Article

Territorial and Human Geography Challenges: How Can Smart Villages Support Rural Development and Population Inclusion?

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Abstract: Rural areas are significantly affected by spatial vulnerability, the digital gap, depopulation, and population ageing. Marginalized populations are seeking collective well-being, social inclusion, and local development in smart villages, an increasingly important area of interest for scholars and practitioners as well as rural areas and communities. This article attempts to highlight the dominant trends in smart villages planning and depict the characteristics of Greek rural areas and populations alongside the implemented localized smart actions. To achieve this aim, the research utilized the existing literature through bibliometric analysis by extracting data from the Web of Science database. Building upon the bibliometrics, the research focused on identifying localized implemented interventions in the Greek rural areas. The results suggest that innovation, knowledge, growth, and management appear to impact rural smart planning, while the limited interventions of smart villages in Greece focus on social innovation and local development. The study argues that in Greece, a single holistic smart villages model cannot be proposed, due to the country's geographical and demographical variability. The proposed trends, though, can be implemented locally to encourage rural development and population inclusion; therefore it is recommended to increase local stakeholders' awareness and active engagement.

Keywords: smart villages; spatial vulnerability; marginalized population; depopulation; rural development; bibliometric analysis; Greece

1. Introduction

Demographic change in rural areas reflects their spatial vulnerability and is related to many broader issues. The strong heterogeneity of Greece contributes to the emergence of inequalities, and is related to local social and economic development, and the continuation of rural exodus. Determining the factors of sustainability, resilience, and attractiveness of the Greek rural areas is of utmost importance, but also a great challenge.

The emergence of smart villages as a tool for the resilience of disadvantaged areas is the most prevalent, recently developed, and population-centered approach (Slee 2019). Debate about this issue focuses either only on one aspect of the smart village approach or only on specific case studies. The smart space has multiple purposes; depending on local needs, it focuses on improving living conditions (through better access to infrastructures and services) and living standards of residents, strengthening local entrepreneurship (productivity development), and attracting investment interest. The current pandemic has also brought the issue of smart villages to the forefront due to their contribution in creating more resilient societies and structures (Doyle et al. 2021). Evidence from the urban space shows that COVID-19 will affect the soft planning micro-actions and will lead to more compact, more inclusive, tech-led development (Graziano 2021). Therefore, the study of the development conditions of this new model is necessary to identify appropriate solutions to support marginalized populations and encourage the resilience of fragile areas.

The ability to meet the main social and economic needs of the local population will contribute to a minimum level of social integration and improvement of living standards. Acknowledging that smart villages constitute a highly innovative tool to strengthen sustainability and rural attractiveness in remote and disadvantaged areas, the main objective of this study is twofold: (i) to explore the sociodemographic and spatial profile of Greek rural areas and examine the current smart interventions implemented; and (ii) to identify the global trends in smart village planning. In Greece, smart villages are currently the subject of both theoretical investigation and to a lesser extent private initiatives funded by the EU Rural Development Programme (RDP); however, little interest has been expressed by stakeholders. Thus, the contribution of this article is a significantly innovative approach for the Greek context and provides insight for future analysis and consideration from interested parties by shaping a fruitful background for studying, or even, in combination with other methodological frameworks, forecasting potential and prospects in the emerging transformation of modern smart villages.

The development of an innovation depends on local political and socio-spatial dynamics (Raven et al. 2016), so the contribution of the local stakeholders in directing the rural development is crucial. The challenge lies in actors' awareness and perspectives to pursue a change, usually motivated by potential socioeconomic benefits (Falcone 2018). It is a fact that very often mismatches occur between objectives and final measures in actions related to rural areas (Sisto et al. 2018), so any contribution to improving the perceptions of stakeholders is crucial in the way they will operate for the benefit of rural areas.

This study consists of four sections. The first is a short review of the theoretical literature on smart villages and the need for their creation. Subsequently, the context of vulnerable rural areas in Greece is presented along with the interventions so far implemented. The third section presents the methodological approach; that is, a bibliometric analysis depicting the trends in implementation of smart villages. Finally, the discussion section presents the underlying spatial heterogeneity of the Greek area and discusses the relationship between space, population, and stakeholders, and the dominant trends in smart villages implementation.

2. The Need for Smart Villages

The concept of smart villages has recently been introduced by European institutions (European Commission 2014) and is one of the most recent approaches to rural development (ENRD 2018). The concept originated in the Cork Declaration 2.0, "A better life in rural areas", on the future of EU rural development and agricultural policy (European Commission 2016). This is part of the "Rural Development" pillar of the Common Agricultural Policy (CAP), aimed at improving the sustainability of rural areas through the involvement of the local population (Martinez Juan and McEldowney 2021).

