks within municipalities; namely the (a) head of village/mayor’s approval for the citizen-centered governance style (b) type and affluence of municipality, and (c) variables describing a head of village/mayor.

The approval of heads of villages and mayors for the citizen-centered governance style was measured on a five-point Likert scale using two questions on their perception of active and direct involvement of local residents in making locally important decisions and the necessity to consider the needs and opinions of residents who are socially excluded or threatened with exclusion from local decision-making.

The type of municipality used in this study, reflects the current typology of municipalities in Poland: i.e., (a) cities with district status, (b) urban municipalities, (c) urban-rural municipalities and (d) rural municipalities. In 2019, in Poland there were 2478 municipalities, including 66 cities with district status (2.7% of all municipalities), 236 urban municipalities (9.5% of all municipalities), 638 urban-rural municipalities, which include within their administrative boundaries both city/town areas, as well as areas outside city limits (25.8% of all municipalities) and 1537 rural municipalities, which do not have any city/town areas within their administrative boundaries (62.0% of all municipalities). The invitations and requests to take part in the survey were sent out in 2017 to all municipalities. Altogether, 1236 municipalities participated (37.2% of the population of municipalities) in the research. The questionnaire was addressed to the executive bodies (i.e., mayors, heads of villages) and their deputies since they have the greatest influence on the shaping and implementation of local policies. In addition, we considered basic qualities of units covered by the study and their representatives (see Table 2).

**Table 2.** Sample structure by selected features (n = 1236).

<b>Respondents by:</b>		<b>%</b>
<i>Features of municipalities</i>		
Type of municipality	city with district status	3.4
	urban municipality	11.8
	urban-rural municipality	22.5
	rural municipality	62.5
Income (PLN mio)	below 50 mio	73.4
	50–100 mio	14.6
	100–500 mio	7.4
	500 mio or more	4.6
<i>Features of heads of villages and mayors</i>		
No. of terms of office	1	37.6
	2	23.5
	3	18.6
	over 3	20.3
Political party membership		18.8
Membership in a NGO		31.4
Professional experience in enterprises		30.1
Experience in running a business		15.0
Sex	Female	13.9
	Male	86.1
Age	below 35 years of age	2.8
	35–44 years	19.1
	45–54 years	29.1
	55–64 years	41.4
	65+	7.6
Level of education	Higher	91.5
	Lower than higher	8.5

### 3.3. Statistical Methods

The analysis of the results of questionnaire studies was conducted using statistical tests, which enable comparing the population and assessing relationships between variables. We used the chi-square test of independence (or, alternatively, Fisher's exact test) and the Mann–Whitney test. The power of effect was measured with Cramer's V coefficient or rho Spearman correlation coefficient. Basic descriptive statistics were also deployed.

In addition, logistic regression was used to identify factors important for the implementation of smart and age-friendly community approach in a municipality. The output variable was the dichotomous variable SAfA (Smart-Age-friendly Approach) based on the answers to two questions: (1) concerning the perception of implementing smart city/village concepts in the municipality (SMART variable = 1, when strategy relevance is assessed—on a scale from 1 to 5—as 4 or 5) and (2) assessments of the importance of the development of an action strategy vis-à-vis demographic challenges and the implementation of the 'silver economy' (AGE-FRIENDLY variable = 1, when the relevance of this action was assessed as very important or extremely important). It was assumed that a municipality represents a holistic approach to the implementation of smart city/village concept and responds to demographic challenges if variables SMART and AGE-FRIENDLY equal 1 (relevance of both approaches was assessed as high)—the output variable SAfA equals 1 (in the remaining cases 0 was attributed to it). The following were the explanatory variables: (1) citizen-centered governance style (2) qualities of the municipality: type and income (3) features of mayors: age, sex, education, political party membership, membership in a NGO, professional experience in the enterprise sector, experience in running a business, terms of office as a mayor.

Logistic regression equation was estimated using the maximum likelihood estimation method. The logistic regression models were considered correct if: (1) in the omnibus test of model coefficients  $p < \alpha$ , (2) Nagelkerke's pseudo  $R^2$  is relatively high, (3) counting determination measure is relatively high, in particular, the percentage of correct qualifications for  $y = 1$  is high. Due to the inclusion of qualitative variables, the Hosmer—Lemeshow test was omitted.

For all calculations, we adopt a standard level of significance ( $\alpha = 0.05$ ). The calculations are performed in PS IMAGO SPSS 4.0 (Version 4.0, Predictive Solutions, Krakow, Poland).

## 4. Results

### 4.1. Older Adults' Absorption Capabilities in the Field of ICT Solutions across Polish Cities and Villages

We need to stress that in Poland the population of people aged 60+ represents an important group of consumers of products and services also because it is constantly growing. On top of that, demographic forecasts suggest that the forthcoming decades will witness the intensification of the ageing process. It is expected that in 2060 all the major indicators of ageing will be above the EU average. In particular, the age dependency ratio is to increase two or three-fold; there will be ca. 90 people in the non-working age, including 67 aged 65+, per 100 people in the working age. Poland (together with Slovakia, Malta, and Cyprus) will belong to the group of countries with the highest increases in the age median—until 2050 the median will increase by at least 8 years. Considering low fertility rates (still below 1.5) and low migration balance (ca. 22k in 2018), it would be rather unreasonable to expect that these forecasts will be positively revised.

