

# Synergies and complementarities of digital innovation ecosystems in the smart territory development process

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## ABSTRACT - ENG

The concept of smart territories (ST) is a relatively new phenomenon that emerged in the scientific literature as an extension of the smart city (SC) concept and in opposition to it (Navío-Marco et al., 2020). Digital Innovation Ecosystems (DIEs) provide opportunities and pose new challenges related to the interaction between citizens, organizations, and the territories acting in a smart environment. In the scientific discourse, the ongoing expansion of the concept of SC to ST and the development of the phenomenon of DIEs are two parallel trends, with still a lack of scientific evidence on the full-fledged interaction between them for the successful sustainable development of the territories. This dissertation aims at investigating and finding solutions to this knowledge gap.

The objectives of this research are:

1. to provide a conceptualization and definition of DIEs;
2. to get an in-depth understanding of the ST concept;
3. to build a comprehensive model of the interaction between DIEs and ST;
4. to provide an overview of the application of the DIE-ST interaction model in real-life conditions.

Using a qualitative approach, the research consists of four main phases. Systematic literature reviews on the DIE and ST concepts are conducted in order to gain an understanding of the phenomena under consideration. Once the definitions and dimensions of DIE and ST are identified, the research proceeds to their mutual confrontation in order to formulate a DIE-ST interaction model. Case-study of the DIE-ST interplay provides an overview of the application of the DIE-ST model in real-life conditions; interviews with the stakeholders of the territory gain feedback on the DIE-ST interaction model and reveal the shared understanding of the ST, the current state of adoption of digital technologies and DIEs for the development of STs.

The findings of this dissertation contribute to advancing knowledge in the fields of digital transformation and regional development while offering useful managerial implications.

## ABSTRACT – ITA

Il concetto di territori intelligenti (ST) è un fenomeno relativamente nuovo emerso nella letteratura scientifica come estensione del concetto di città intelligente (SC) e in opposizione ad esso (Navío-Marco et al., 2020). Gli ecosistemi di innovazione digitale (DIE) offrono opportunità e pongono nuove sfide legate all'interazione tra cittadini, organizzazioni e territori che agiscono in un ambiente intelligente. Nella discussione scientifica, la continua espansione del concetto di SC in ST e lo sviluppo del fenomeno dei DIEs sono due tendenze parallele che mostrano ancora una mancanza di prove scientifiche sulla loro interazione, per il successo dello sviluppo sostenibile del territori. Questa tesi si propone di indagare e trovare soluzioni a questa lacuna di conoscenza.

Gli obiettivi di questa ricerca sono:

1. fornire una concettualizzazione e definizione di DIE;
2. ottenere una comprensione approfondita del concetto ST;
3. costruire un modello completo dell'interazione tra DIE e ST;
4. fornire una panoramica dell'applicazione del modello di interazione DIE-ST nella vita reale.

Utilizzando un approccio qualitativo, la ricerca si compone di quattro fasi principali. Viene condotta una revisione sistematica della letteratura sui concetti DIE e ST al fine di acquisire la comprensione dei fenomeni in esame. Una volta identificate le definizioni e le dimensioni di DIE e ST, la ricerca procede al loro reciproco confronto al fine di formulare un modello di interazione DIE-ST. Il caso di studio dell'interazione DIE-ST fornisce una panoramica dell'applicazione del modello DIE-ST nella vita reale; le interviste con gli stakeholder del territorio forniscono un feedback sul modello di interazione DIE-ST e rivelano la comprensione condivisa dello ST, lo stato attuale di adozione delle tecnologie digitali e le DIE per lo sviluppo delle ST.

I risultati di questa tesi contribuiscono al progresso delle conoscenze nei campi della trasformazione digitale e dello sviluppo regionale offrendo utili raccomandazioni manageriali.

## INTRODUCTION

The concept of smart territories (ST) emerged in the scientific literature in the 2010s as an extension of the smart city (SC) concept and in opposition to it. Around 55% of the world population and 75% of the European population live in cities, by 2030, six out of ten people are expected to live in a city, and the number will increase to seven by 2050 (World Bank 2019). As the world becomes more urban, cities become smarter (Manville et al., 2014). Since the end of the 20th century, cities have been increasingly looking for solutions to traditional management challenges and eco-environmental problems, as well as the necessary living conditions to raise citizens' satisfaction and well-being, so the phenomenon of SC arises (Gorelova et al., 2021a). The variety of definitions (Yigitcanlar et al., 2019; Laitinen and Piazza, 2020; Salkuti, 2021) confirms that this term defines SCs through a wide range of characteristics and dimensions to provide efficient solutions for economic growth and sustainable development to create high-quality and inclusive life conditions for the citizens. One of the SC's main characteristics is its digitalization, which is not only an inevitable part of SC infrastructure - smart telecommunication networks, intelligent transportation systems, and developed energy infrastructure - but also a fertile land for talent discovery and entrepreneurship. However, the "smartization" of cities (Schivavone et al., 2019; Magnaghi et al., 2021) can produce a digital gap in the territories, particularly in rural and marginal areas that do not have the same services and capabilities that citizens and organizations in urban areas enjoy (Navío-Marco et al., 2020).

The concept of ST arises as a response to the above-mentioned tendencies. Duval and Woo (2010) described ST through the lens of ubiquitous computing as territories of tens or hundreds of kilometers networked with sensors and actuators that may form entities able to inform about and react to their situation. Barbosa et al. (2018) recall it as a bounded space (from communities to a region) with particular features due to the anthropic influence, where the digital transformation is an outcome of a participatory, rational, and comprehensive planning strategy. UNESCO and NETEXPLO (2019) define ST as an application of SC goals and techniques on a smaller scale, such as a neighborhood or a small town. In their report, they claim that we will refer to STs (at plural level) rather than to a single SC in the future. Diversification of the areas to be modernized, in addition to the diversity of civilizations, populations, and urban histories, will require more and more adaptability, both from city pilots and from their modernity providers. Poletti (2015) as well affirms that the transition from the "SC" concept to the "ST" one represents an element of territorial and institutional development recognizing the pivotal role of industrial innovation. Some scholars use both terms interchangeably (Couzineau-Zegwaard et al., 2013; Citrigno, Graziano, Lupia, & Saccà, 2014; Serrano, 2019). Serrano (2019) considers "ST/City/Ecosystem" as a superior design level concept, a "digital system of integrated digital systems" capable of reproducing and serving as a support to optimize monitoring, operation, efficiency, and effectiveness of production structures at micro and macro level. So, the new phenomenon might take advantage of the potentials

of the current scientific-technological revolution and ICT, pursuing economic and management goals in spatial, environmental, and urban planning.

The rapid development of digital technologies creates digital ecosystems that penetrate the everyday life of society. A digital ecosystem is a relatively new phenomenon. It has multiple connotations and dimensions in the scientific literature, but it is univocally recognized as a context or a mode of technological execution of both innovation and business ecosystems (Cassia et al., 2020; Loos et al., 2020; Nugroho and Cahyono, 2021). Some definitions of digital innovation ecosystems (DIE) claim it is a dynamic collective of interdependent agents and the resources they rely on to innovate with digital technology (Wang, 2019; Schiavone et al., 2021). DIEs are giving opportunities but, at the same time, posing new challenges related to the interaction between citizens, organizations, and territories in the changing environment.

In the scientific literature, the ongoing expansion of both SC and ST concepts, recently boosted by the Covid-19 pandemic, and the development of the DIEs phenomenon are the two main parallel trends along which the author aims to promote her research activity. There is still a lack of evidence on the full-fledged interaction between them for a complete economic and business empowerment of territories. This research aims at investigating and find solutions to this knowledge gap.

