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SMART TERRITORIES AND THE FACTORS INVOLVED IN THEIR CONSTITUTION: A SYSTEMATIC REVISION

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ABSTRACT

Smart territories encompass both rural and urban areas in diverse integration contexts, making it necessary to know the factors that constitute them to evaluate their applicability in various contexts. The aim of this research was to investigate the factors that influence the formation of smart territories in Latin America. A systematic revision was carried out using the PRISMA declaration guidelines. A search in Dialnet, Redalyc, ResearchGate, Scielo, and Google Scholar produced 18 documents for revision. Articles were found in Colombia, Spain, Mexico, Brazil, and Venezuela, and each country considered specific factors relevant to their reality. Regarding the theme of the studies, a significant part of them focused on the conceptualization of what a smart territory is and the identification of the factors involved in their development. Among the factors found, five were frequently mentioned: innovation based on the generation of knowledge, effective governance, identification of the competitive advantages of the territory, active participation of all sectors of society, and the improvement of quality of life for everyone. It was concluded that access to technology and education implementation are both essential in the development of smart territories, along with democracy and good governance.

Keywords: economy, sustainability, Latin America.

INTRODUCTION

Key economic aspects are of paramount importance for every nation, so they ensure that productive activities continue as efficiently as possible. Sustainability terms have recently gained prominence and, along with the new knowledge economy, have sparked a shift in how these aspects are perceived. This amalgamation is complemented by creativity to face the current variations in productive processes (Mora *et al*., 2020).

New economic archetypes emerge in an attempt to integrate all of these aspects that arise in a society whose dynamic has undergone unprecedented changes as a result of technological influence. These new conformations have been mainly supported by characteristic aspects of urban areas. However, the need for a more comprehensive territorial perspective that also includes rural sectors has become evident (Calderero-Gutiérrez *et al*., 2006).

In this context, the search for adequate terms to describe this reinvention of spaces dates back to the late 1990s in order to avoid the scattering of people. Because technology was not used in the same way that it is today, the data gathered with technology was limited to environmental and fiscal aspects. As the year 2000 approached, the first terms for the new urban denomination were coined: *Smart City* (Harrison and Donnelly, 2011; Söderström *et al*., 2014).

Smart cities are defined as those that use technological innovations to improve their economy, services, and governance (Spicer *et al*., 2019). However, in practice, this concept is often manifested by isolated actions or even simple political or strategic marketing decisions. Additionally, the proposals are centered on particular areas, making the implemented solutions only applicable to the context for which they were designed (García-Ayllon and Miralles, 2015). Finally, placing emphasis on the implementation of smart cities can establish a digital gap with rural areas, where technology is less accessible (Navío-Marco *et al*., 2020).

For these reasons, the term Smart Territory has been proposed, which is based on the socio-technical relations within territories rather than administrative borders, helping solutions be coordinated and coherent, both for cities and rural areas (Navío-Marco *et al*., 2020). A smart territory is defined by economic sustainability, energy self-sufficiency, and technological innovation, while also satisfying the needs of its residents and promoting sustainable development principles (Panuccio, 2019). This concept has a broad focus, allowing for the design of various strategies to promote territorial development, whether through the exploitation of the physical characteristics of the territory, the development of infrastructure associated with information and communication technologies, or the innovative capacity of its human talent (Parada-Corrales *et al*., 2018).

The significance of the evolution of the concept of smart city to smart territory lies in the ability to achieve a higher quality of life for all citizens, not just those who reside in cities. Not only is the development of territories important, but it is also important to do it thoroughly (García-Ayllon and Miralles, 2015). In order to achieve this, we must know the factors that can favor this process, since developing smart territories strengthens the population's attachment to the area and generates local opportunities (Navío-Marco *et al*., 2020), which is essential for all countries.

This study focuses on Latin American countries that are experiencing rapid urbanization, require increased competitiveness, and face significant social and environmental challenges. Knowing the factors that influence the formation of smart territories is critical for understanding how to effectively design and manage these

spaces in the 21st century. As a result, the purpose of this study is to investigate the factors that influence the formation of smart territories in Latin America.