The research on this unexplored territory is under development and is a matter of concern in both European research (Komorowski and Stanny 2020; Adamowicz 2021; Zavratnik et al. 2018, 2020; Adesipo et al. 2020; Stojanova et al. 2021) and the international literature (Murty and Shankar 2020; Zhang and Zhang 2020; Klenova et al. 2021; Kim 2021). It is still at an embryonic stage, so there is yet no official definition of smart villages and researchers propose the consideration of special features including demography, location, human geography, social, and physical resources (Heap and Hirmer 2020). The difficulty in formulating the term lies in the spatial and temporal variability of the spatial units. Making a parallel with smart cities (Gascó-Hernandez 2018), yet acknowledging the relative limitations, local circumstances must be considered, leading to several routes to implementing smart initiatives. Consequently, it is difficult to call for a common EU-wide definition. The discussion focuses on the sustainable and inclusive development of disadvantaged and remote areas so that the local population enjoys a high standard of living (Boncinelli et al. 2015). In line with this, smart villages could be developed according to the smart city model (Manika 2020a).

Modern technologies and innovations constitute the major components to improve the standard of living, increase the quality of public services, and support maximum utilization of resources found in the rural setting (Zavratnik et al. 2018). The promotion of new technologies improves the overall standard of living for residents, as their daily routines depend on multiple and continuous interconnections through access and utilization of a variety of broadband services and tools. Technology, therefore, acts as a catalyst for growth, promotes education and local business opportunities, improves health and well-being, strengthens democratic commitment, provides environmental prosperity, and strengthens rural people (Ranade et al. 2015). At the same time, the European Union encourages innovation, for example, through innovative procurement, as an important tool for smart areas to improve the efficiency of public services (Manika 2020b).

In developing digital services, the approaches take into strong consideration local knowledge and needs. In remote areas, particularly, digitization is important due to demographic change and the trend towards economic and human desertification (European Commission 2020). As the digital transformation in rural areas is a prerequisite for smart transition, questions are raised about the risk of digital exclusion, implying both spatial criteria (areas without internet access) and social criteria (age, educational level). Rural areas often suffer from slow and unreliable network infrastructure, which limits access to content and services that can promote economic growth. Smart village development addresses technology's usability in satisfying rural inhabitants and serving the local needs (Zavratnik et al. 2020).
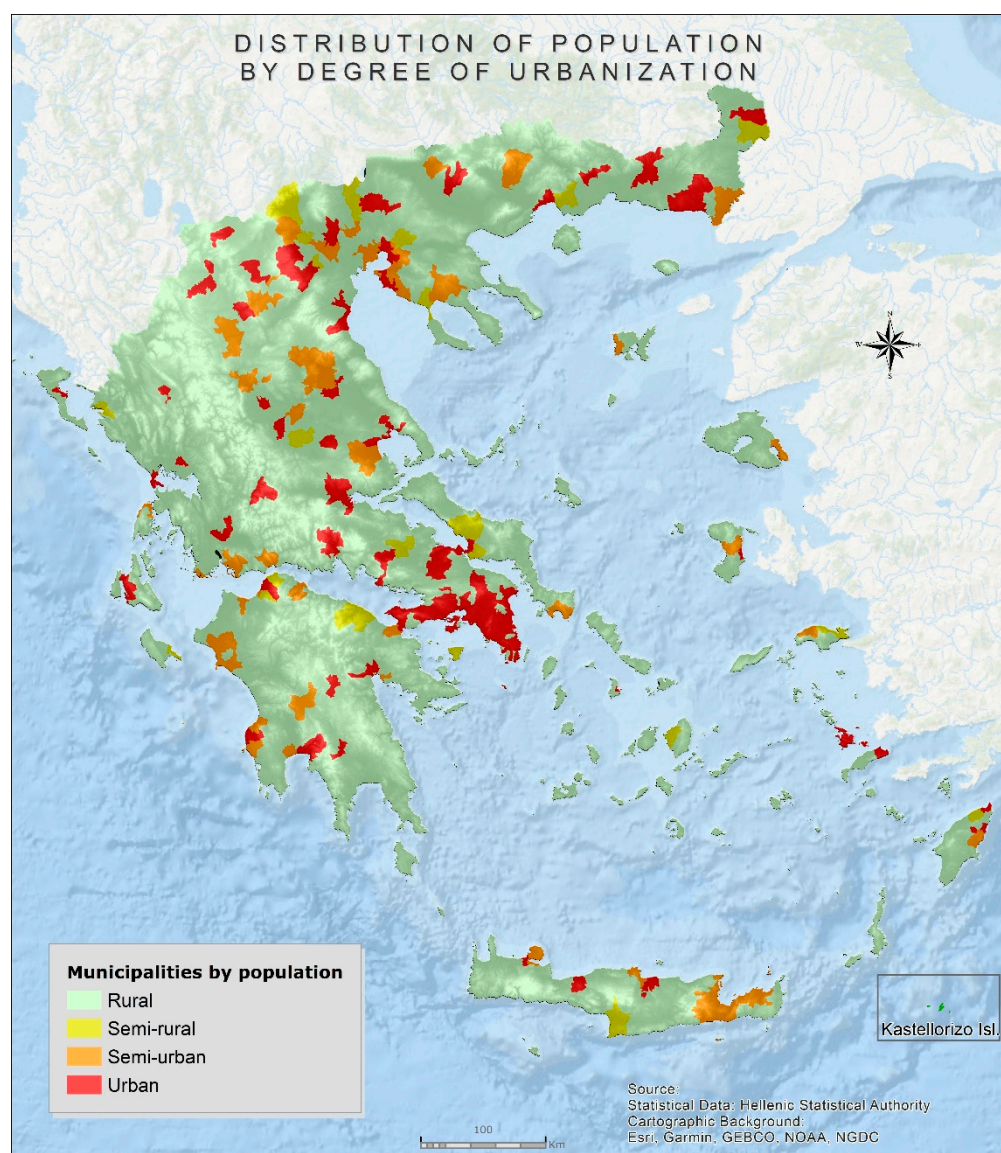
The majority of European countries have or are implementing policies contributing to the development of smart villages. These are guided by challenges experienced in rural areas, including the absence of essential services and depopulation. Consequently, these policies focus on creating feasible and versatile rural areas, with healthy and sustainable agro-food systems and forestry and agricultural sectors. Additional motivations driving the development of smart villages include improving the quality of life in rural areas, diversification of the rural economy, creating employment opportunities, and protecting environmental and sustainable management of natural resources. In recent years, several smart villages have been developed in Europe focusing on different areas, including innovation, management, growth, and knowledge (O'shaughnessy and O'Hara 2013; Barraket et al. 2019; Kelly et al. 2019; Nieto and Brosei 2019; Krizanovic Cik et al. 2018; Wolski and Wójcik 2019; Bacco et al. 2020; Majumdar 2020; Adesipo et al. 2020).