Hence, the question recurses to what extent the elderly population is ready to embrace smart solutions in everyday life. The aforesaid is closely linked with the degree of digitalization measured with a multiplicity of indices produced by public statistics in the area of digital society. They show that 87.2% of households in big cities in Poland have a computer (2019), while in smaller towns and in rural areas the percentage reaches 81.0–81.1%. Similarly, 90.0% of households have access to the Internet while in smaller towns and rural areas the coverage is ca. 85%, also the quality of access is better in larger cities. Regular computer use has been confirmed for 81.8% of big city residents, 73.3% of residents of towns compared to 66.0% in rural areas. In turn, 86.3% of big city dwellers and 79.7% of residents of towns use the Internet regularly compared to 71.4% of inhabitants of rural areas [47]. Data of the Social Diagnosis 2015 (Table 3) allow more detailed observations [48]. By referring to two fundamental indicators of digital society we can conclude that, in Poland, digitalization decreases in older age groups and in each age group it is lower for rural areas than for the urban ones. Moreover, differences between cities and villages intensify for older age ranges (Table 3).

**Table 3.** The use of computers and the Internet in Poland by age groups in cities and in rural areas (in %).

Place of Residence	Computer Use				Internet Use			
	≥54	55–64	65–74	75+	≥54	55–64	65–74	75+
cities of 500k residents and more	96.3	73.3	53.7	30.5	96.6	74.2	53.3	29.7
cities of 200–500k residents	93.5	62.3	42.5	11.9	93.5	63.0	41.4	11.9
cities of 100–200k residents	91.4	60.6	35.5	9.9	92.2	59.9	34.3	9.9
cities of 20–100k residents	87.5	51.3	29.2	10.7	87.7	50.4	27.3	11.0
towns below 20k residents	86.5	50.6	22.7	7.1	86.7	49.0	22.3	6.6
rural areas	77.9	26.2	9.9	2.1	78.2	25.6	9.5	1.6

The scale of digital exclusion for Poles aged 75+ is rather significant as it tackles ca. 70% of older adults living in big cities, more or less every tenth person aged 75+ living in towns with the population ranging between 20 and 500k, almost 90% of residents of the smallest towns and as many as ca. 98% of the rural population. This means that opportunities to develop smart and age-friendly solutions are—on the demand side—clearly greater in the biggest cities than in other areas. Notably, however,

in Poland people aged 75+ are usually taken care of by their family members and they can count on assistance also with regard to ICT solutions; with respect to that, rural population aged below 55 represents a high degree of digitalization (Table 3).

Assessing digitalization levels of older adults, attention should be drawn to other aspects, including a rather high degree of use of e-government services. In Poland in 2019 the percentage of individuals aged between 55 and 74 who used the Internet to interact with public authorities (last 12 months) reached 50%, being much below the indicator for Germany (87%), Austria, UK, and Finland (ca. 75%), but it was comparable with Ireland (56%) and Croatia (61%); the indicator was lower for all the remaining EU Member States. The percentage of individuals downloading official forms (last 12 months) reached 28% in 2019, while the percentage of individuals submitting completed forms (last 12 months) was 32%. Less impressive indicators are reported for digital skills. The percentage of individuals aged 55–74 who have above basic software skills is amongst the lowest in the EU and amounts to hardly 7% (compared to as much as 32–33% in the UK and Finland). Similar conclusions can be drawn for the percentage of individuals who have basic or above basic overall digital skills (in 2019, 16% compared to as much as even 64% in the Netherlands). Online shopping is used moderately by older adults in Poland but they make marginal use of financial services online [49].

#### 4.2. Perception of Smart City/Village Approach and the Development and Implementation of Strategy Addressing Demographic Challenges and Silver Economy

As we have stressed, the examination of how heads of villages and mayors perceive smart and age-friendly solutions could be carried out based on the findings of our own research (see Section 3.2). Respondents covered by this survey assessed three local policy/practice priorities and interventions relevant from the point of view of the problem at hand: social policy development, responding to global trends, inter alia, technological revolution and the implementation of smart city/village concepts. They answered on a scale from 1 to 5, where 1 meant an irrelevant approach and 5 indicated a very much relevant approach (Table 4).

**Table 4.** Perceptions about individual priority policy/practice areas and interventions by type of municipality.

Priority Policy/Practice Areas and Interventions	n	% of Respondents with Opinion from 1 to 5 (Type of Municipality = 100)					M	Me	SD	Min	Max	
		1	2	3	4	5						
Developing social policies that ensure the appropriate housing, health care, education, and cultural needs of vulnerable social groups (e.g., elderly, young, unemployed) (p = 0.015*; V = 0.071)	UM	131	0.0	1.5	6.1	32.1	60.3	4.51	5.00	0.684	2	5
	CDR	32	0.0	0.0	9.4	18.8	71.9	4.63	5.00	0.660	3	5
	URM	254	0.4	1.2	6.3	35.0	57.1	4.47	5.00	0.704	1	5
	RM	739	0.4	1.2	12.6	34.0	51.8	4.36	5.00	0.777	1	5
	Total	1156	0.3	1.2	10.4	33.6	54.5	4.41	5.00	0.751	1	5
Responding to global trends, e.g., technological revolution (p = 0.159; V = 0.060)	UM	131	6.1	15.3	39.7	34.4	4.6	3.16	3.00	0.951	1	5
	CDR	32	9.4	21.9	28.1	28.1	12.5	3.13	3.00	1.185	1	5
	URM	255	7.1	18.4	39.2	29.0	6.3	3.09	3.00	1.002	1	5
	RM	732	10.7	19.5	37.7	25.8	6.3	2.98	3.00	1.064	1	5
	Total	1150	9.3	18.9	38.0	27.6	6.3	3.03	3.00	1.043	1	5
Implementing smart cities/villages concepts in the municipality (p < 0.001*; V = 0.136)	CDR	131	6.1	15.3	39.7	34.4	4.6	3.27	3.00	1.006	1	5
	URM	31	9.4	21.9	28.1	28.1	12.5	3.68	4.00	1.137	1	5
	RM	254	7.1	18.4	39.2	29.0	6.3	3.02	3.00	1.055	1	5
	UM	723	10.7	19.5	37.7	25.8	6.3	2.72	3.00	1.097	1	5
	Total	1139	9.3	18.9	38.0	27.6	6.3	2.88	3.00	1.103	1	5