Hence, in this research, we are dealing with the two main concepts - smart territories (ST) and digital innovation ecosystems (DIE); these phenomena are quite new and are still little used in scientific literature and political, economic, and managerial debate. At the same time, trends such as digitalization, smartization, and emphasis on regional development in the economy on national (Italian) and supranational (EU) levels evidence that the concepts of ST and DIE will be in trend in the coming years. At this debate stage, it is fundamental to integrate a comprehensive technological, economic, and management perspective to fully understand the nature of these phenomena and their causality nexus. So, only with an overall vision of them from multiple interdisciplinary perspectives will it be possible to use all the opportunities that these new trends present and get ready for future challenges.

The objectives of this research are:

1. to provide a conceptualization and definition of digital innovation ecosystems;
2. to get an in-depth understanding of the ST concept;
3. to build a comprehensive model of the interaction between DIEs and ST;
4. to provide an overview of the application of the DIE-ST model in real-life conditions.

The present research has five research stages; four of them pose substantive research questions and result in full-fledged outcomes that could create a field for discussion in academic and managerial circles. The dissertation is organized as follows:



- 1) *the first chapter* is introductive and provides a descriptive analysis of the current trends in the contemporary international agenda on regional development and the role of digital technologies and digital transformation in the regional development process;
- 2) the concept of DIE is studied in detail *in the second chapter*; the main objective of this research stage is to provide a full-fledged definition of the term DIE and the core components of the studied phenomenon; in order to reach the goal and approach based on a systematic literature review (SRL) of scholarly studies is adopted.
- 3) *the third chapter* has the aim of deepening the existing knowledge on the STs, providing the shared definition of the phenomenon under consideration, its dimensions, and conceptual framework based on the evidence gathered from the systematic literature review on the topic;
- 4) once the definitions and dimensions of DIE and ST are identified, the research proceeds to their mutual confrontation in order to formulate a DIE-ST interaction model in the *fourth chapter*;
- 5) case study of the DIE-ST interplay provides an overview of the application of the DIE-ST model in real-life conditions in the *fifth chapter*; interviews with the stakeholders of the territory gain feedback on the DIE-ST interaction model and reveal the shared understanding of the ST, the current state of adoption of digital technologies and the DIEs for the development of STs.

# CHAPTER 1. DIGITAL TRANSFORMATION IN THE REGIONAL DEVELOPMENT CONTEXT. THE CURRENT AGENDA

## Chapter Summary

This chapter is introductory and provides a descriptive analysis of the current trends in the contemporary international agenda on regional development and the role of digital technologies and digital transformation in the regional development process. The chapter represents the initiatives of the United Nations (UN), Organization for Economic Cooperation and Development (OECD), European Union (EU), and Italy as an example of the regional development agenda on a national level. The scientific literature corroborates the narrative on the topic under consideration.

## Overview of the regional development initiatives

The development of globalization processes and the introduction of digitalization in all spheres of everyday life have influenced the change in the position of the region and the increase in its role on national and supranational levels (Kim and Lee, 2022; Öjehag-Pettersson, 2022; Harrison et al., 2020). The formation of the region as an independent actor in the global processes is gradually taking place; in many spheres, regions, and cities, along with countries, become full-fledged actors of the modern global agenda (Gussen, 2020; Hsu et al., 2020; Sabău-Popa et al., 2020). The region represents a fertile ground for the development of entrepreneurial activity, tourism, and culture; a region is a source of natural and labor resources, unique knowledge and skills, as well as a producer of innovative technologies and necessary goods for development (Liu and Gao, 2022; Dubou et al., 2020; Martinus et al., 2020; Singh and Kumar, 2020). Therefore, it is extremely important to pursue a policy to ensure the regions' modernization and sustainable development (Fomina et al., 2020; Wang et al., 2019).

The formulation of the regional development agenda is a complex and necessary process for the country's economy, leading to solving the socio-economic problems of the inhabitants of the region to improving the quality of life of the population by achieving a balance of social, economic, and environmental development through the rational use of all the resources of the region (De Laurentis and Pearson, 2021; Likhacheva and Stepanov, 2021; Randolph, 2019). Hence, the concept of sustainable development plays an important role in the context of the current regional development agenda (Mally, 2021; Dovlen and Hilding-Rydevik, 2016). The sustainable development concept combines three areas: environmental, economic, and social (Guzmán et al., 2017). From the point of view of the environmental factor, sustainable development is aimed at maintaining the viability of ecosystems; the economic component of the concept reveals the issues of optimal use of limited resources and the use of environmentally friendly materials and tools in the production process and the development of energy-saving technologies, as well as the processing and disposal of production waste; the social component of

sustainable development implies a focus on people, the preservation of socio-cultural systems, the implementation of the principles of social partnership and inclusion (Sadollah et al., 2020; Megyesiova and Lieskovska, 2018). Based on the key provisions of the concept of sustainable development, strategic development initiatives are being developed at the international, national, and regional levels.

The UN Centre for Regional Development (UNCRD) was established in 1971 to promote regional development. UNCRD is considered an advantage and a tool to ensure large-scale regional development<sup>1</sup>. The Center's main objectives are to encourage structural changes and social reforms to provide social equity; increase citizen participation in setting development goals, decision-making, and organizational process in collaboration with institutional and administrative structures; more effective integration of urban and rural development and environmental considerations. The UNCRD serves as the training and research center, provides consulting services, promotes the exchange of research data and practical experience, and plays a mediator role between stakeholders of the regional development process. One may see that the main objectives of the UNCRD are similar to those that are essential to sustainable development; hence regional development approach becomes a tool for sustainable development. UNCRD has employed an Integrated Regional Development Planning (IRDP)<sup>2</sup> as the main instrument to promote sustainable development. IRDP applies a multidisciplinary, multi-scalar, and integrated approach, which addresses urban and rural linkages, territorial integration, and a balanced distribution of population and economic activities in a spatial context to attain equity, and social cohesion/justice. Furthermore, IRDP promotes initiatives in participatory planning, an efficient territorial organization, the effective incorporation of environmental and disaster risk management (including climate change), in close cooperation with the other sectors of territorial development (transport, housing, basic and social services, energy, water, economy, etc.). IRDP also works in the enhancement of resilience and better governance by incorporating appropriate institutional arrangements. IRDP embraces a territorial and spatial approach to development. This is a holistic and integrated approach to regional development; its nature consists of transcending sectors and administrative or jurisdictional boundaries to pursue sustainable development at sub-national levels. The territorial and spatial approach embraces the three pillars of sustainable development - the environmental, social, and economic domains, promoting the required articulation of the different scales. The approach is also applied vertically, addressing regional, local, and community levels for empowerment and capacity development. IRDP enables "addressing the existing interdependencies and complementarities between the territories (city-regions, urban agglomerations, systems of cities, and urban and rural linkages), which are mutually related through complex exchanges of materials (resources), services (including environmental services), energy, information, and population". IRDP favors the local stakeholders' dialogue and synergies, common regional visions, and thus participatory planning. The overall objective of the initiative is to enhance the application of IRDP in

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<sup>1</sup> <https://www.uncrd.or.jp/index.php?menu=368>

<sup>2</sup> *ibid.*

Asian, African, and Latin America and the Caribbean (LAC) countries as an effective tool to achieve sustainable regional development. UNCRD serves as an acknowledgment platform for IRDP. It also provides the ground to exchange experiences on regional development planning and management; IRDP conducts training of policymakers and planners; provides technical assistance for policy formulation and integrated regional planning and management processes, including multi-stakeholder consultations as well as implementation and favors networking activities with the regional development stakeholders including UN organizations, aid agencies, central/local governments, universities, training, and research institutes, etc. UN claims cities are the agents of economic, social, cultural, technological, and political changes and advancement (UN-Habitat, 2011); if properly managed and planned, urbanization could be an engine of economic growth and industrialization. The outcome of the UN Conference on Sustainable Development, also known as Rio+20, is the report *The Future We Want*<sup>3</sup> highlights the UNCRD initiatives to address the challenges of cities from a regional development perspective so that the issues of city-rural linkages can be adequately solved through the application of a regional development approach. The report states the commitment to support and apply an integrated approach to planning and building sustainable cities and urban settlements by supporting local authorities, increasing public awareness, and enhancing the participation of urban residents in decision-making; to promote sustainable development policies for inclusive housing and social services; a safe and healthy living environment for all; affordable and sustainable transport and energy; the promotion, protection, and restoration of safe and green urban spaces; safe and clean drinking water and sanitation; healthy air quality; the generation of decent jobs; improved urban planning and slum upgrading; the sustainable management of waste. The reports also underline the importance of considering disaster risk reduction, resilience, and climate risks in urban planning. The report also recognizes the efforts of cities to balance development with rural regions (para. 135).