3. Smart Villages in Greece

3.1. The Context of Vulnerable Rural Areas in Greece

The Greek countryside as a broader concept of rural space acquires great symbolic significance for contemporary urban societies. According to the Population Census of 2011 (ELSTAT 2011), 91% of the 5542 municipal units in Greece had fewer than 2000 inhabitants. The total population of these so-called "villages" was 2,326,042 people (22% of the national population). An important point is that 73% of these municipal units (3972) showed a decrease in their population during the decade 2001–2011. The rate of the Greek lowland-mountainous population (Scheme 1) and urban-rural population (Scheme 2), along with the urbanization trend and the demographic change, could explain to some degree that decrease.

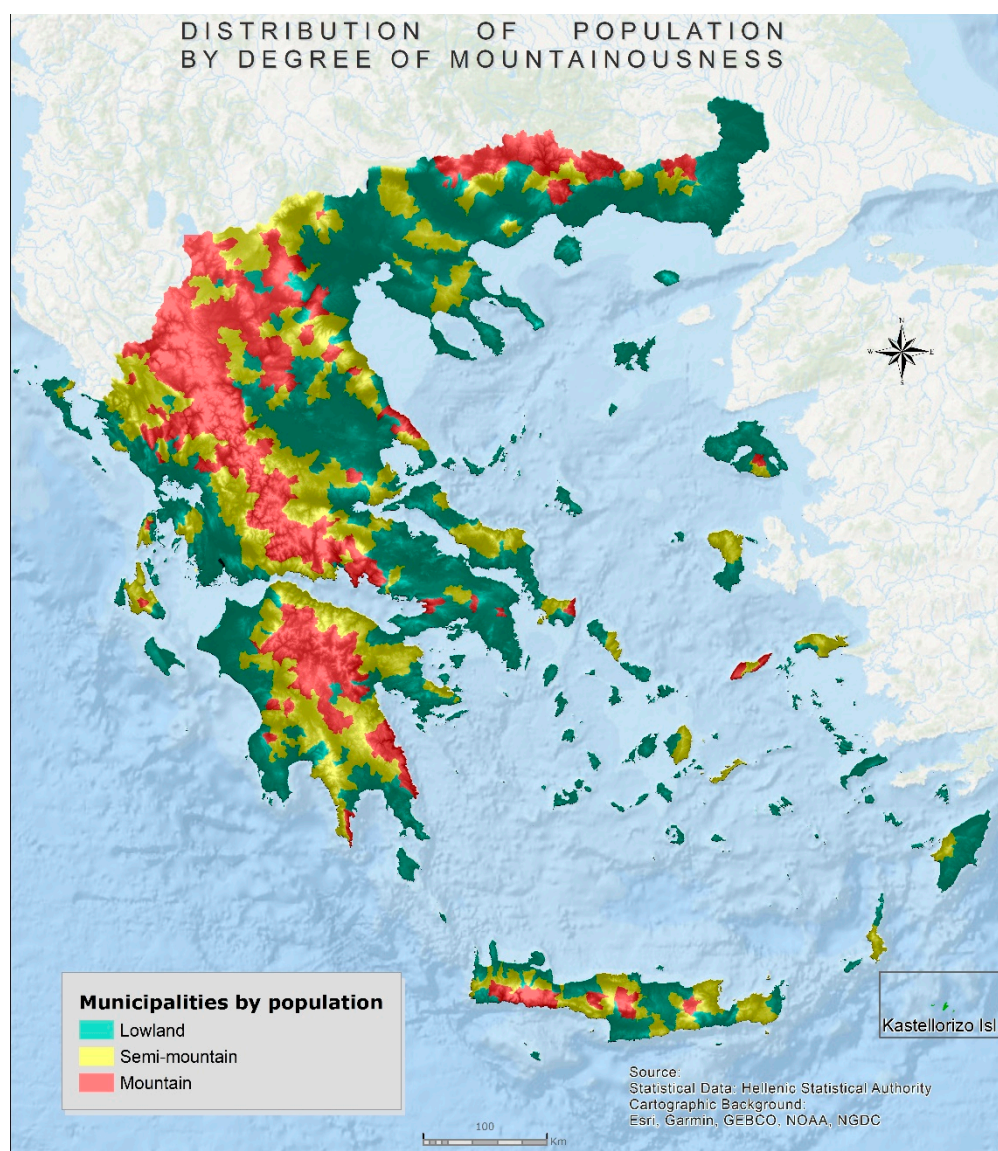The majority of the population is concentrated in the main metropolitan areas, Athens and Thessaloniki (60% of the population is concentrated in 6% of the total area). The unbalanced distribution of the population is also reflected in the trend of rural depopulation over time. Rural exodus demographically weakened the countryside, mainly due to population ageing and the migration of the young workforce.