n—number of respondents, M—mean, Me—median, SD—standard deviation. p—probability in the Mann–Whitney test; \*—differences statistically significant ( $\alpha = 0.05$ ), V—V-Cramer coefficient; CDR—Cities with district rights, UM—Urban municipalities, URM—Urban-rural municipalities, RM—Rural municipalities.

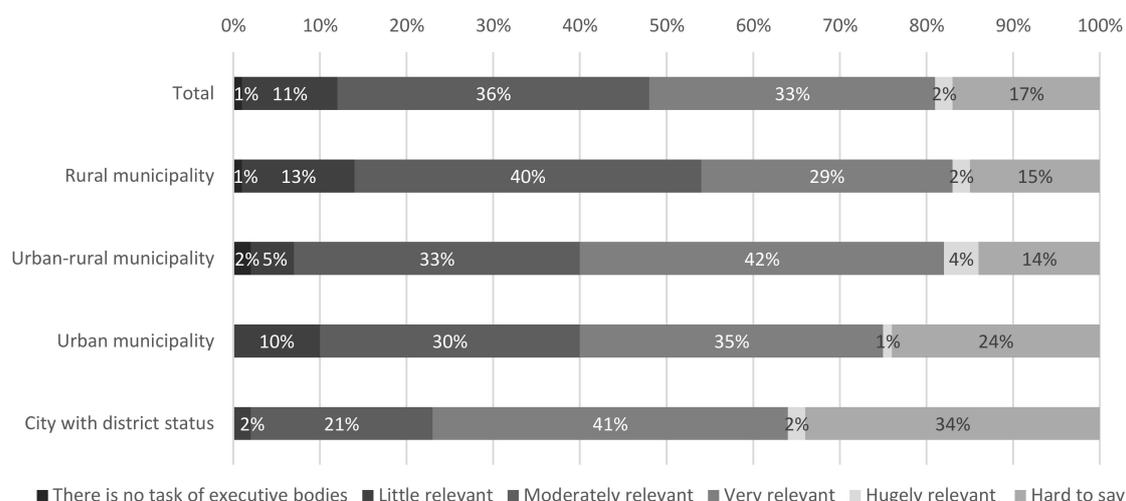
Average score given by respondents to the development of social policy reached the highest level (4.41 points), which may be interpreted as laying the foundations for the approach promoting the emergence of age-friendly municipalities. The more urbanized a municipality, the higher the score with the highest average score reported for cities with the district status (M = 4.63, as many as 72% respondents in this group decided it is an important strand in local policy).

Heads of villages saw the need to respond to global trends and technological revolution as clearly less relevant (average score 3.03 points, almost 40% of municipalities decided it was a moderately important issue (score 3)). Again, cities with the district status stand out here with the highest percentage of scores 4 and 5. On the other hand, in rural municipalities the biggest share of respondents (11%) see this challenge as irrelevant. A similar percentage, on average, was reported for opinions concerning the relevance of the smart city/village concept (average score for the relevance of this approach reached 2.88). This time also the most urbanized units—cities with the district status—stand out with the average score of 3.68 and nearly 70% of respondents who decided that a smart city approach was a relevant or very much relevant trend in the local policy. Rural areas, in turn, stand out negatively by giving the smart village concept only 2.72 points (30% of respondents decided that building smart villages was irrelevant or of little relevance to development orientations). By analyzing the opinions of respondents—local decision makers—we could unambiguously conclude that the integration of smart city/village and age-friendly city/village approaches may turn out to be difficult in practice in the Polish reality.