Organization for Economic Co-operation and Development (OECD) claims that regional development is a broad term but can be seen as a general effort to enhance well-being and living standards in all region types, from cities to rural areas, and improve their contribution to national performance and more inclusive, resilient societies<sup>4</sup>. OECD regional development policy or place-based policies aim to reduce regional disparities within countries across regions by supporting economic activities in all regions. OECD claims place-blind policies (subsidies) have failed to reduce regional disparities significantly; this approach has not helped a number of regions to reduce the gap in development between regions. OECD place-based policies go beyond direct support for less developed regions. They include the initiatives to adapt to specific territorial assets, develop investment and attractiveness strategies, optimize complementarities, develop efficient multi-level governance systems, and favor stakeholders' involvement. OECD works on regional policy, multi-level governance, and policies tailored to rural and urban areas with special attention to national growth strategies, conformity with the Sustainable

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<sup>3</sup> <https://sustainabledevelopment.un.org/futurewewant.html>

<sup>4</sup> <https://www.oecd.org/regional/regionaldevelopment.htm>

Development Goals, resilience to shocks, and regional well-being and inclusiveness. The OECD's activity in regional development policy has evolved in the four work areas: the response to the Covid-19 pandemic – it is the most urgent issue as it is aimed at restoring productivity growth during and after the Covid-19 pandemic and strengthening resilience to future challenges; digitization and regional innovation in another work area that aims the active application of digital solutions and new technologies to increase productivity; transition to a low-carbon economy by rethinking the approach to sustainable development; reduction of regional inequalities by maintaining inclusive growth and well-being for people in all the regions.

To promote regional development, a smart specialization approach is adopted at the European and international levels; this approach defines the methodology for supporting regional development (Giustolisi et al., 2022; Ferreira et al., 2021; Rebolledo et al., 2020). The term "smart specialization" was first formulated by the expert group of the European Commission "Knowledge for Growth" in 2009<sup>5</sup> and became the basis of the strategy for the innovative development of regions. According to the concept's developers, the main goal is to direct public investment in knowledge and innovation. Smart Specialization combines several aspects of industrial, regional, innovation, and educational policies that determine the choice of the priority areas for investment within a region based on its strengths and comparative advantages (Marques Santos et al., 2021). One of the key differences between "smart specialization" and traditional industrial policy is an interactive process, referred to as the entrepreneurial discovery process (EDP)<sup>6</sup>. Support for business research activities contributes to complementing other production areas, realizing internal potential, and creating competitive advantages on the international level. The long-lasting consequences of "smart specialization" are the rising role of scientific, technological, and economic specialization in the formation of comparative advantages and the achievement of economic growth; development of a policy aimed at identifying priority areas of the local economy, taking into account strategic development prospects; favoring managerial decisions aimed at strengthening regions and industries, in order to achieve effective socio-economic results (OECD, 2013).

European regional policy originates from the Treaty of Rome, which established the European Economic Community in 1957. After almost 20 years, the European Regional Development Fund was created in 1975. In 1988 after the accession of Greece (1981), Spain, and Portugal (1986) to the EU, the Structural Funds were integrated into a Cohesion policy, introducing the following key principles: focus on the poorest and most underdeveloped regions; policy planning has become multi-year with a strategic investment orientation; strong involvement of regional and local partners<sup>7</sup>. Regional policy has now become the EU's main investment policy. EU regional policy addresses all regions and cities of the European Union in order to support job creation, business competitiveness, economic growth, sustainable development, and the improvement of

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<sup>5</sup> [https://ec.europa.eu/invest-in-research/monitoring/knowledge\\_en.htm](https://ec.europa.eu/invest-in-research/monitoring/knowledge_en.htm)

<sup>6</sup> <https://s3platform.jrc.ec.europa.eu>

<sup>7</sup> [https://ec.europa.eu/regional\\_policy/en/policy/what/history/](https://ec.europa.eu/regional_policy/en/policy/what/history/)

citizens' quality of life. In 2014-2020, regional policy investment was one-third of the total EU budget. The main regional policy directions of this period are *A Smart Europe*; according to this direction, significant resources were allocated to strengthen research, technological development, and innovation, to improve or provide access to the digital economy and IT services, and to increase the competitiveness of SMEs; *a Sustainable Europe*, with the investments, to support the transition to a low-carbon economy in all sectors, to preserve and protect the environment, to increase resource efficiency and to promote adaptation to climate change, the prevention, and management of environmental risks to make a greener Europe; *an Inclusive Europe*, with the promotion of sustainable and quality employment, social inclusion, the fight against poverty and discrimination and investment in education, training and training<sup>8</sup>. The current European regional policy covers the period from 2020 to 2027 and has five priorities: *a smarter Europe* through innovation, digitization, economic transformation, and support for small and medium-sized enterprises; *a greener and carbon-free Europe*, which implements the Paris Agreement and invests in the energy transition, renewable energy and the fight against climate change; a more connected Europe, with strategic transport and digital networks; *a more social Europe*, realizing the European Pillar of Social Rights and supporting employment, education, skills, social inclusion and equal access to quality healthcare; *a Europe closer to citizens* by supporting locally-led development strategies and sustainable urban development across the EU<sup>9</sup>. Comparing these two periods of European regional development policy, we can see that it has become more citizens-oriented; the approach has also become more individual, taking into account the specific characteristics of the regions. Cohesion Policy invests in all regions based on three categories of regions (less developed; transition; more developed). The method of allocating the funds is still largely based on GDP (gross domestic product) per capita. And then, new criteria are added (youth unemployment, low level of education, climate change, and reception and integration of migrants) to better reflect the reality in particular regions. The outermost regions will continue to benefit from special EU support. Cohesion policy further supports locally-led development strategies and supports local authorities in managing funds. The urban dimension of the cohesion policy is strengthened, with 8% of the European regional development fund dedicated to sustainable urban development and a new networking and capacity-building program for urban authorities, the European Urban Initiative<sup>10</sup>. Within these priorities, each EU Member State has adopted specific national objectives defined within the Partnership Agreement with the European Commission. The Partnership Agreement covers four funds: the European Regional Development Fund (ERDF), the European Social Fund (ESF), the European Agricultural Fund for Rural Development (EAFRD), and the European Maritime and Fisheries Fund (EMFF). The thematic objectives of the previous Partnership Agreement (2014-2020) were oriented toward the development of an innovation-friendly business environment and an e-economy by supporting the competitiveness growth of start-ups and small businesses; concentration on the efficient management of natural resources; promotion

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<sup>8</sup> [https://ec.europa.eu/regional\\_policy/en/policy/how/priorities/2014-2020/](https://ec.europa.eu/regional_policy/en/policy/how/priorities/2014-2020/)

<sup>9</sup> [https://ec.europa.eu/regional\\_policy/en/2021\\_2027/](https://ec.europa.eu/regional_policy/en/2021_2027/)

<sup>10</sup> [https://ec.europa.eu/regional\\_policy/en/funding/erdf/](https://ec.europa.eu/regional_policy/en/funding/erdf/)

of social inclusion and improving the quality of human capital; supporting the quality, effectiveness, and efficiency of the public administrations; strengthening the capacity of institutions involved in the management of European Structural and Investment Funds (ESIF) programs, in particular in the less developed areas<sup>11</sup>. These priorities were the cornerstone of Italy's medium and long-term development strategy. According to the Partnership Agreement for Italy (2014-2020), Italy is allocated around €32.2 billion for Cohesion Policy (ERDF, ESF), including €1.1 billion for territorial cooperation; an additional €10.4 billion were devoted to the development of the agricultural sector and rural areas from the EAFRD; the allocation for the EMFF amounts to some €537.3 million<sup>12</sup>.