MATERIALS AND METHODS

A systematic revision of literature was performed, following the guidelines of the PRISMA declaration (Page *et al*., 2021). Similarly, inclusion and exclusion criteria were used, as well as search algorithms and databases to recover documents relevant to the topic.

Search strategies

Scielo, Redalyc, Dialnet, Researchgate, and Google Scholar indexes were used for searches. Documents in Spanish and Portuguese were included, with combinations of terms composed of keywords for the appropriate search, represented by T* = Smart territories, using the Boolean connectors "AND" and "OR" (Table 1).

Table 1. Search equations used for article indexation.

T*
Smart territories AND factors or "Smart territories and factors"
Smart territories AND concepts or "Concepts of smart territories"
"Smart territories and problems"

Criteria for inclusion and exclusion

The timeframe used ranged from 2005 to 2021. Likewise, inclusion and exclusion criteria were established for the literature summary (Table 2).

Table 2. Criteria for article inclusion and exclusion.

Criteria for inclusion	Criteria for exclusion
Studies between years 2005 and 2021.	Publications before the year 2005.
Studies that include smart territories and smart cities.	Studies without terms of smart territories or smart city.
Research studies.	Systematic revisions or dissertations.
Studies in *Open Acces*s format.	Studies with scarce author information.

Data extraction and critical evaluation

Articles published before 2005, as well as those in the format of systematic reviews, dissertations, duplicates, those without *Open Access* format, and those with little authorship information, were excluded (Figure 1). The most frequently repeated words were then identified using the word count tool.

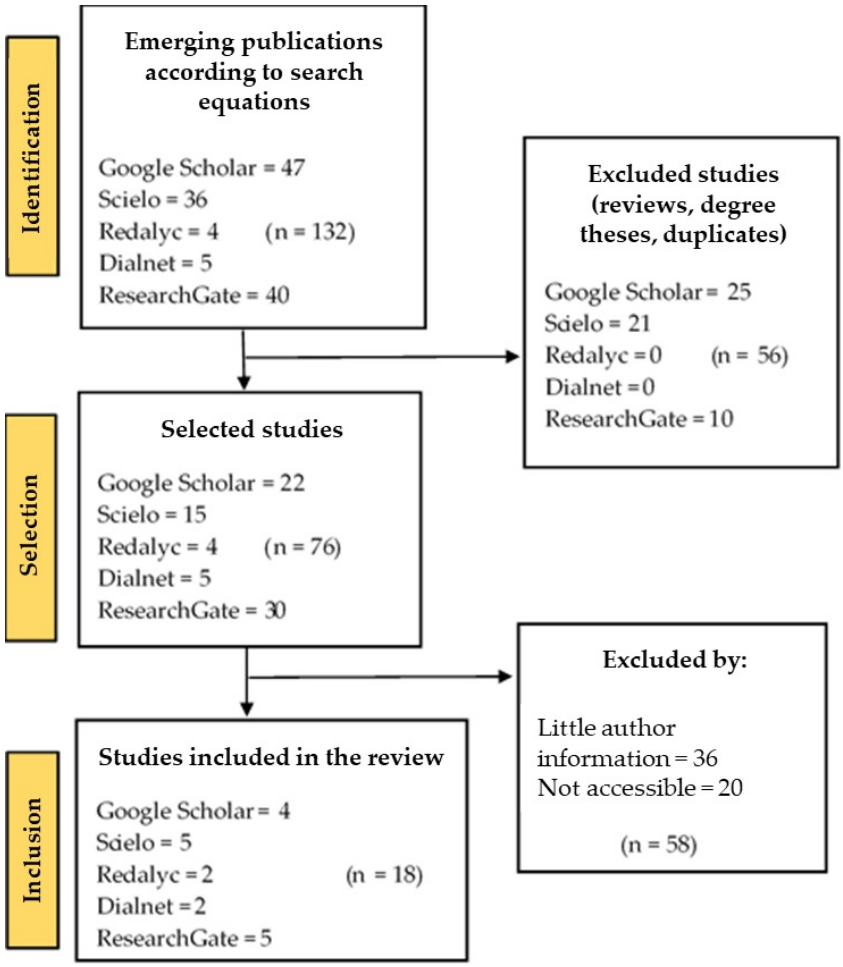

Figure 1. Inclusion and exclusion flow chart used for article selection.