Scheme 1. Distribution of population by degree of urbanization.

Despite the dominant urbanization trend, the first insights on the Greek counterurbanization trend appeared after 1990 (Duquenne 2014) in the context of the search for better living conditions, especially for the inhabitants of urban centers who have retained their family lots in rural areas (Gkartzios 2013). In particular, since 2000 there has been a halt to the systematic exit from rural areas, mostly due to the economic crisis (Anastasiou 2020; Kasimis and Papadopoulos 2013). At the same time, there is a significant population redistribution within the country, with 27% of urban inhabitants who left the urban areas during 2001–2011 moving to the countryside (Anastasiou and Duquenne 2017).

Apart from the economic crisis (Anastasiou 2020; Salvia et al. 2020), transformation of the rural space has been a significant cause of this phenomenon. The rural restructuring has gradually advanced, accelerating the substantial consumption of space (Maravegias 2007). The overly unidirectional orientation towards agriculture (arable and livestock farming) was supplemented by a number of economic activities such as manufacturing, wholesale and retail trade, and accommodation and food service activities and leisure investments (Anthopoulou and Gousios 2007). In line with this, the rural attractiveness issue has emerged, contributing to the revitalization and the resilience of rural spaces, especially those that are especially remote and marginalized.

Scheme 2. Distribution of population by degree of mountainousness.

In Greece there may be disadvantaged areas in both mountain and lowland regions. Regarding the mountainous areas, modernization of agricultural production and the change of consumption patterns and urbanization have shaped a specific landscape. There is also a lack of good transport links, lack of access to markets, poor telecommunications infrastructure, and limited educational facilities, due to geographical location. Economic activity is limited to pastoral farming and seasonal employment. Both the social and economic existence in mountainous areas depend on the corresponding contributions of the non-inhabitants and non-permanent residents who have close ties with the specific areas. At the same time, many local communities adapt to the needs of visitors and tourists, highlighting the rural mountainous landscapes as the rural idyll, the imaginary alternative place to live. These images reflect and determine the human behavior in space (Yarwood 2002). This fact also affects the future of specific villages, leading to loss of their local and territorial identity (Kibreab 1999) by focusing on the offering of unrealistic (Yarwood 2005) snapshots of rural life.

On the other hand, intensive cropping predominates in the lowland areas and therefore that production capacity determines the economic structure of these areas. Compared with the mountainous areas, lowland villages have the advantage of being close or relatively close to small towns or urban areas, resulting in the formation of clusters and increasing the

mobility between villages and cluster centers. Although lowland villages are usually not remote, they are vulnerable due to two major issues: the agricultural profession is not attractive to young people (Maucorps et al. 2019), while at the same time there are significant trends in upward social mobility. The role of space in the reproduction of social inequalities is widely discussed (McKeag et al. 2018; Alexandru 2012). Young people growing up in rural communities change their social strata (upward educational and occupational mobility) and move to the urban space, thus contributing to local depopulation.

Population ageing and increasing depopulation of the Greek rural areas, mostly by young people, leads to consequent problems for the locals, such as unemployment, poverty, illiteracy, and social isolation. The marginalized populations in particular face challenges such as isolation, brain drain, lack of decent services, and limited business opportunities. In line with that, the capacity of an area to retain its local population and/or attract new inhabitants is of utmost importance for its livability.

During the recession in Greece, there were population shifts toward rural space (Anastasiou and Duquenne 2020) not only because of the crisis (Anastasiou 2020; Salvia et al. 2020), but also because of people seeking the rural idyll (Anthopoulou et al. 2017) cultural experience, and collectivism (Gkartzios and Scott 2015). Seeking the rural idyll though, threatens the authenticity and the physiognomy of the countryside and transforms it into an urban playground (Rogers 2017). This aspect is putting countryside at risk of becoming hybrid (Nicholls et al. 2020) in an attempt to offer a particular view of rural life to the visitors or newcomers.

Regardless of the movers' motives, specific rural areas benefited from the newcomers (Davezies 2009; Baudet 2011), and new spatial patterns and attractive areas emerged. The challenge lies in developing the capacity to implement locally targeted interventions focused on retaining the locals' essential needs, and revitalizing the rural population, because the countryside remains an important component of the socioeconomic fabric of Greece.