The Partnership Agreement for 2014-2020 proposes two territorial classifications in Italy. Firstly, a national classification groups municipalities in types of rural areas in relation to the analysis, monitoring, and identification of the priorities of the rural development policy. Secondly, the Partnership Agreement maps the inner areas of the country. Inner areas are "territories characterized by being far from urban centers that supply adequate services, being rich in natural assets and cultural resources and having diverse natural phenomena and human settlement processes. The criteria to identify these areas is the distance from a 'service provision Centre' (a municipality or group of municipalities able to provide a full range of secondary education, at least one grade of emergency care hospital, and at least one Silver category railway). These definitions are analytical tools to support the definition of local development strategies."<sup>13</sup>.

The new Cohesion Policy Partnership Agreement between the Commission and Italy for 2021-2027 was adopted in 2022. According to the agreement, Italy will receive €42.7 billion from the EU in 2021-2027 to promote economic, social, and territorial cohesion and support sustainable growth, employment and modernization with a particular focus on the Southern regions. The new Partnership Agreement defines the investment priorities to support Italy's green and digital transition while supporting the most fragile socio-economic areas and vulnerable groups. Together with national co-financing, the total Cohesion Policy allocation is €75 billion<sup>14</sup>. The main directions that were set out by the Partnership Agreement and hence the initiative's main objectives are: 1) to strengthen sustainability and fight climate change; 2) to promote smart growth and employment for women and the youth; 3) sustainable fishery<sup>15</sup>. The new agreement is aimed at making energy more clean and affordable by promoting green transition actions and developing low-carbon and circular economy; strengthening sustainable mobility and making regions, cities, and infrastructures more resilient to impacts of climate change and natural risks; enhancing the competitiveness of industry in all regions; the digitalization and productivity of SMEs and the support of R&D&I; development and allocation of social inclusion measures; strengthening the sustainable exploitation and management of

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<sup>11</sup> [https://ec.europa.eu/info/publications/partnership-agreements-european-structural-and-investment-funds\\_en](https://ec.europa.eu/info/publications/partnership-agreements-european-structural-and-investment-funds_en)

<sup>12</sup> [https://ec.europa.eu/info/sites/default/files/partnership-agreement-italy-summary-oct2014\\_en.pdf](https://ec.europa.eu/info/sites/default/files/partnership-agreement-italy-summary-oct2014_en.pdf)

<sup>13</sup> <https://www.oecd.org/regional/Rural-WellBeing-Italy.pdf>

<sup>14</sup> [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_22\\_4562](https://ec.europa.eu/commission/presscorner/detail/en/IP_22_4562)

<sup>15</sup> *ibid.*

aquatic and maritime resources and boosting innovation with the special attention to the local coastal communities<sup>16</sup>.

Other cohesion strategies and tools adopted in Italy are: 1) The National Recovery and Resilience Plan (Il Piano Nazionale di Ripresa e Resilienza), which assigns around 82 billion euros to the development of regions of southern Italy<sup>17</sup>; 2) The National Strategy for Inner Areas (La Strategia Nazionale per le Aree Interne) is a national policy with a strong local orientation, which is aimed at promoting the wealth and diversity preserved in the most remote places of the country, improving the quality of services to citizens and stimulating the capacity of people living in these areas to implement new paths for innovation for sustainable regional development<sup>18</sup>; 3) The Special Economic Zones (Le Zone Economiche Speciali) initiative that was established in 2017 to boost the growth of the Italian South by facilitating the business activity<sup>19</sup>; 4) The Institutional Development Contracts (I Contratti Istituzionali di Sviluppo) that are the agreements between Ministries, Regions, and implementing bodies for the acceleration of the construction of strategic railway and motorway infrastructures<sup>20</sup>; 5) The Territorial Public Accounts System (Il Sistema Conti Pubblici Territoriali) is responsible for measuring and analyzing the financial flows of income and expenditure of public administrations and all entities belonging to the extended component of the public sector<sup>21</sup>; 6) Smart Specialization Strategy (S3) – a cohesion strategy that places the economic and social development of territories driven by innovation and managed through a new multi-level and multi-stakeholder governance model<sup>22</sup>; 7) The 2030 Plan for Southern Italy (Piano Sud 2030) is an investment plan directed to the development of the connected, inclusive, innovative, and green Italian South<sup>23</sup>.

## Digital transformation from a regional perspective

The issues of development and distribution of innovation on the regional level are relevant and extremely important since, without their solution, the adequate functioning of regional ecosystems in accordance with the challenges of the external environment is impossible (Samara et al., 2022; Florida, 2021; Marques and Morgan, 2021). In recent years, innovations have greatly influenced regional development; innovations introduction into all spheres of human activity facilitates sustainable development within regions, which is based on the innovative potential of the territory (Božić, 2021; Kraus et al., 2021; Sánchez-Carreira et al., 2019). Innovations are a factor of economic development since their diffusion determines the prospects for long-term economic growth and is also the solution to many socio-economic problems (Wu et al., 2021; Sidorova, 2019). The

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<sup>16</sup> *ibid.*

<sup>17</sup> <https://www.mef.gov.it/focus/Il-Piano-Nazionale-di-Ripresa-e-Resilienza-PNRR/>

<sup>18</sup> <https://www.agenziacoesione.gov.it/strategia-nazionale-aree-interne/>

<sup>19</sup> <https://www.agenziacoesione.gov.it/zes-zone-economiche-speciali/>

<sup>20</sup> <https://www.ministropersud.gov.it/it/approfondimenti/cis-contratti-istituzionali-di-sviluppo/cosa-sono/>

<sup>21</sup> <https://www.agenziacoesione.gov.it/sistema-conti-pubblici-territoriali/>

<sup>22</sup> <https://www.agenziacoesione.gov.it/s3-smart-specialisation-strategy/>

<sup>23</sup> [https://www.ministropersud.gov.it/media/2003/pianosud2030\\_documento.pdf](https://www.ministropersud.gov.it/media/2003/pianosud2030_documento.pdf)



innovative potential of the region is a set of financial, human, scientific, and technical resources that are used in the implementation of activities in economic development (Saleh et al., 2020; Tronin et al., 2019). Application of innovations in the regional development process is the impetus for the development of knowledge-intensive industries, the production of innovative products that not only find wide demand among the consumers but also increase the level of economic growth in the region and create the basis for sustainable regional development (Ding et al., 2022; Chaplitskaya et al., 2021; Thapa et al., 2019). The region's innovation infrastructure is a complex of interrelated elements that are necessary for the organization and implementation of innovative activities of interested parties – stakeholders of the territory and ensure their interaction to develop and implement innovations (Deegan et al., 2022; Helman, 2020). To develop the innovation infrastructure, it is important to support the cooperation and partnership of all the stakeholders in the innovation process (Santos, 2022; Nieth, 2019; Hauge et al., 2018). The widespread penetration of digital transformation today is crucial for regional development. However, each country or supranational organization is at different stages in developing the digital environment. Digital transformation is “a fundamental change process, enabled by the innovative use of digital technologies accompanied by the strategic leverage of key resources and capabilities, aiming to radically improve an entity and redefine its value proposition for its stakeholders” (Gong and Ribiere, 2021). Digital transformation allows increased efficiency and productivity, as it is the basis for further changes and improvement of existing development processes; it is the main source of sustainable and long-term economic growth (Turgel et al., 2022; El Massah and Mohieldin, 2020). The ubiquitous penetration of the Internet, mobile devices, and the active transition from the offline to the online environment are modifying existing business models, helping to accelerate economic growth and quality of life of the population; digitalization is seen as a strategic task, which is expected to become a qualitative breakthrough in the development of modern society. Digital technologies are changing the ways of social interaction; dramatic changes are taking place in politics, education, everyday life, and culture. Digitalization contributes to the integration of regional SMEs into the global economy, increases competition in the market, and contributes to the emergence and active implementation of innovations and technologies (Khurana et al., 2022; Winarsih et al., 2021). The role of innovations and digital technologies in regional development is growing; this is evident from the discussions at the political and scientific levels.