RESULTS AND DISCUSSION

According to the inclusion criteria, 18 articles followed the methodological guidelines. To achieve the goal presented in this study, the information from the articles found (Table 3), as well as their attributes, were synthesized. These documents are consistent with smart territories and their factors, and they show plurinational diversity, authorship data, and year. Another feature of the information gathered is the prevalence of Latin American studies.

Table 3. List of articles reviewed (2005–2021).

	Author, year, and country	Title	Results
1	Ortiz-Chao and Garnica-Monroy (2008), Mexico	Spatial accessibility in the definition of smart territories	Five applications of tools for the integration of territorial structure and mobility are presented: equipment and strategic project location, urban revitalization or recycling, centrality hubs, public transportation, and pedestrian movement.
2	Caravaca-Barroso and García-García (2009), Spain	The debate on smart territories: The case of the metropolitan area of Seville.	Seville's metropolitan agglomeration fails to meet the criteria for a smart territory in terms of economic and integrated territorial development. However, institutions and stakeholders are working to advance innovative economic processes.
3	Rodríguez and Esteban (2009), Spain	Innovation, creativity, and smart territories	Innovation, creativity, and knowledge are critical components in the development of smart territories. Smart territory development strategies must include social, environmental, and cultural dimensions.
4	Álvarez-Areces (2010), Spain	Industrial and cultural inheritance in the landscape: Industrial heritage, landscape, and smart territories	Industrial heritage must be recognized as a new cultural asset. National and international experiences with the industrial revolution are analyzed, highlighting the limitations and opportunities for regional development programs, cultural and industrial tourism, and the establishment of museums and civic equipment.
5	Parada-Corrales (2017), Colombia	Social innovations for "smart" territories: Fiction or reality?	"Smart" territories imply a relationship between citizens, businesses, and the government. In addition to technology, the implementation of a smart city requires modern institutions and good governance aimed at improving the quality of life for the poor.
6	Rolim *et al*. (2018), Brazil	An integrative platform for education in the intelligent territory	SGeol-Educ, a platform that combines georeferenced data with educational information from various sources, is presented. The platform allows users to view information in maps, access data from various sources, and spatialize results related to socio-educational vulnerability factors.
7	Zaldívar-Colado *et al*. (2018), Mexico	Social factors that influence the design of smart cities	To plan a smart city, sustainability, governance, and connectivity must all be considered.
8	Alvarado-López (2017), Mexico	Smart and sustainable cities: Towards a model of inclusive innovation	Smart and sustainable cities seek to improve life quality. To achieve this, local actors must accelerate their learning and collaboration processes. Innovation plays an important role, and its dissemination must promote equality by placing citizens at the center.
9	Flores-Ruiz *et al*. (2018), Spain	Smart tourist destinations or smart territories? Case studies in Spain	Smart tourism destinations are those with technological intelligence. The conversion processes lack governance. Another major flaw in the analyzed destinations is information treatment and accessibility. The four axes that define smart tourism, namely technology, information, sustainability, and governance, are out of balance.

Table 3. Continue.