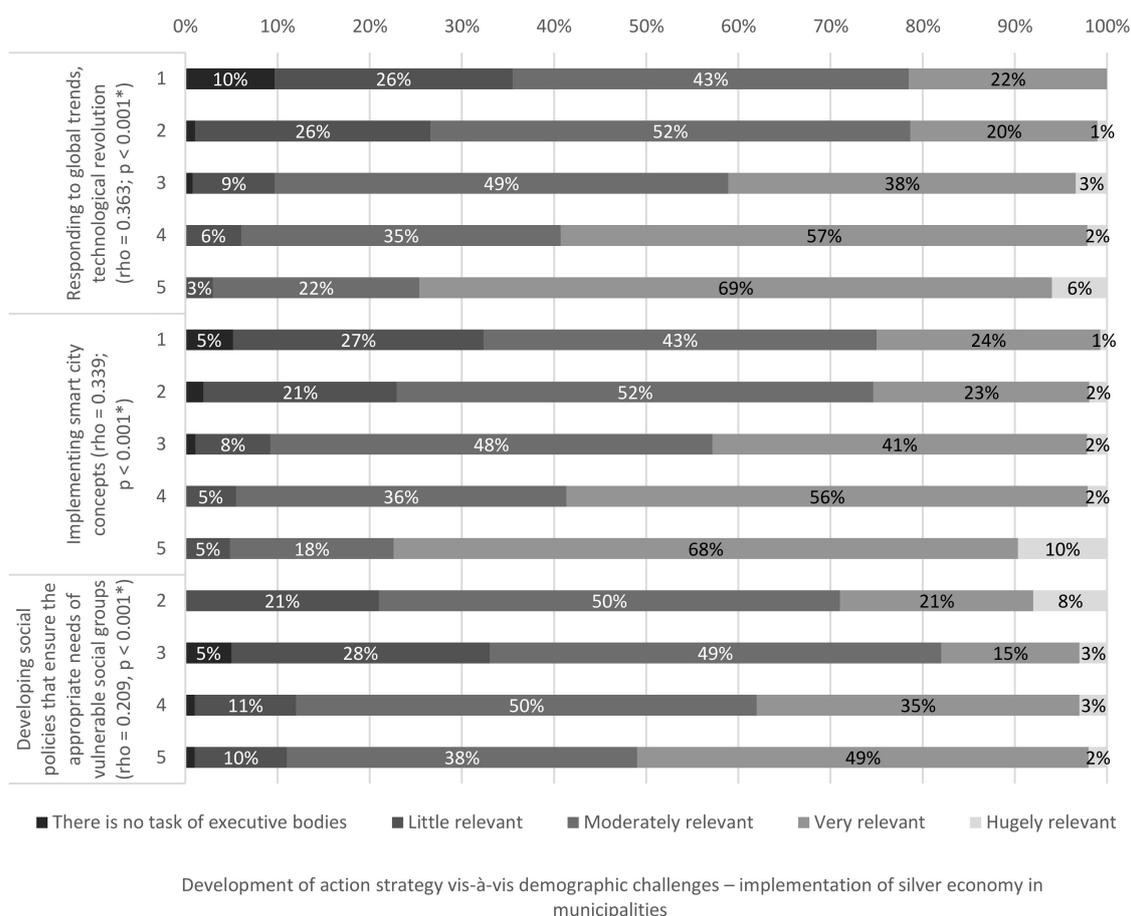
In summary, the perception of the three principal local policy interventions—which provide the proper framework for the implementation of the smart and age-friendly community concept—among representatives of local authorities in municipalities in Poland indicates an unbalanced distribution of priorities. Respondents very clearly see the need to respond to social issues through the continuously improved social policy dedicated to the excluded communities (including the elderly population), however, they do not link it with the possibility to deploy technological solutions and give a lower score to the challenge consisting of addressing the digital revolution or the possibility to put in place solutions relating to smart communities. In the next step we will try to find out how local authorities address the need to develop and implement a strategy that would respond to demographic and silver economy challenges in municipalities. By the same token, we will consider the extent to which the high relevance of the challenge to develop social policy at the local level coincides with the ageing of local communities.

Local self-government should respond to the obvious and advancing ageing of local residents in a proactive way and include it in adopted strategies and programs aimed at improving the living conditions, bringing forward the offer and quality of services dedicated to the ever-increasing elderly population. Figure 2 shows respondents' opinions on the relevance of the preparation and implementation of action strategies vis-à-vis demographic and silver economy challenges in municipalities. Almost half (46%) of the representatives of municipalities (including 52% of rural municipalities) perceive this task as of moderate or little relevance. Urban-rural municipalities pay the most attention to being strategically ready to face the consequences of ageing (in total 45% of 'very relevant' and 'highly relevant' answers were given by their representatives). The discussed differences are statistically significant (skipping the 'hard to say' answers, in the exact Fisher test  $p < 0.001^*$ ), but the effect is rather small ( $V = 0.115$ ). At this point, we were surprised with a rather significant share of 'hard to say' answers given by 17% of municipalities (even more frequent in cities with district status and rural municipalities: 33% and 24%, respectively). This may be evidence of the lack of knowledge about the opportunities and the need to come up with local economy solutions that would respond to demographic challenges.

Our research goal consisted, among others, of finding out if local authorities see the challenges and opportunities linked with the ageing societies and contemporary technological trends in an integrated way (Figure 3).



**Figure 2.** Preparation and implementation of an action strategy addressing demographic and ‘silver economy’ challenges in the opinions of the municipal executive authority.



**Figure 3.** Perception of selected global trends and the assessment of the relevance of development and implementation of a local action strategy addressing demographic challenges. rho—Spearman correlation coefficient, p—probability in t test, \*—correlation statistically significant (α = 0.05).

Strategic approaches to demographic challenges are the more important to a head of village/mayor the more he/she sees the need to consider global trends and technological revolution in local policy contexts (correlation is statistically significant and positive— $\rho = 0.363$ ,  $p < 0.001^*$ —Figure 3). A similar relationship can be observed between the relevance of developing an action strategy addressing demographic challenges and the assessment of smart city/village approach ( $\rho = 0.339$ ,  $p < 0.001^*$ —Figure 3). The share of persons who saw the relevance of the task in question as at least high was clearly higher for executive bodies which gave higher scores in particular to the smart city concept and following global trends (almost 80% of persons with perception score 5, ca. 60%—score 4). This means that politicians who do not ignore global trends do not disregard local trends either, however, which is worth stressing, they represent a small group of respondents. Analogously, potential opportunities to dedicate smart programs to older adults should be greater in municipalities in which local authorities realize the importance of global trends. This is also a way of manifesting their awareness of diverse challenges faced and managed by municipalities and their wide, comprehensive viewpoint. We may expect that Polish municipalities whose leaders are aware of the complexity of the modern world as well as its social, economic, and technological developments are more likely to embrace the smart and age-friendly community approach.