United Nations Development Programme (UNDP) defines digital technologies as “an ever-evolving range of technologies (like mobile technologies, artificial intelligence, machine learning, blockchain, Internet of Things, and robotics, to name a few) that impact nearly all aspects of our world”<sup>24</sup>. UNDP Digital Strategy 2022-2025<sup>25</sup> claims digital technology is a fundamental force for change that reshapes economies, governments, and civil societies. The development of digital technologies requires both local action and global leadership. With this renewed strategy, UNDP continues its efforts to strengthen

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<sup>24</sup> <https://www.undp.org/>

<sup>25</sup> <https://digitalstrategy.undp.org/>

digital capabilities and accelerate digital transformation in response to the Covid-19 pandemic. United Nations Environmental Programme (UNEP)<sup>26</sup> embraces digital transformation to accelerate and scale environmental sustainability. UNEP applies data, digital technologies, and solutions to the organization's key activities, products, and services in the domains of climate, nature, and pollution. The UN analysis suggests the benefits from digital transformation can potentially reduce carbon dioxide emissions by at least 20%, the use of natural resources in products by 90%, and waste and detoxifying supply chains by a factor of 10-100X. UNEP Digital Transformation subprogramme (2022-2025)<sup>27</sup> includes three strategic actions: 1) support and scale-up of a sustainable digital ecosystem for the Planet; 2) transformation of markets and consuming behavior; 3) strengthening digital literacy, innovation, and e-governance. UN Secretary-General's Data Strategy 2020-22<sup>28</sup> is another initiative in the digital transformation domain; it proclaims data a strategic asset; with a problem-driven approach, it helps to build the capabilities to unlock the UN's data potential, advancing a transformation in people, culture, partnerships, data governance, and technology. The Data strategy is expected to provide reference to the Member States who seek data-driven change. UN Secretary-General's Strategy on New Technologies<sup>29</sup> defines how the UN will support the use of new technologies like artificial intelligence, biotechnology, blockchain, and robotics to accelerate the achievement of the 2030 Sustainable Development Agenda. UN Secretary-general's roadmap on digital cooperation<sup>30</sup> was adopted in 2020 and defines eight key areas for action: achieving universal connectivity by 2030; promoting digital public goods to create a more equitable world; ensuring digital inclusion for all, including the most vulnerable; strengthening digital capacity-building; ensuring the protection of human rights in the digital era; supporting global cooperation on artificial intelligence; promoting trust and security in the digital environment; building a more effective architecture for digital cooperation.

OECD claims that digital technologies have the potential to contribute to inclusive and sustainable development “by spurring innovation, generating efficiencies and improving services”<sup>31</sup>. As well as the UN agenda, OECD sees digital technologies as an important tool for countries worldwide to face challenges brought on by the Covid-19 pandemic. OECD’s main areas of work in the domain of digital transformation embrace the actions to develop the technologies (artificial intelligence; blockchain; broadband, and telecom) but also the areas of the new technology application (consumer policy and product safety; digital economy; digital government; digital security). The main objective of the OECD Going Digital project<sup>32</sup> launched in 2017 is to provide policymakers with an understanding of the nature of digital transformation in order to develop appropriate policies to promote digitalization.

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<sup>26</sup> <https://www.unep.org/>

<sup>27</sup> <https://www.unep.org/explore-topics/technology/what-we-do/digital-transformation>

<sup>28</sup> [https://www.un.org/en/content/datastrategy/images/pdf/UN\\_SG\\_Data-Strategy.pdf](https://www.un.org/en/content/datastrategy/images/pdf/UN_SG_Data-Strategy.pdf)

<sup>29</sup> <https://www.un.org/en/newtechnologies>

<sup>30</sup> <https://www.un.org/en/content/digital-cooperation-roadmap>

<sup>31</sup> <https://www.oecd.org/g20/topics/digitalisation-and-innovation>

<sup>32</sup> <https://www.oecd.org/digital/going-digital-project>

EU has defined the incentives to promote innovation that are based on three pillars - open innovation, open science, and open the world (EU, 2016). Open innovation means opening the innovation process to people with experience in sectors other than academia and science; by including more people in the innovation process, knowledge can be transmitted more freely; this knowledge can then be used to develop products and services that create new markets. Open science - is a scientific process approach that focuses on disseminating knowledge as it becomes available using digital technologies. Open the world pillar is aimed at promoting international cooperation in the research community to ease access to the latest research from around the world, address global challenges and create business opportunities in emerging markets. Speaking about the EU digital policy<sup>33</sup>, the European Commission launched the single digital market in 2015 and presented its main legislative proposals in the digital field, including proposals to promote 1) e-commerce, 2) e-privacy, 3) data protection, 4) the harmonization of digital rights, and 5) information security. Following the 2014-2019 Digital Single Market Strategy<sup>34</sup>, the European Commission published a set of documents in 2020 that define Europe's digital future. The EU's digital strategy highlights the EU's intention to position itself as the world leader in the digital market. The main objectives of the strategy are: 1) technology that works for people - this objective is directed to the development, implementation and dissemination of technology that really makes a difference in people's daily lives, of a competitive digital economy that respects European values; 2) a fair and competitive digital economy - a single market, where businesses of all dimensions and in any sector can compete and develop, use digital technologies, products and services to increase their productivity and competitiveness; 3) an open, democratic and sustainable digital society – is devoted to the development of a reliable environment in which democratic values are strengthened, fundamental rights are respected and a sustainable and efficient economy is supported; 4) Europe as a global digital player - the EU is committed to setting global standards for emerging technologies and will remain the most open region to trade and investment in the world, as long as anyone who comes to work here accepts and respects European values.

According to the Italian Strategy for technological innovation and digitalization of the country 2025 (Strategia per l'innovazione tecnologica e la digitalizzazione del Paese)<sup>35</sup> innovation and digitalization are inevitable components of the country's structural reform that promotes more democracy, equality, ethics, justice, and inclusion and generates sustainable growth in respect of the human being and our Planet. The first challenge of the strategy is creating a digital society in which citizens and businesses use efficient digital services of the Public Administration in a simple and systematic way. This objective is based on the creation of better digital infrastructures, the enhancement of data, the creation of digital skills, on the radical digitization of the public sector, which will also give impetus to the digital transformation of the private sector. The second

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<sup>33</sup> [https://ec.europa.eu/info/publications/EC-Digital-Strategy\\_en](https://ec.europa.eu/info/publications/EC-Digital-Strategy_en)

<sup>34</sup> [https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/shaping-europe-digital-future\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/shaping-europe-digital-future_en)

<sup>35</sup> <https://assets.innovazione.gov.it/1610546390-midbook2025.pdf>

challenge proposes structural changes to develop innovation in the country. In particular, we want to encourage the design and application of new technologies in the Italian production fabric and the growth of technology sectors such as robotics, the mobility of the future, artificial intelligence, and cyber security. The third challenge addresses the human challenge's central theme of the fourth industrial transformation. Working for ethical, inclusive, transparent, and sustainable innovation that increases society's well-being is this challenge's goal. Digital Republic (Repubblica Digitale)<sup>36</sup> is the national strategic initiative to fight the digital cultural divide present in the Italian population to support maximum digital inclusion and foster education on the technologies of the future, accompanying the country's digital transformation process. The strategy represents an organic and complete response to the issue of digital skills. In this context, the National Strategy for Digital Skills and the related Operational Plan has been developed to strengthen, integrate, and enhance the projects already in progress and develop actions. The Italian National Strategy for Digital Skills (Strategia Nazionale per le Competenze Digitali)<sup>37</sup> was adopted in 2020. The four axes of intervention of the strategy are 1) higher Education and Training - for the development of digital skills for young people; 2) active workforce - to ensure adequate digital skills in both the private and public sectors, including e-leadership skills; 3) ICT specialist skills - to enhance the country's ability to develop skills for new markets and new employment opportunities, largely linked to emerging technologies and the possession of the skills necessary for the jobs of the future; 4) citizens - to develop the digital skills necessary to exercise citizenship rights and conscious participation in democratic life. The main goal is to eliminate the gap with other European countries, in general terms of digitization and with respect to the individual axes of intervention, and to break down the digital divide between various areas of our national territory. The objectives of the strategy are to raise the share of the population with at least basic digital skills to 70%, with an increase of over 13 million citizens compared to 2019, and close the gender gap; duplicate the population with advanced digital skills; triple the number of ICT graduates and quadruple those of women, double the share of companies that use big data; increase the share of SMEs using ICT specialists by 50%; increase the percentage of the population using public digital services by five times, reaching 64%. To bring the Internet spread to the levels of the most advanced European countries, even in the less young segments of the population (84% in the 65-74 age group).