	Author, year, and country	Title	Results
10	Miranda-Bran and Rendón-Acevedo (2019), Colombia	Smart territories and cities from the perspective of technological surveillance	Achieving a smart city or smart territory requires two components. First, to define a public policy on smart territories that involves both urban and rural areas. Second, technical and financial requirements to model and implement the smart territory project.
11	Márquez-González *et al*. (2019), Mexico	Smart territorial development: The case of La Riviera, Nayarit, Mexico.	Lack of strategic territorial planning is evident in speculation in the sale of agricultural lands, a lack of documentation of residential spaces, and the mixing of residential and commercial zoning in key locations.
12	Rico-Ramírez *et al*. (2019), Colombia	Participative design experiences in Colombia. "Smart" transformation of territories	Community initiatives that are not managed by the state stand out for transforming vulnerable and marginalized areas. In some cases, integration with information technologies has increased participation, but in peripheral and rural areas, the implementation of new technologies remains sporadic.
13	Quintero-Pérez (2020), Colombia	Towards a social focus of smart territories: A first approach.	Refers to seven key elements for the constitution of a smart territory: sustainability and equality, continuous learning and adaptation, knowledge, the identification of competitive advantages, governance, and working as a network.
14	Quintero-Pérez and Gómez-Suárez (2020), Colombia	From smart cities to smart territories: similarities, differences and transcendences	Smart territories are designed by different sectors of the community. In terms of the environmental factor, they assume active protection of the environment and generate a territorial public value. In terms of competitiveness, it is generated by highly qualified human resources.
15	López-Pérez and García-Lobo (2020), Venezuela	Smart rural territories: Guidelines for the curricular reconsideration in territorial development	Rural territories are the result of collaboration among various societal actors (collaborative networks), with knowledge serving as a key component for innovation generation and investment in human resource training serving as a factor in their consolidation.
16	Pulido (2021), Spain	Towards smart facing forest fires	Advocates for a fire-prevention strategy supported by land uses that can economically extract potentially flammable vegetation (timber harvesting, livestock farming, agricultural, and mixed uses).
17	Buelvas-Salgado (2021), Colombia	Guidelines for land use planning and territorial development for Sincelejo based on the smart territories model	A smart territory is based on three dimensions: the economic, the social, and the physical-built.
18	Cervera-Quintero (2021), Colombia	Internet connectivity in Colombia and its relation with the Sustainable Development Objectives (SDOs) (2015–2020)	The study focused on Internet connectivity and its relationship with SDOs. As a result, an attempt has been made to respond to progress toward the SDO 2020 goals.

Analysis by year of issuance

Studies on territorial intelligence revealed a variation in their years of issuance, serving as a point of analysis to determine the temporary importance implied (Figure 2).

The greatest accumulated percentage of studies was found since 2017, with 73 % (13) of the documents. According to Vegara-Gómez *et al*. (2011), the model of smart territories was developed on a global scale at the turn of the millennium, motivated by territorial transformations characterized by a certain dispersion in new cities, as well as on a regional scale, with unprecedented complexity. Likewise, the most notorious changes are attributed to urban areas, which makes research on the repercussions of this new era necessary.

By 2015, cities with more than five million people would concentrate 21 % of the population in urban areas, and 48 % would be concentrated in cities with less than one million inhabitants. This prompted the search for a more comprehensive concept that would allow for the intelligent development of other spaces. As a result, other studies began to be conducted, related to recognizing the smart development of smart territories, exploring their structure, and the factors to consider for a region to be considered as such (Ortiz-Chao and Garnica-Monroy, 2008).

It is evident that the configuration that a geographic area should be present to be called a smart territory was already being outlined. According to Rodríguez and Esteban (2009), the capacity for innovation and the development of knowledge is considered key to the competitiveness and productivity of both companies and territories, with the latter playing a crucial role in the cultural, institutional, local context and internal competencies. Additionally, the preservation of historical-artistic heritage can result in economic benefits (Buelvas-Salgado, 2021).