#### 4.3. Citizen-Centered Governance Style and the Perception of Smart Challenges

In the next step of the analysis, by making reference to the human-centric smart cities concept, we wanted to learn if local authorities open to considering residents' opinions in the decision-making process are more willing to implement smart and age-friendly solutions. Table 5 shows the relationship between a priority to implement smart city/village concept and preferred level of social participation in municipal governance.

**Table 5.** Perception of residents' involvement in local decision making and the relevance of the implementation of smart city/village concept (in %).

		n	Relevance of the Implementation of Smart City/Village Concept in a Municipality (%)				
			1	2	3	4	5
Residents should be actively and directly involved in making important local decisions ( $\rho = 0.124$ ; $p < 0.001^*$ )	Totally disagree	9 <sup>a</sup>	33.3	22.2	33.3	11.1	0.0
	Disagree	17 <sup>a</sup>	29.4	11.8	29.4	17.6	11.8
	Neither agree nor disagree	94	20.2	31.9	29.8	17.0	1.1
	Agree	681	12.2	21.1	38.0	24.2	4.5
	Totally agree	331	13.3	16.6	33.8	26.3	10.0
Opinions and needs of residents socially excluded or threatened with social exclusion are important and should be considered in local decisions ( $\rho = 0.172$ ; $p < 0.001^*$ )	Totally disagree	4 <sup>a</sup>	25.0	0.0	75.0	0.0	0.0
	Disagree	14 <sup>a</sup>	7.1	21.4	42.9	21.4	7.1
	Neither agree nor disagree	161	21.1	26.7	36.0	13.0	3.1
	Agree	790	12.5	20.6	37.5	24.7	4.7
	Totally agree	166	11.4	14.5	27.7	32.5	13.9

<sup>a</sup>—percentages are given only for comparison purposes.  $\rho$ —Spearman correlation coefficient,  $p$ —probability in  $t$  test, \*—correlation statistically significant ( $\alpha = 0.05$ ).

Heads of villages/mayors who gave lower scores to the need to involve residents as well as inhabitants socially excluded or threatened with social exclusion in municipal decision making gave also lower scores to the 'smart city/village development' measure (Table 5). For instance, more or less every third person who (totally) disagrees with this stance scores smart city/village development the lowest, as 1, while among those who 'agree' with the view the percentages are almost twice as low (for "1" given to smart city/village). These relationships are also statistically significant ( $p < 0.001^*$ ). Thus, the human-centered smart city/village idea could be implemented in Polish municipalities, however, to a limited extent. Being open to implement both approaches was declared by ca. 1/3 of respondents.

Additionally, when it comes to the development and implementation of the action strategy addressing demographic and silver economy challenges, a positive and significant correlation was

observed: the higher perception of the importance of co-creation, the higher relevance is attributed to the policy and measures adopted in response to the ageing population ( $p < 0.001^*$ , Table 6). The great relevance of this task was recognized and acknowledged practically only by those heads of villages and mayors who see residents' involvement as hugely relevant. In addition, the 'very relevant' answer was more often given by heads of villages/mayors who show higher appreciation to the participation of residents. Moreover, it is more visible with regard to the inclusion of residents who are socially excluded or threatened with social exclusion ( $\rho = 0.182$ —Table 6).

**Table 6.** Perception of residents' involvement in local decision making and the relevance of developing and implementing action strategy vis-à-vis demographic challenges and silver economy in municipalities (in %).

		Developing an Action Strategy Addressing Demographic Challenges—Implementation of "Silver economy" in Municipalities (%)					
		n	It Is Not the Responsibility of Head of Village/Mayor	Little Relevant	Moderately Relevant	Very Relevant	Hugely Relevant
Residents should be actively and directly involved in making important local decisions ( $\rho = 0.139$ ; $p < 0.001^*$ )	Totally disagree	10 <sup>a</sup>	10.0	30.0	30.0	30.0	0.0
	Disagree	12 <sup>a</sup>	0.0	25.0	33.3	41.7	0.0
	Neither agree nor disagree	82	6.1	15.9	47.6	30.5	0.0
	Agree	617	1.3	12.5	45.4	38.9	1.9
	Totally agree	291	0.7	10.0	38.5	46.0	4.8
Opinions and needs of residents socially excluded or threatened with social exclusion are important and should be considered in local decisions ( $\rho = 0.182$ ; $p < 0.001^*$ ) <sup>b</sup>	Disagree	12 <sup>a</sup>	0.0	23.1	53.8	23.1	0.0
	Neither agree nor disagree	146	2.1	22.6	46.6	28.1	0.7
	Agree	700	1.4	10.9	45.0	40.3	2.4
	Totally agree	147	2.0	8.8	29.9	53.7	5.4

<sup>a</sup>—percentages are given only for comparison purposes; <sup>b</sup> answers 'totally disagree' ( $n = 4$ ) have been omitted;  $\rho$ —Spearman correlation coefficient,  $p$ —probability in t test, \*—correlation statistically significant ( $\alpha = 0.05$ ).

Thus, in municipalities which consider developing strategic action programs in response to demographic trends as important, local authorities are also open to involving residents, including those who are socially excluded (who are often older adults), in the decision making process (and conversely a higher relevance of policies and programs addressing the ageing population is observed in municipalities attaching higher importance to co-creation). Hence, we may expect that in these municipalities intelligent solutions dedicated to older adults could be co-created with residents.