## Conclusion remarks

In this chapter, we reviewed some aspects and initiatives at the international and national levels on regional development and the application of digital technologies to support digital transformation initiatives. Regional development initiatives follow the SDG agenda, aiming to improve the society's quality of life by achieving a balance of social, economic, and environmental development through the rational use of all the resources

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<sup>36</sup> <https://repubblicadigitale.innovazione.gov.it/it>

<sup>37</sup> <https://innovazione.gov.it/notizie/articoli/l-italia-ha-la-sua-strategia-nazionale-per-le-competenze-digitali>

of the regions. To promote regional development, supranational organizations such as the UN, OECD, and EU are developing and applying holistic and integrated place-based approaches and policies that favor participatory planning and social cohesion; to reduce disparities in order to enhance well-being and living standards. The incentives adapted are mainly focused on specific territorial assets, provide investment and attractiveness strategies, optimize complementarities, develop efficient multi-level governance systems, and favor stakeholders' involvement. Regional development strategies contribute to national performance and more inclusive, resilient societies. Digital transformation and innovation initiatives are becoming inevitable in regional development. The ubiquitous penetration of digital technologies helps accelerate economic growth and the population's quality of life; digital technologies are changing the ways of social interaction in politics, education, everyday life, and culture. The range of policies adopted on supranational and national levels support the diffusion of digital technologies helping to reduce the digital gap between countries and regions.

## CHAPTER 2. CONCEPTUALIZING AND DEFINING DIGITAL INNOVATION ECOSYSTEMS

### Chapter Summary

The rapid development of digital technologies creates digital ecosystems that penetrate the everyday life of society. A digital ecosystem is a relatively new phenomenon. It has multiple connotations and dimensions in the scientific literature, but it is univocally recognized as a context of technological execution of both innovation and business ecosystems. Digital innovation ecosystems (DIEs) give new opportunities but, at the same time, pose new challenges related to the interaction between citizens, communities, organizations, and territories in the rapidly changing environment. The concept of DIE is only partially debated in the scientific literature. Hence, the main objective of this research is to provide a full-fledged definition of the term DIE and the core components of the studied phenomenon. In order to reach the goal, an approach based on a systematic literature review (SRL) of scholarly studies is adopted. SRL on the definitions and dimensions of DIEs provides evidence on the nature and components of this rising trend, allowing an in-depth understanding of the dynamics in this domain. The main results of the research are the aggregation and analysis of the various definitions and components of the DIEs, their systematization and formulation of comprehensive and shared ones, identification of internal and external context DIE variables, and levels of the DIEs allocation.

### Background information

Digital technologies are the key elements that are shaping the everyday life of society nowadays. Digitalization is becoming an important topic of discourse both in scientific literature and at the governmental, national, and supranational levels. Thus, the United Nations digital strategy 2022-2025 aims to create a world in which digital is an empowering force for people and the Planet in three directions of change – structural transformation, leaving no one behind, and building resilience (UNDP, 2022). One of the European Commission's (EC) main priorities for the 2019-2024 period is "A Europe fit for the digital age" - the European Union's (EU) digital strategy will empower people with a new generation of technologies. The EU's digital strategy aims to make digital transformation work for people and businesses. The main three pillars of the European approach are 1) technology that works for the people, 2) a fair and competitive digital economy, and 3) an open, democratic, and sustainable society (European Union, 2020). More incentives on national and supranational levels were discussed in Chapter 1 of this dissertation.

The digital age is characterized by technology, which increases the speed and breadth of knowledge turnover within the economy and society (Shepherd, 2004). Indeed the digital transformation of the last decades has strongly affected markets, customers, firms (Verhoef et al., 2021), and diffusion of innovation (Yoo et al., 2010). As a result of these

changes, the limits and the barriers among the economic actors have fallen, new products and services are introduced, and now there are more efficient ways to do business (Schwertner, 2017). In this new dynamic context, the innovations are increasingly the result of a network that could present the form of an "ecosystem" (Kolloch M. & Dellermann D., 2018) and less and less the result of the action of a single entrepreneur (Hagedoorn, 1996); all this poses new challenges to the actors involved in innovation processes (Adner and Kapoor, 2010). The concept of "Ecosystem" is widely studied in the literature (Adner, 2006; Iansiti and Levien, 2004; Christensen and Rosenbloom, 1995; Kolloch and Dellermann., 2018; Basole, 2009) as well as the concept of "Innovation systems" (Freeman et al. 1987; Breschi and Malerba, 1997) but the "Innovation ecosystems" has become popular during the last years and the debate around the ambiguity of the term has been increasing in time (Granstrand O. & Holgersson M., 2020). A synthetic way to describe this phenomenon is reported in Dodgson M. et al. (2014), where the "Innovation ecosystems" are defined as a range of different ways to define value-creating interactions among different actors; in fact, it can represent a new way to conceive the value creation linked to the concept of innovation (Adner and Kapoor., 2010). Digital Innovation Ecosystems (DIEs), being an inevitable part of the innovation context, lack a coherent theory to synthesize diverse opinions, experience-based insights, and research findings about DIEs (Wang, 2020). So the main goal of this research is to gather evidence in the scientific literature on the definitions and core components of the DIEs with their further conceptualization.

The chapter is organized as follows: section two, step-by-step illustrates the research method applied to the study and introduces the research questions; in section three, the study's results are represented; section four provides concluding remarks on the study.

## Research methodology

A systematic literature review (SRL) is a key tool of an evidence-based approach that enables a researcher to analyze and structure the knowledge existing in the scientific literature for its further practical and scientific use (Tranfield et al., 2003). Following the format of previous SLRs (Durach et al., 2017; Savastano et al. 2019), a six-step review process was carried out in this research.

(1) Stage one of our research involves *the definition of the research questions and keywords*. The study aims to gather evidence in the scientific literature on the definitions and core components of DIEs. The DIE phenomenon entered the international scientific discourse more than a decade ago, but its characteristics are still illegible and depend on the research context. Therefore, the author of this study found it interesting to explore the plethora of scientific literature where the DIEs were discussed. In order to do so, the keyword combination "digital innovation ecosystem\*" was chosen; a wildcard \* was applied to the keyword combination to embrace the cases when the keyword combination was used in the plural. Taking into account all of the above, the main research question (RQ) of this research stage is:

**RQ:** What is the state-of-the-art of academic literature regarding the DIEs discussion?

The nature of the research approach and the aim of this study imply the deepening of the existing knowledge on the DIEs, so the following sub-research questions (SRQ) should be answered in the study:

**SRQ1:** What are the system levels of the DIEs discussion?

**SRQ2:** What DIEs definitions are presented in the scientific literature?

**SRQ3:** What are the main DIEs components and their interplay?

**SRQ4:** What are the common dimensions of the DIEs discussed in the scientific literature?

(2) The next step of the study is *the determination of the required characteristics of the studies and the inclusion criteria* in order to focus on relevant and rigorous literature sources only:

- The author studied the peer-reviewed articles and conference papers written in English, with no limitation on the year of publication; this way, the whole amount of literature on the topic could be retrieved; for the same reason, no geographical limitations were applied;
- To ensure academic quality, the Web Of Science (WOS) and Scopus online databases were used in the research because these databases guarantee peer-reviewing of the articles; the study was corroborated by supplementary materials identified in Google Scholar – so in a case when the articles were extracted from Google Scholar database the author additionally checked whether the study was subject to a peer review;
- The central theme of the studied articles was chosen intentionally in order to not limit the future results of the research and to study the discussion on the DIEs in their wide variety.