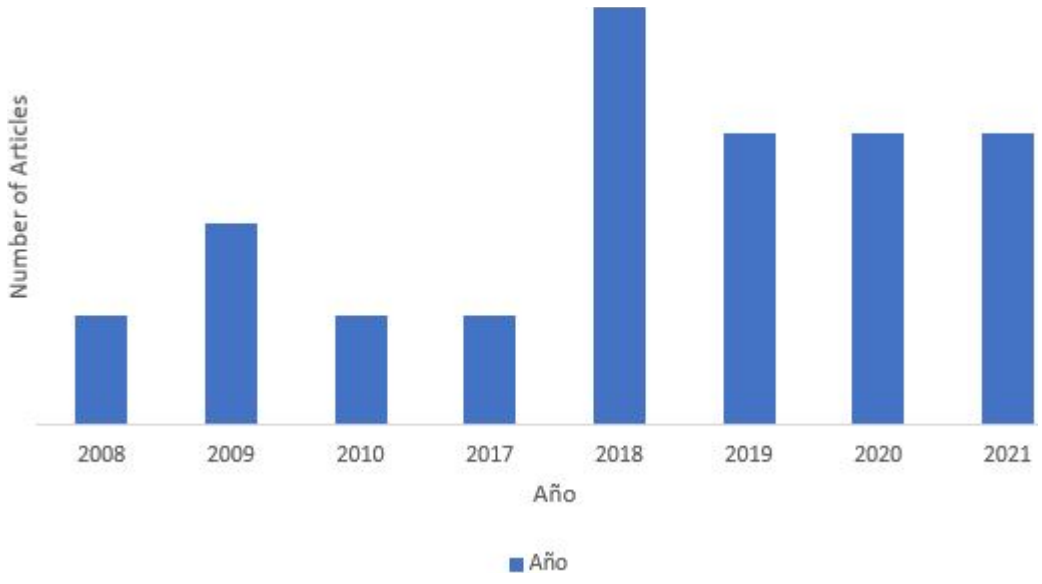

Figure 2. Percentages of research articles published according to the year of release.

The recent increase in investigations responds to the growing need to search for sustainability, as established by Casas *et al*. (2017) in relation to the distinct change that world population dynamics have experienced. This can also be noticed in the most recent studies, which, unlike the investigations cited earlier, focus not only on projection but also on working with what is currently experienced and the technological tools available. (Alvarado-López, 2017).

Analysis by country of origin

The realities of each nation differ for a variety of reasons, including economic characteristics and cultural influences (Cadenas, 2014), making it easier to conduct an analysis based on the origin of the documents found, grouping them by country of origin (Figure 3).

According to the data, the greatest percentage of articles come from Colombia, with 39 % (seven documents), followed by Spain, with 28 % (five documents), and Mexico, with 22 % (four documents), whereas Venezuela and Brazil account for 6 % (one document) each. Colombia has a noticeable interest in the development of smart territories, according to the guidelines of the 2030 Agenda 2030 incentivized since 2015, which consider that the attention to environmental effects cannot be delayed (Guillén-de Romero *et al*., 2020).

One of the important points that stands out in an investigation carried out in Colombia is access to global information as part of the conformation of smart territories, resulting in the need to close digital breaches for vulnerable populations due to the