#### 4.4. Assessment of the Holistic Smart and Age-Friendly Community Approach

A holistic approach to local policy priorities dealing with the degree of development of the smart city/village and age-friendly city/village concepts (assessed in the way discussed in Section 3.3. above) is adopted by 15.1% of municipalities (mayors of a further 32.9% of municipalities pay significant attention to only one of these areas while half of the total population of municipalities disregard both). A holistic approach is the most often exercised by cities with district status (35.7%) and the least often in rural municipalities (11.2%). Every fifth urban and urban-rural municipality adopts a holistic approach (in the  $\chi^2$  test  $p < 0.001^*$ ,  $V = 0.158$ ). Co-creation assessment (in both approaches) is significantly higher in municipalities applying the holistic smart and age-friendly approach (in the Mann–Whitney test  $p < 0.001^*$ ).

The outcome of a comprehensive assessment of conditions specific to the approach that embraces the smart and age-friendly perspectives using the logistic regression can be found in Table 7. *Ceteris paribus*, only three out of all variables considered by the model ( $p < 0.05$  in the Wald test) are critical (statistically) for the perception of a smart city/village concept and the policy holistically addressing demographic challenges. These variables are representative to all three groups of factors. First, co-creation is critical; the higher the assessment of the relevance of opinions and needs of the socially excluded or members of the community threatened with social exclusion and the need to account for them in local decisions, the greater the likelihood of a holistic approach to the smart and age-friendly approach in municipalities. OR = 2.663 suggests that with each point on a five-degree

assessment scale the opportunity to arrive at such a holistic approach increases on average 2.7 times (with other conditions remaining the same).

**Table 7.** Determinants of holistic smart and age-friendly approach—logistic regression results.

Variables	B	S(B)	p	OR
Experience in the enterprise sector <sup>1</sup>	0.423	0.197	0.032*	1.526
Type of municipality <sup>2</sup>			<0.001*	
Urban-rural municipalities	0.748	0.219	<0.001*	2.112
Urban municipalities	0.742	0.281	0.008*	2.100
Cities with district rights	1.981	0.437	<0.001*	7.250
Relevance of opinions and needs of residents socially excluded or threatened with social exclusion (range 1–5)	0.980	0.177	<0.001*	2.663
Const	−6.147	0.765	<0.001*	0.002
p in the omnibus test of model coefficients	$\chi^2(12) = 66.9; p < 0.001^*$			
Nagerkelke's R <sup>2</sup>	0.123			
% of the correct classifications for y = 1	65.8%			
Count R <sup>2</sup>	62.5%			

B—regression coefficient, S(B)—error of regression coefficient estimation, p—probability in the Wald test, OR—odds ratio. Reference groups: <sup>1</sup> lack of experience, <sup>2</sup> rural municipalities.

Amongst qualities of local government units, the type of a municipality turned out to be significant ( $p < 0.001^*$ ). Compared to rural municipalities, in cities with district rights the likelihood that we examine is on average 7.3 times higher while in urban and urban-rural municipalities it is on average twice as high (Table 7). Against the background of other factors, the income of a given municipality is not statistically significant. From among personal features of heads of villages and mayors, only having professional experience in the enterprise sector turned out to be relevant (*ceteris paribus*); mayors with previous professional experience gathered outside of the local government administration were ca. 1.5 times (compared to mayors without such a track record) more likely to appreciate the importance of solutions originating from the two areas in question. The model that we have estimated represents proper statistical properties (in the omnibus test  $p < 0.001^*$ ). Nevertheless, using it to forecast or classify municipalities would produce limited quality outcomes (bearing in mind that the survey was designed to assess the relationships and identify critical factors, such outcomes are not problematic).

## 5. Discussion

Results of studies discussed in the paper were intended to provide us with knowledge about conditions conducive to the implementation of smart city/village concept addressing the needs of older adults in Poland. In our approach, the proposed idea of smart and age-friendly communities responds to two contemporary megatrends: digitalization and demographic transition. According to the assumption adopted for this work, the deployment of the idea in local planning and governance can be triggered by at least two conditions: demand of the older adults for smart everyday products and services and a perspective of decision makers—local authorities who delineate local policy priorities.

Statistics quoted in the paper demonstrate that older adults in Poland already make up a numerous group of potential consumers of services and products and demographic forecasts suggest that the years to come will witness the intensification of these trends. Contrary to popular belief, demographic transformations are accompanied by a growing affluence of older adults. In Poland in 2017 average disposable monthly per capita income in households with only people aged 60+ amounted to PLN 1888.76 (PLN 1998.56 in cities and PLN 1575.88 in the country) and was 17.5% higher than for households with only people aged below 60 (Statistics Poland, 2018). Obviously, average size of a household of people 60+ is smaller (these are usually single- or two-person households compared to on average three-person households typical of the rest of the Polish population) meaning fixed costs of housing and energy are relatively more burdensome to people 60+ than to younger adults (in cities these

expenses account for 23.2% for persons aged 60+ compared to 18.4% and, respectively, 23.0% vs. 19.0% in rural areas). In addition, this age group reports higher healthcare related expenditure (healthcare services account for ca. 9% of all expenses of urban and rural residents), which restricts spending on other products and services. Still, the extreme poverty rate is lower for people aged 60+ than for younger adults (3.5% vs. 4.5–4.7% for persons under 17 and between 18 and 59 years of age), while the poverty rate and poor living conditions are the same for them and for the younger population (8.1%). Thus, we may conclude that the 60+ population in Poland has got the purchasing power similar to that of the younger age groups and because it continues to grow there are conditions conducive to the development of the silver economy and perceiving older adults as important beneficiaries of smart age-friendly city/village solutions.