By following these criteria, we included all the papers relevant to the purpose of the study and ensured their quality.

The summary of the inclusion criteria and their characteristics is presented in Table 1.

Type of inclusion criteria	Characteristic of inclusion criteria
Document type	Articles and research papers
Time period	Not specified
Language	English
Geography	Worldwide
Databases	Scopus, WOS, Google Scholar

*Table 1. Inclusion criteria and their characteristics*

(3) Stage three involves the primary *retrieving a sample of potentially relevant literature* according to the keywords and inclusion criteria discussed using the default search field TITLE-ABS-KEY in Scopus, Topic field in WOS, and the above-mentioned keywords combination in the search box of Google Scholar.



(4) In the fourth stage of the study, pertinent literature was selected. The Preferred Reporting Items for Systematic Review (PRISMA 2020) checklist was adopted for the stages of identification, screening, and inclusion of papers in this review (Page et al., 2021). PRISMA represents the widely accepted methodological standard for performing systematic literature reviews in business and management studies and related fields (Ambad, 2022; Sikandar and Kohar, 2021). Figure 1 represents the PRISMA flow diagram to report the different stages of literature selection.

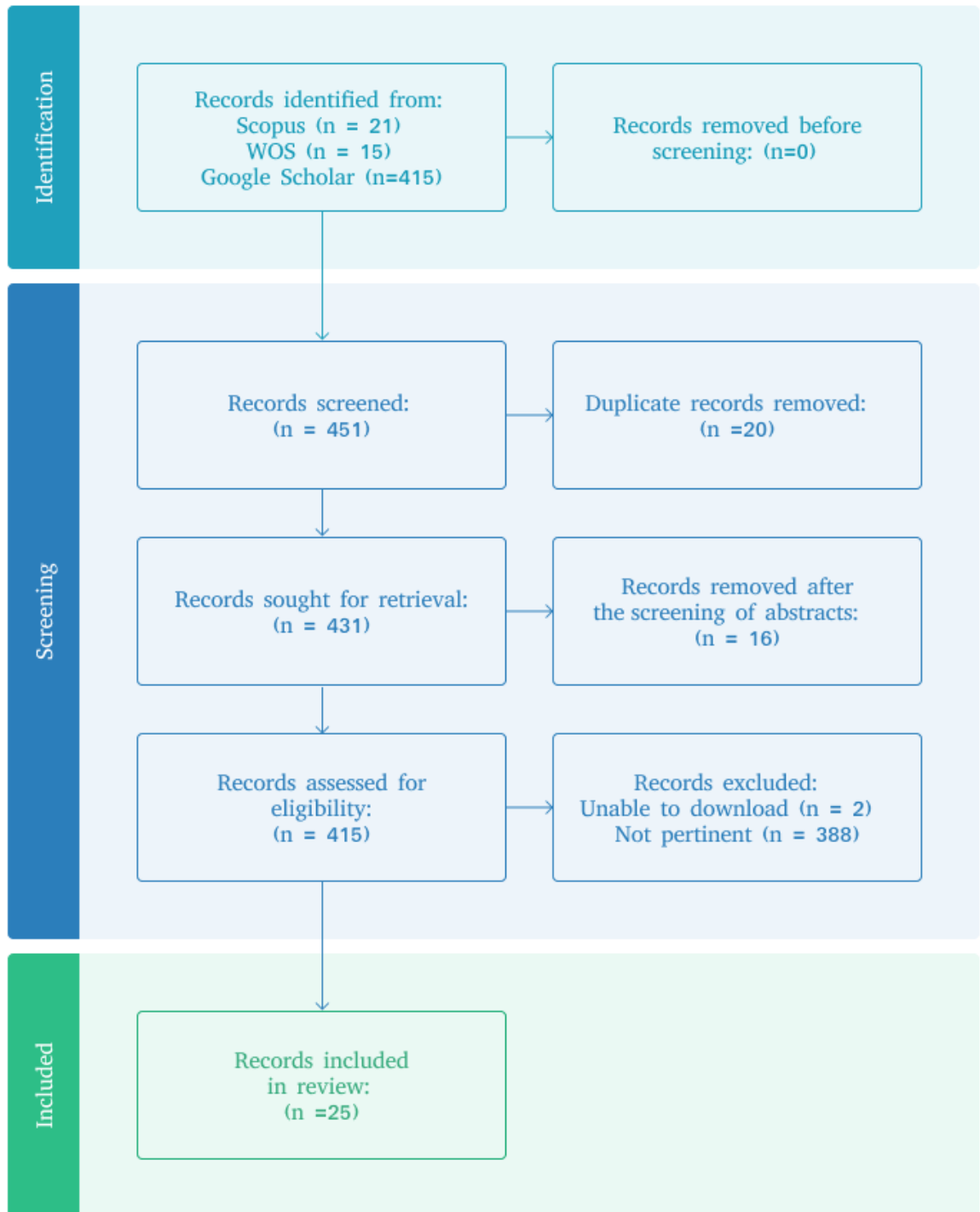


Figure 1. Articles' selection stages based on PRISMA 2020 flow diagram

(5) The next step of the systematic review process includes *synthesizing the literature* by applying a "coding scheme to extract pertinent information from the literature and synthesizing studies by summarizing, integrating, or cumulating the different findings across the primary studies" (Durach et al., 2017). The coding categories were predefined and corresponded to the aim of the study and its RQ and SRQs.

(6) Finally, the study's results were analyzed and reported providing a descriptive overview of the studied literature and discussing thematic findings answering the RQ and SRQs discussed above. The findings of the review process are presented in the next paragraph.

## Results and discussion

### *Characteristics of the studied literature*

As it was already mentioned in the paragraph above, we selected 25 articles from 451 found in 3 databases for our research. Figure 2 shows the distribution of studied literature by year. The first mention of DIE dates back to 2011, but research on the topic has been growing since 2018, peaking in 2020. Such a distribution of the literature may indicate that the DIE phenomenon is just beginning to enter the scientific discourse even though the studied literature shows in-depth research on this topic.