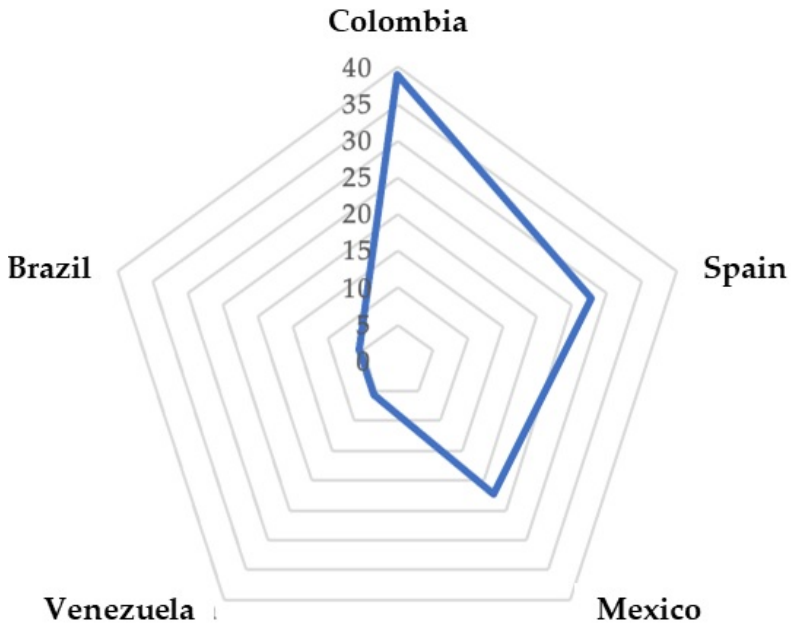

Figure 3. Percentages of research papers published according to country of origin.

disadvantages for them. The study mentions that in 2017, the number of fixed and mobile connections was 80 %, with 20 % of the population having no access to the Internet (Quintero-Pérez, 2020).

Other studies conducted the same year reinforced the premise of low Internet access and pointed out that conditions are difficult for some Colombian regions, such as the Caribbean areas, to be classified as smart territories in terms of population characteristics. Furthermore, although policies aimed at supporting less favored populations are immersed in a halo of corruption, there is evidence of support for the health and education sectors, which are also important factors in the conformation of so-called smart spaces (Cervera-Quintero, 2021; Parada-Corrales, 2017).

In turn, Spain is another country that has committed to investigating smart territories, as evidenced by the percentage of documents found. Prior to 2011, the Spanish experience aided in the identification of key factors for smart territory development. Emphasis was placed on the need for concatenation between democracy, good governance, and territorial governance, hand in hand with new cultures on territory and landscape (Romero, 2011). Four broad principles were established to define a smart territory: sustainability, multidimensionality, collaboration, and participation. However, although the bases of this term are known, there are reports that some sectors, such as tourist destinations, are not in accordance with the smart objectives, due to the complexity of the application of the mentioned requirements (Flores-Ruiz *et al*., 2018).

Certain studies in Mexico examine smart cities, as the term refers to both urban areas and smart territories. Thus, some studies suggest that information technologies are critical to the formation of the aforementioned territories. However, social inequality prevents the development of the less favored population, as previously mentioned (Zaldívar-Colado *et al*., 2018).

Analysis by aims of study

The articles focus their research on different objectives (Figure 4), which can be classified into three categories: analysis of concepts (50 %, nine articles), analysis of experiences and specific cases (28 %, five articles), and use of tools for the formation of smart territories (22 %, four articles). The high percentage found in concept analysis is due to the fact that many studies find it necessary to establish the foundations that define smart territories within the framework of the constant transformations that societies experience. Despite the adequate use of resources being part of the conceptualization of a smart territory, the expansion model is mostly urban and it is based on intensive use, which hinders the application of the required guidelines (Caravaca-Barroso and García-García, 2009).

Along this very conceptual direction, it becomes necessary to revisit a previously mentioned point about the correspondences between smart cities and territories. According to Quintero-Pérez and Gómez-Suárez (2020), the former focuses on the urban aspect, with its main foundation in the use of technology as a factor of