Considering the possibility to develop products and services adapted to the needs of older customers, similarly to other researchers in Poland [50,51], we believe this is an opportunity for economic growth to be achieved in conditions of demographic transition. At the same time, we also are of the opinion that the implementation of a silver economy strategy should engage public bodies, in particular local authorities, who have a direct impact on the quality of life and living conditions of older residents as well as on stimulating the emergence of the ecosystem favorable for businesses and other stakeholders active in the silver economy. We need to stress that we see their engagement in a wider perspective as striving to create an age-friendly local environment. Literature studies [35,41] have provided us with evidence that technological solutions can be used to develop a local policy toolkit that would smartly respond to the needs of older adults and, consequently, integrate the smart city/village and age-friendly city/village concepts already existing into research accomplishments.

Our studies were innovative by nature and included the analysis of differentiated circumstances, in which the integrated smart and age-friendly community concept is being implemented, such as, e.g., demographic trends, digital competencies of older adults, preferences of local authorities and their openness to social participation. In the course of the literature studies, we did not come across such a wide analytical approach, hence the results of our studies bring in new knowledge useful in the shaping of local sustainable growth policy. The previously existing studies usually centered around one of the above-listed aspects, although we found some theoretical works that advocated integrating smart and age-friendly city concepts. Our empirical analyses have gone far beyond quantitative estimates of the present and forecasted demographic situation in Poland and the affluence of the elderly. We decided that demand for inclusive solutions targeting older adults and offered by smart cities derives also from realistically available skills and possibilities of this group to make use of these solutions in everyday life. In other words, we share the approach of researchers who investigate the demand side of technological solutions in tackling issues related to the elderly population and argue that the position of older adults should be examined from the perspective of living in a dynamic technological society while technology should be investigated in terms of its potential to improve their everyday lives and facilitate social participation, as well as expand the period of living independently in their own homes [19,52,53]. We also assumed that the use of technology to improve the quality of life of older adults is not free of potential threats. In studies dealing with the factors and measures of the digital divide, DiMaggio and Hargittai [54] describe five key aspects of digital inequality: (a) access to equipment, (b) autonomy of use, (c) skills, (d) social support, and (e) the purposes for which the technology is employed. On the other hand, according to [55], the digital divide index includes: (a) access to infrastructure, (b) affordability, (c) use, (d) social and government support, (e) socio-demographic factors (like age or geographic dispersion for example). Unfortunately, our findings suggest there are significant barriers in the above listed fields of analysis of the digital divide that impede the implementation of the smart and age-friendly community concept that we promote. The main issue is the deficit of digital skills amongst older adults, which intensifies with age and is more acute in little-urbanized areas where it is exacerbated by the deficit of the hardware and absence of proper infrastructure. As a result, the digital divide affects ca. 70% of Poles aged 75+ living in big cities, almost 90% of residents of the smallest cities and ca. 98% of the rural population (Section 4.1).

The attitude of local authorities in Poland may act as another barrier to the implementation of smart and age-friendly community concept. Results of our studies demonstrate (Section 4.2.) that although the mayors see urgent need to develop a responsible and inclusive social policy, they do not associate it with the use of technological solutions and undermine the challenge of addressing the digital revolution or the possibility to implement smart city/village solutions. They also seem to disregard the demographic effects of ageing of local communities for development trajectories of Polish cities and villages. Almost half of Polish municipalities perceive having a demographic challenge action strategy as of moderate or little relevance.

Our approach concurs with other researchers' opinions [56] that the smart city idea tends to be understood too narrowly only as efforts undertaken to design new technological and communication solutions intended to support and modernize urban infrastructure. Smart solutions need to be seen in a wider context as tools rather than means in themselves. They should be employed to improve the quality of life in municipalities, ensuring their sustainable growth and providing an integrating and responsive environment for people of any age. Similar opinions have been formulated by other researchers who examined extreme/diverse approaches to smart cities: the technology driven method (TDM) vs. the human driven method (HDM) [57], the ICT and technology oriented approach vs. the people oriented approach [58], supply vs. demand driven approaches [27].

Increased supply of new technologies that can be used in local environments does not mean we are dealing with a smart city or village [59], which calls for, inter alia, a cross-disciplinary and cross-sectoral approach, building new forms of cooperation and alliances. Truly smart cities and villages are places in which people want to live, work and rest. Therefore, quality of life (and happiness) metrics should be seriously factored into any smarter strategy [60]. To stand up to the challenge, development plans of smart cities/villages must consider the assumptions of place based policy and focus on the local identity and place-based knowledge [61] as well as put the residents in the center of its interests (citizen centric technology) [62]. The citizen-centric smart city has turned into one of the most dynamically developing strands of research [63]. Smart cities (particularly humane smart cities) call for new governance models where public authorities and citizens build sustainable relationships [64]. Furthermore, in smart villages stress is put on the needs and role of the local community in technological transformation. The definition of smart eco-social villages highlights that their communities use innovative solutions to improve their resilience and take advantage of local strengths and opportunities. Their approaches are participatory-based when it comes to drafting and implementing strategies aimed to improve economic, social, and/or environmental circumstances, in particular through mobilizing solutions offered by digital technologies. Smart villages cooperate and enter into alliances with other communities and actors in rural and urban territories [65].

To some extent, our findings confirm the above quoted opinions of other researchers and indicate that authorities open to the involvement of local residents, not only attribute higher relevance to the examined priority directions of policies and interventions (Section 4.3.) but also view technological challenges of our times (smart city/village idea) and local solutions underpinning them in response to demographic challenges (Section 4.4) in a more comprehensive way.