3.2. Smart Villages in Greece

In Greece, smart villages remain unexplored as an alternative model for rural development. The first coordinated effort to develop planning strategies for smart villages is presented in the framework of the "Preparatory Action on Smart Rural Areas in the 21st Century" and concerns the island of Kythera (Smart Rural 21 2020). At the implementation level (Table 1) there are a number of interventions mainly promoting social inclusion, poverty reduction, and local development, and specifically focusing on economic desertification and job creation, local development, and communication and information technologies (ICT), under the 2007–2013 and 2014–2020 RDPs. To a lesser extent, projects prioritized competitiveness, ecosystem management and resource efficiency, and climate.

Table 1. Projects implemented under the European Network for Rural Development.

Priority	Focus Area	Projects (n)
P2. Competitiveness	2A: Farms' performance, restructuring and modernization	2
P4. Ecosystems management	4A: Biodiversity restoration, preservation and enhancement	2
P5. Resource efficiency and climate	5C: Renewable sources and waste management	1
	6A: Diversification and job creation	3
P6. Social inclusion and local development	6B: Local development	8
	6C: Information and communication technologies (ICT)	1

Source: European Network for Rural Development, authors' elaboration.

Apart from the above, there are also two applied interventions under the act of Social Innovation in Marginalized Rural Areas (SIMRA). The first intervention regarded the small fishing communities in two Aegean islands (SIMRA 2019a) and the second the sustainable and organic agriculture in a remote rural area (SIMRA 2019b). They both aimed

to consider local conditions in order to support and address the challenges of environmental sustainability, poverty, and social exclusion in marginalized rural areas.

4. Bibliometric Approach

The main purpose of this article is to explore the global trends in smart village conceptual and planning approaches, and identify whether these trends are in line with the smart interventions applied in the Greek area. More specifically, this study sheds light on the term smart villages using bibliometric analysis and methods. The selected method provides quantification and assessment of the impact of the particular topic and it was adopted as a main bibliometric method of analysis specifically focused on science mapping (Aria and Cuccurullo 2017). The bibliometric analysis, developed from an approach based on both a traditional literature review (Cooper 1988) and a systematic literature review (Taylor 2012), includes statistical analysis of published articles and citations therein to measure their impact.

The main tool of the article's analysis was package bibliometrix (and BiblioShiny App) (Aria and Cuccurullo 2017), an R-tool as described in detail by Aria and Cuccurullo (2017)—and presents an interesting multitude of results as it is applied in the social sciences (Aria et al. 2020). To outline the existing literature, the Web of Science was utilized. The period from 2010 to 2021 was chosen as the reference period, because it was considered the appropriate period to give the most contemporary approaches to the term under research. The search strategy included the main topic of smart villages and to capture its voice and presence, similar but uncommon terms were used (Table 2). Duplicates were excluded, and only papers in English were considered. A hand search was performed and led to the collection of 444 journal articles (Table 3).

Table 2. Main keywords used in the literature search.

Keywords	Indicative Citation
Smart villages	(Zavratnik et al. 2018; Srivatsa 2015; Smart Village Network 2018; Komorowski and Stanny 2020; Pérez-del Hoyo and Mora 2019; Szanyi-Gyenes 2019)
Smart rural areas	(Doerr et al. 2018; Poggi et al. 2017; Naldi et al. 2015)
Smart countryside	(Bosworth et al. 2020; Lindblom et al. 2021; Zapletalová and Vaishar 2020)
Smart territory	(Giovannella and Roma Ricerche 2014; Navío-Marco et al. 2020; Zvirbule et al. 2017)
Smart alpine	(Stettler et al. 2016)

Table 3. Main information about data used.

Timespan	2010:2021
Sources (journals, books, etc.)	228
Documents	444
Average years from publication	4.13
Average citations per documents	12.98
Average citations per year per doc	2.088
References	23,106
DOCUMENT TYPES	
article	444
DOCUMENT CONTENTS	
Keywords plus (ID)	1081
Author's keywords (DE)	1717

Table 3. *Cont.*

Timespan	2010:2021
AUTHORS	
Authors	1355
Author appearances	1419
Authors of single-authored documents	85
Authors of multi-authored documents	1270
AUTHORS' COLLABORATION	
Single-authored documents	88
Documents per author	0.328
Authors per document	3.05
Co-authors per document	3.2
Collaboration index	3.57