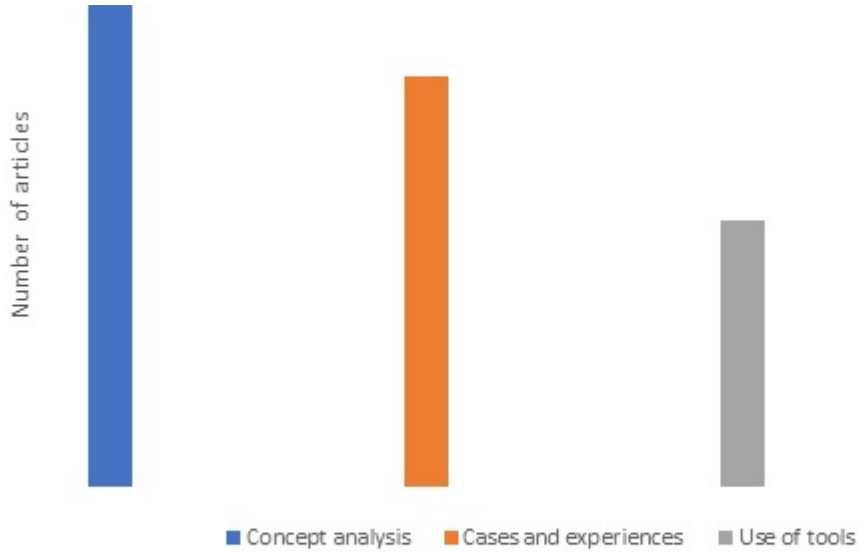

Figure 4. Percentages of articles published according to research objectives.

intelligent development, whereas the latter takes a more comprehensive perspective, contemplating their dynamics and interdependence.

While the conceptualizations support the search for factors that may constitute the smart territories, the experiences and cases show their feasibility and success. Thus, an example is displayed in an applied study in La Riviera, Mexico, where a series of inconveniences related to land use were identified, but access to basic and public services was considered acceptable (Márquez-González *et al*., 2019). On the other hand, a Colombian study shows the participative characterization of the urban and rural, which considers that the success in the implementation of the factors to conform a smart territory lies in the value attributed to collectiveness in terms of decisions made. It was shown that, although there is a greater participatory union of rural inhabitants to achieve the proposed goals, the scarce implementation of technology leads to processes being carried out more slowly than in urban areas (Rico-Ramírez *et al*., 2019).

Based on the above, the use of tools that enable the better operation of a smart city or territory must be included. Some studies advocate for the use of technological surveillance tools, while others use digital platforms to integrate georeferenced data for educational purposes. This helps to analyze the reach of school education (Miranda-Brand and Rendon-Acevedo, 2019; Rolim *et al*., 2018). Similarly, another research proposal suggests implementing "productive firebreaks" to prevent fires from spreading and create a dynamic between unpopulated rural areas. The experience of their application has not only helped against the spread of disasters, but it has also created jobs for local residents (Pulido, 2021).

Factors involved in the constitution of smart territories

Starting off, it is important to note that all of the articles mention the use of technology and innovation as factors to consider when implementing a smart territory, as this is a critical component of considering any space, whether a city or a territory, as smart. Several authors believe that knowledge generates innovation, which must then be used for the common good (Caravaca-Barroso and García-García, 2009; Rodríguez and Esteban, 2019; Quintero-Pérez, 2020). University education, particularly in rural areas, plays an important role in producing, transferring, and applying knowledge (López-Pérez and García-Lobo, 2020). Furthermore, it is necessary to attract, retain, and mobilize local creativity and talent to drive development and innovation, making a territory more competitive (Rodríguez and Esteban, 2009).

Governance was also a frequently mentioned factor, which makes sense because policies to promote a smart territory must be promoted by the state, whether in the tourist, cultural, or environmental fields (Caravaca-Barroso and García-García, 2009; Álvarez-Areces, 2010; Flores-Ruiz *et al*., 2018; Pulido, 2021), to foster innovation (Rodríguez and Esteban, 2009; Parada-Corrales, 2017), and to promote industry, agriculture, education, and transportation (Buelvas-Salgado, 2021). To accomplish this, local governments must plan and define policies for the smart development of the territory (Miranda-Bran and Rendón-Acevedo, 2019; Márquez-González *et al*., 2019). These policies must allow for a sustainable and competitive economy on a global scale (Zaldívar-Colado *et al*., 2018), adapt to the reality of each territory, avoiding model imitation of cities or territories in other countries (Miranda-Bran and Rendón-Acevedo, 2019), and incorporate the participation of formal institutions such as the private sector, voluntary organizations, and the domestic sphere (Rodríguez and Esteban, 2009).