In light of these studies, smart and age-friendly community approach stands no realistic chance of getting widely propagated across Polish municipalities. Only 15% of municipalities, mainly the biggest cities, expressed interest in such a holistic approach to local policy addressing demographic problems by highly assessing both of its pillars (smart and age-friendly) (Section 4.4). Polish municipalities have just launched the implementation of smart pilot projects out of which only a few are dedicated to older recipients. In addition, projects which have been selected for funding in the national call for proposals 'Human Smart Cities. Smart Cities Co-created by Their Residents' pay special attention to the involvement of older adults but do not provide for a universal access to typically smart solutions. For instance, in the project '60+ Smart City—Innovation as the Effect of Inter-generational Co-operation' carried out over the period 2019–2021 by the municipality of Zduńska Wola provided for the arrangement of the city as a space friendly for people aged 60+ through the introduction of

innovative technological solutions that would improve their sense of safety and enhance their activity levels. Measures designed to achieve this goal included, above all, social consultations, education and promotion efforts, and the arrangement of an integration square in the public space. Technology-based solutions will be offered to only 10 older adults suffering from memory loss (e.g., Alzheimer, dementia), who will be equipped with electronic devices with GPS function and a 24/7 monitoring system. Besides this, six interactive information kiosks are foreseen. The scale of technological solutions makes us question their effectiveness as measures intended to improve living conditions of the entire elderly population in the municipality.

The fact that the number of smart projects in cities and villages is insufficient to meet the demand, as well as the scope of proposed solutions may be explained by the lack of vision concerning how the smart and age-friendly community approach could be implemented in Poland. The Strategy for Responsible Development until 2020, the principal strategic document delineating development directions for the country, realizes the need for shaping smart cities and the improving of digital skills of Poles and the overall digitalization of the country. Despite highlighting negative demographic trends, the strategy does not clearly promote the need to develop smart and age-friendly cities and villages.

Limitations identified for our study consist of failing to cover the already completed smart and age-friendly community projects and investigating only into the priorities declared by local authorities. Most probably the analysis of exercised practices would reveal the even smaller interest of Polish municipalities in integrated projects. In fact, our studies confirmed the negligible interest of regional and local authorities in Poland in new concepts of local development addressing present challenges (silver economy, sustainable development) [6,66]. Despite the human- and demand-driven approach towards smart cities that we advocate and the need to analyze the perspective of recipients of smart and age-friendly community projects, we have not considered actual expectations and needs of older adults. In the future, we would like to develop this aspect by conducting qualitative studies of older adults' expectations with this regard and through case studies of smart solutions that have been implemented to improve the quality of life of the elderly in urban and rural contexts.

## 6. Conclusions

The general conclusion reads that both development concepts that we have examined—smart city/village and age-friendly city/village—should be seen in an integrated manner in the times of demographic transition so that the designed and implemented technological solutions could respond to the needs of older users and those who care for them. The challenge of demographic ageing of local communities calls for a new approach to the development of new services and products that respond to the needs of older adults and create an age-friendly environment. This is a challenge facing not only Poland but all of Europe, which is why we need to widely promote the idea of making cities and villages aware of specific ageing-related needs to assist the elderly living independently. Using the ICT in the context of smart cities/villages should be viewed as a tool ensuring personalized healthcare, social services (including care), social mobilization, and safe older adults-friendly spaces.

The emergence of smart municipalities should be coupled with education efforts intended to improve digital skills of older adults. By focusing on the supply of new technological solutions and failing to examine the demand for them or develop digital skills of their users we will not make the cities or villages smart or inclusive. After having investigated the absorption capabilities of older adults in Poland for the solutions underpinning the smart city/village concept, we must conclude that they are potentially high although restricted to some extent. While the population of elderly consumers of these solutions continues to grow, judging by the two principal indicators of the digitalization of the Polish population (the use of computers and of the Internet), we may say that in Poland the level of digitalization drops in higher age ranges and it is lower for each age group in rural areas compared to cities. Moreover, differences between cities and villages grow with residents' age. Under such circumstances, the role of digital education for the population aged 60+ becomes even more important and the same can be said about the promotion of the smart city/village idea amongst this group of

the population. Efforts need to be made to expand digital infrastructure and equipment enabling the implementation of the smart village concept, including the provision of computers with Internet access to public institutions and local institutions of culture that could be used by the general public. Such solutions, linked with digital training courses and consultancy, could successfully bridge the digitalization gap between cities and villages revealed in our survey.

Our findings also allow us to confirm the disturbing conclusion that local policy in Poland is lagging behind and cannot match the development levels of smart cities and villages addressing demographic changes. Dynamic ageing of society is also true for other countries in Europe, which is why efforts to achieve higher interdisciplinary coherence at local levels (through the development of smart and age-friendly cities/villages) should be based on a shared EU vision reflected in development strategies of the EU Member States. To properly design and implement local solutions, we need to have multi-sectoral and multilateral cooperation combined with active and creative citizen involvement to arrive at inclusive communities that would be friendly to residents of any age. In the absence of a supportive political environment, the danger of missing the opportunity for a wider development of innovation becomes real, making positive changes at local levels increasingly more difficult.

**Author Contributions:** Conceptualization, A.P.-K., J.P., J.W.; Data curation, A.P.-K., J.P. and J.W.; Formal analysis, J.W.; Investigation, A.P.-K. and J.P.; Methodology, A.P.-K., J.P. and J.W.; Project administration, A.P.-K., J.P. and J.W.; Resources, A.P.-K., J.P. and J.W.; Visualization, A.P.-K., J.P. and J.W.; Writing—original draft, A.P.-K., J.P. and J.W.; Writing—review and editing, A.P.-K., J.P. and J.W. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Acknowledgments:** This research was supported by University of Łódź, Poland.

**Conflicts of Interest:** The authors declare no conflict of interest.

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