The three-fields plot (Sankey diagram, Figure 1, as analyzed in Riehmann et al. 2005; Fatehi et al. 2020), shows which countries are publishing most on which topic, based on smart villages' related keywords and which journals are publishing on which topics. The left field contains the countries of origin of the sources, the middle field contains the corresponding keywords, and the right field contains the sources of papers used as imported data. The number of items selected in each case is ten. This plot was created to depict the proportion of research topics for each country and the recency of the papers that they cited. The largest numbers of smart village researchers are located in China, Italy, the United Kingdom, and the United States. Despite the global interest in smart villages, different emphases are observed in the research of different countries. The main interests of smart village researchers in China are rural development, innovation in general terms, and more specific social innovation. From this group of researchers, special emphasis is also placed on the research of smart villages that focuses on their country of origin. The interests common to most researchers are rural development and innovation, climate change, and region-specific issues related to government decisions and policies.
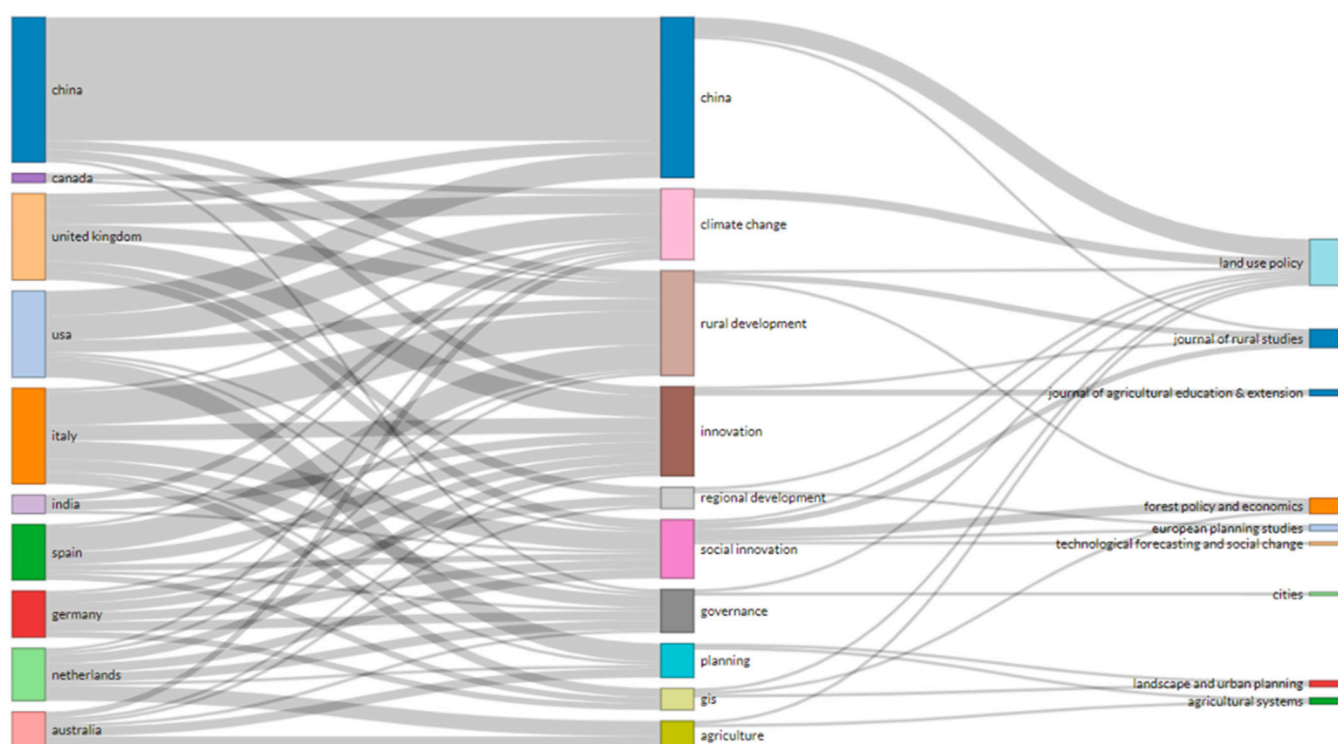

Figure 1. Three-fields plot of research topics for each country and the recency of the papers that they cited.

The most relevant keywords used in the academic articles (Figure 2), which are the base of the present research, are mainly related to innovation, management, policy, growth, and governance.
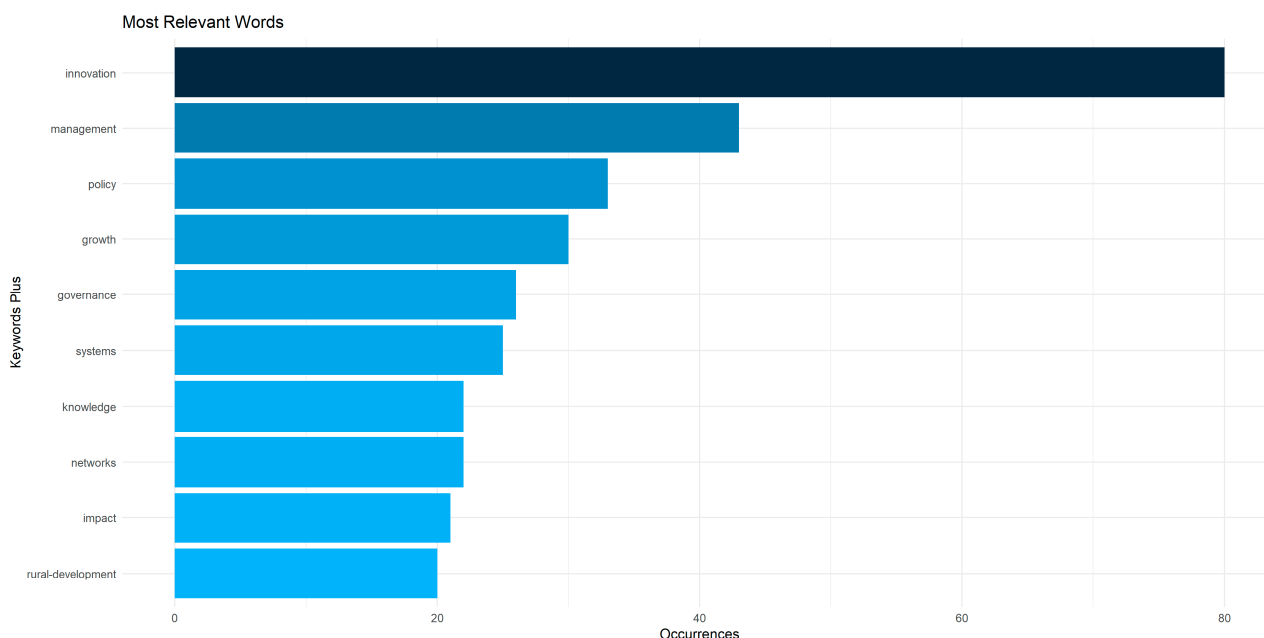
Most Relevant Words