Another factor frequently cited by the authors is the identification of competitive advantages (Quintero-Pérez, 2020). In this sense, territories have either natural, geographical, cultural, or historical resources that can be exploited for the benefit of everyone (Caravaca-Barroso and García-García, 2009; Rodríguez and Esteban, 2009; Álvarez-Areces, 2010; Alvarado-López, 2017; Quintero-Pérez and Gómez-Suárez, 2020; Pulido, 2021). In addition to achieving sustainability by identifying and exploiting the advantages of a territory, new jobs are also created, which can help retain more people in their localities (Quintero-Pérez and Gómez-Suárez, 2020).

A territory in which people participate is another factor in the creation of a smart territory. A civil society is required that is committed, not only to producing goods and services but also to demanding the quality of public goods and services (Parada-Corrales, 2017). Communities can also participate by planning and managing the construction of their spaces, but ideally, social inclusion should be promoted, which means that communities should have the ability to make decisions regarding the problems and needs of territories, which generates a sense of belonging and gives the implemented projects greater chances of success (Rico-Ramírez *et al*., 2019). For an effective solution to problems, organizations, companies, academies, and institutions must also participate (Quintero-Pérez, 2020).

Finally, most authors must prioritize the social factor when designing a smart territory. The goal of promoting innovation in a territory must be to improve people's quality of life, particularly in less favored areas (Parada-Corrales, 2017; Rico-Ramírez *et al*., 2019). Innovation processes must find new and better ways to respond to the needs of a society, although this process must primarily promote equity and inclusion (Caravaca-Barroso and García-García, 2009; Alvarado-López, 2017; Quintero-Pérez, 2020).

The Latin American context poses challenges to the implementation of smart territories. Social inequities, particularly those involving access to digital technology, hinder the implementation of technological solutions, particularly in rural areas. There are also complications in terms of governance, as there is insufficient investment in the infrastructure required for the development of smart territories, inadequate management of each territory's resources, and corruption prevents projects from being delayed or faulty. Furthermore, human resources require information technology (IT) training.

In conclusion, there are still numerous obstacles impeding the consolidation of smart territories in Latin America, particularly in rural areas. However, studies have revealed a growing interest in digital innovation and proposals, particularly in the fields of tourism and culture. Latin America also has natural and energy resources that can be used to implement sustainable solutions in both urban and rural areas, as well as a young and creative human capital that can be educated and stimulate innovation. This work identifies key components for the development of smart territories and suggests that we focus more on rural areas. By doing so, we can make them more competitive, sustainable, and inclusive. A systematic review involving primarily Latin American countries can help identify common patterns and trends in the topic discussed, as well as the challenges that these countries face in the development of smart territories. Finally, the limitations of this study are discussed, which may be attributed to the exclusion of documents from other indexes. Furthermore, by excluding English-language articles, relevant literature on the topic may have been overlooked. Finally, the number of articles discovered does not reflect the realities of Latin American nations.

CONCLUSIONS

In the new millennium, smart territory models have arisen as a response to unprecedented territorial transformations. Initially, the notion of "smart" was associated with urban contexts. However, population growth motivated a more comprehensive approach, also considering peri-urban and rural areas. This change in perspective broadens our understanding and covers the diversity of territorial contexts. By examining the national contexts of several Latin American countries, we gain a more comprehensive and contextualized understanding of the challenges and opportunities for developing territorial intelligence in these countries.

The management of smart territories, whether cities or rural areas, requires the collaboration of several social actors: local governments, communities, the private sector, and organizations. Innovation is crucial, yet its goal must be social well-being, especially for the more unfavored classes. The development of smart territories has the potential to increase citizens' attachment to their communities while also contributing to the reduction of social problems by decentralizing urban populations.

In Latin America, the implementation of smart territories faces challenges. The inequality in access to technology, the lack of investment in infrastructure, inefficient governance, and the scarce formation in information technologies are some of the limitations. Despite this, there is a growing interest in the development of smart territories, and there are natural resources as well as young and creative human capital available to help transform these countries.

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