Figure 2. Most relevant keywords used in the academic articles.

The co-occurrence map of the most frequently used terms in the abstracts of the papers (Figure 3) was created to reveal the link between them and visualize the main clusters derived from the corresponding terms. This map unearthed and visualized three main clusters, related to the resilience of rural areas, rural development through social innovation, and economic performance, and one smaller cluster which reveals a link between design, farms, and cities. A closer look at the clusters shows that *resilience* is associated with *conservation*, *growth*, and *performance*. The dominant cluster depicts the connection between rural development and sustainability with innovation terms and key components of innovation procedures and management (i.e., technology, systems, challenges, etc). The terms economic development, governance, policy, power, and food are associated. It therefore seems that there is a dominant tendency of bibliographic focus on the possibilities of innovation, the development of the rural area, and the response and the actions needed to achieve social cohesion.

Figure 3. Co-occurrence map of the most frequently used terms in the abstract of the papers.

The co-occurrence network of the most frequently used keywords map (Figure 4) verifies the previous results but also it better highlights the connections between the dominant concepts and the corresponding keywords. Its score depicts whether their co-occurrences with other noun phrases follow a more or less random pattern (low relevance score) or if they co-occur with a set of other nouns (high relevance).
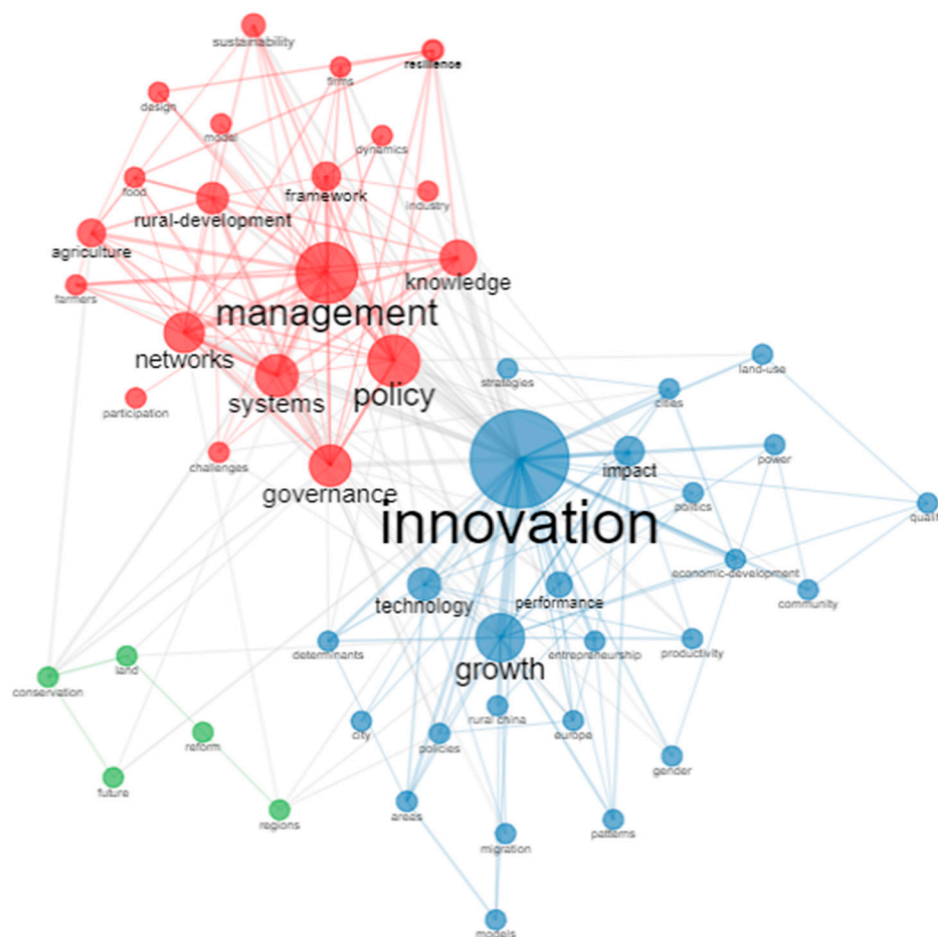

Figure 4. Co-occurrence network of the most frequent keywords.

Three clearly distinct clusters emerge. The first cluster highlights the strong correlation between innovation which can lead to growth and economic development, the prospects and impact of technology, the social and demographic dimensions of the areas under study, and the policies adopted by governments. The second cluster identifies the issues that stem from the principles of management and are the basis for its successful operations or for the implementation of successful policies. More specifically, the second cluster includes the co-occurrence between knowledge and networks (especially for best-practice exchanges between regions), systems development, and the promotion of rural development and resilience. The third cluster concerns the co-occurrence of the transformation of the regions and conversations about their future evolution. Finally, the keywords *innovation*, *growth*, *management*, *policy*, and *governance* display the highest values of betweenness.

5. Discussion

Regarding rural development and population inclusion, the European institutions are looking for a coordinated solution in smart villages (EU 2021; European Commission 2014). The findings suggest that innovation, management, and policy developments seem to be determinant parameters of the contemporary approach of smart villages. There is a dominant tendency of bibliographic focus on the possibilities of innovation, the develop-

ment of rural areas, and the response and the actions needed to achieve social cohesion. The results are in agreement with European institutions at implementing level. There are applied examples of smart villages in several European countries where projects are utilizing approaches based on innovation (European Commission 2020), growth and rural development (Nieto and Brosei 2019), and management (ENRD 2018). These projects shed light on how to assess local needs for services and translate these needs into economically feasible solutions (European Commission 2020).

In terms of management implications, the analysis showed that resilience is associated with conservation and growth to improve systems' performance. This finding is in line with literature, where resilience is often intertwined with the concepts of conservation and growth, on the basis of the model of the adaptive cycle of resilience. That model links ecosystem with resilience and describes the transition from an era with an emphasis on exploitation to an era with a greater emphasis on conservation (Heijman et al. 2019; Luo et al. 2018; Sundstrom and Allen 2019). Smart villages contribute significantly to this transition, as their main purpose is to achieve resilience in rural areas, through the conservation of resources (Slee 2019). The role of smart villages in the resilience of rural areas can lead to improvement in long-term economic performance.

In Greece there is substantial room for improvement of smart villages at implementing level. The analysis shows there were only limited interventions under the 2007–2013 and 2014–2020 RDPs. Interestingly, these interventions were targeted at social inclusion, and local development. The aforementioned interventions though, originate in private initiatives and this necessitates the active engagement of local actors. Targeting innovative concepts, the literature suggests interest in local stakeholders' awareness and perceptions (Falcone 2018), especially regarding empowerment of rural development. Due to the complex local social, spatial, and political fields and the uncertainties emerging in rural areas, there are frequently observed mismatches between goals and priorities. It seems that stakeholder management, regarding their relationships, different objectives and expectations, is vital for rural development and strategies (Longart et al. 2017). Genuine knowledge acquisition from stakeholders for the dynamics of an area is also a key factor needed to address weak strategic valorization (Sisto et al. 2018). According to stakeholders, exogenous factors such as bureaucracy, low technology, and the lack of infrastructure are major weaknesses hindering rural development (Falcone 2019).

The smart approach in Greek rural areas should differ by the spatial and demographic identity of each area. The impacts of space and geography on population distribution and demographic phenomena development (Iyigun 2005) are substantially unique and increasingly interrelated. Given the importance of social inclusion and local development, local stakeholders are encouraged to increase awareness and active involvement and policymakers are encouraged to design interventions according both to marginalized populations' local needs and stakeholders perceptions.

This study has some potential limitations. The bibliometric analysis was based on the Web of Science database. The selection of the specific database among others accessible (Scopus, Google Scholar) limits the range of the existing information perceived. Further research directions should focus on localized bibliometric analysis and field research. The territorial perspective is essential to assess local needs, and implement locally targeted policies and interventions that will support population inclusion.

6. Conclusions

Demographic changes in rural areas such as ageing and depopulation, along with digital lag and geographical peculiarities, contribute to the marginalization of rural local populations. Rural development is a priority for the European Union, which proposes an alternative to marginalization through smart villages. This article attempted to highlight the dominant trends in the smart villages initiative and depict the characteristics of Greek rural areas and populations alongside the implemented localized actions. Innovation, knowledge, growth, and management appear to impact rural smart planning. The limited

localized implemented interventions in the Greek rural areas focus on social innovation and local development, in line with the European directions and the global trends in smart village planning. The study argues that in Greece, a single holistic smart villages model cannot be proposed, due to the country's spatial and demographical variability. The trends identified in this article, though, can be exploited as the basis of implemented locally strategies or policies to successfully encourage resilience, and development, as well as quality of life of marginalized populations. Finally, the connecting link between smart and innovative interventions and spatial development are the stakeholders. To assess development potentials and limitations and formulate locally oriented policies there is a need to create local-aware actors.

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