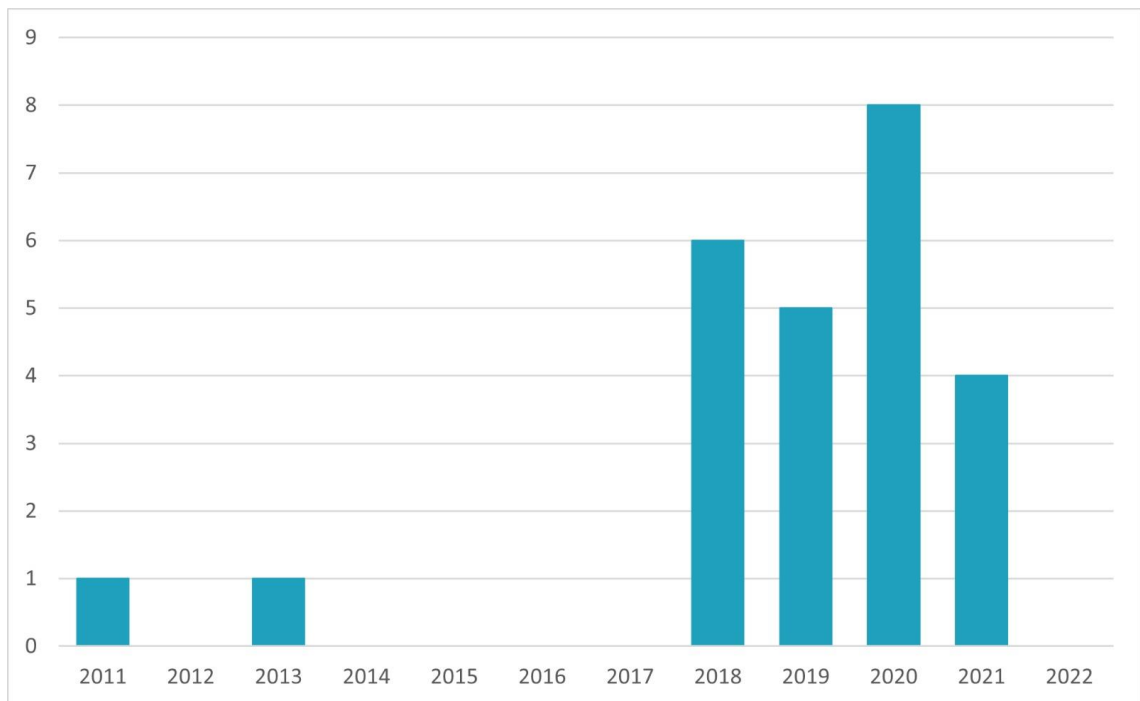
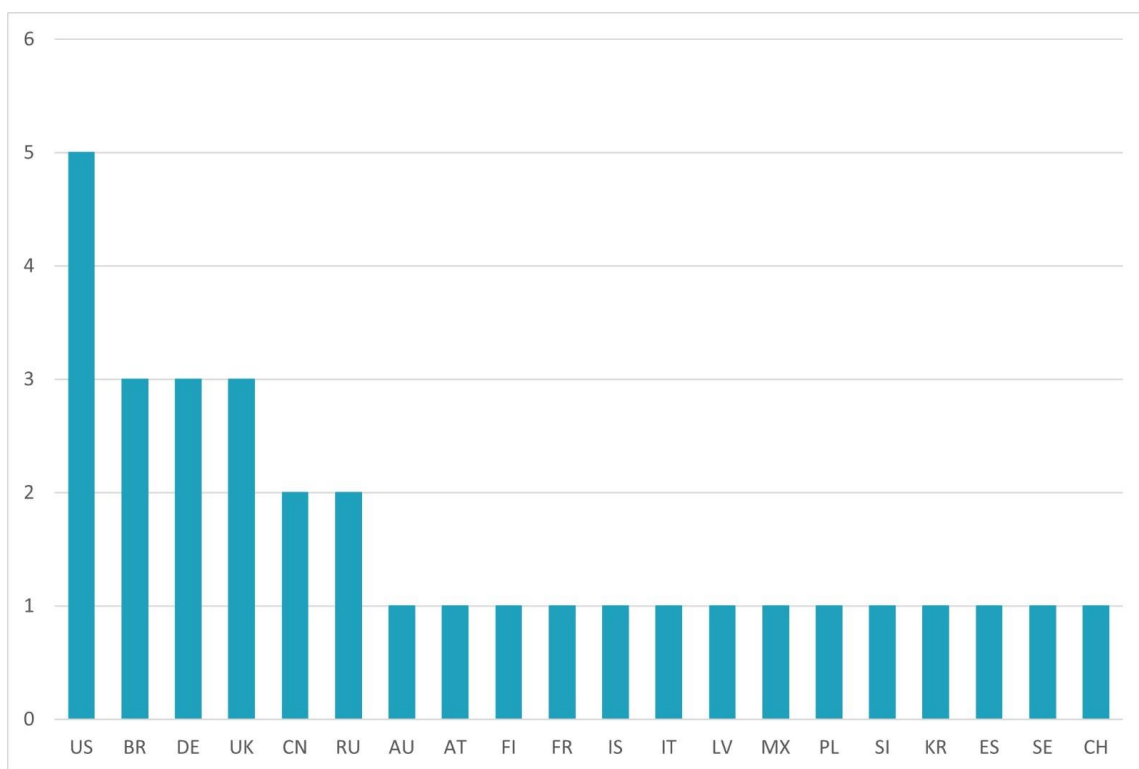


Figure 2. Distribution of the articles by years

Figure 3 shows the distribution of studies by country. As can be seen from the graph, the USA is the leader in DIE research, and Brazil, Germany, and the UK are in second place. Other EU countries represented in the scientific literature are Austria, Finland, France,

Italy, Latvia, Poland, Slovenia, Spain, and Sweden. In total, the countries of the EU account for approximately half of the studies.



*Figure 3. Distribution of the articles by country*

The distribution of articles in table 2 is heterogeneous; the articles are almost equally distributed between the sources and their types – journal publications and conference proceedings. The author believes this may indicate the gradual settlement of the DIE phenomenon into the scientific discourse in recent years.

Journal	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22	Tot.	%
Advances in Intelligent Systems and Computing										1			1	4
IEEE Transactions on Engineering Management											1		1	4
Intereconomics									1				1	4
International Journal for Innovation Education and Research								1					1	4
International Journal of Information Management									1				1	4
Journal of Cleaner Production										1			1	4
Journal of Electronics and Information Science										1			1	4
Journal of Strategic Information Systems								1					1	4
MIS Quarterly: Management Information Systems											1		1	4
Project Management Journal									1				1	4
Research Policy										1			1	4
Sensors										1			1	4
Studies of Transition States and Societies										1			1	4
Technological Forecasting and Social Change								1					1	4
Technology Analysis & Strategic Management									1				1	4
<b>Conference proceedings</b>	<b>'11</b>	<b>'12</b>	<b>'13</b>	<b>'14</b>	<b>'15</b>	<b>'16</b>	<b>'17</b>	<b>'18</b>	<b>'19</b>	<b>'20</b>	<b>'21</b>	<b>'22</b>		<b>%</b>
22nd Pacific Asia Conference on Information Systems								1					1	4
27th European Conference on Information Systems										1			1	4
31st International Business Information Management Association Conference								1					1	4
40th R&D Management Conference "R&Designing Innovation: Transformational Challenges for Organizations and Society"								1					1	4
8th International Conference on P2P, Parallel, Grid, Cloud and Internet Computing			1										1	4
Hawaii International Conference on System Sciences (HICSS)											1		1	4
International Congress and Conferences on Computational Design and Engineering									1				1	4
Portland International Center for Management of Engineering and Technology	1												1	4
Russian Conference on Digital Economy and Knowledge Management										1			1	4
Working Conference on Virtual Enterprises											1		1	4
<b>Total</b>	<b>1</b>		<b>1</b>					<b>6</b>	<b>5</b>	<b>8</b>	<b>4</b>		<b>25</b>	<b>100</b>

Table 2. Distribution of selected articles by journals and publication date

Table 3 represents the most used keywords in the studied literature ranked from 1 to 6, given that other collected keywords have the frequency 1, which is explained by the limited range of the studied literature. In addition to the keywords used to retrieve the literature, the most frequently used keywords are predictably connected to the specific elements of the digital innovation domain. However, the sample also included keywords related to the stakeholders of the DIE – start-ups and innovation community which we will discuss below.

<b>Keyword</b>	<b>Frequency</b>	<b>%</b>	<b>Rank</b>
innovation system	8	9,36	1
ecosystem	6	7,02	2
digital innovation	5	5,85	3
digitalization	4	4,68	4
Industry 4.0	4	4,68	4
digital innovation ecosystem	3	3,51	5
digital transformation	3	3,51	5
ecology	3	3,51	5
start-ups	3	3,51	5
digital ecosystem	2	2,34	6
innovation community	2	2,34	6
open innovation	2	2,34	6
technology	2	2,34	6

*Table 3. Distribution of the keywords by frequency*

### *Definitions of the DIEs*

The literature body proposes several DIE definitions presented in table 4. According to the evidence gathered, DIE could be defined as a complex innovation ecosystem of sociotechnical nature aimed at creating new products and services using digital technologies in order to create value; the scholars stress the presence of technological (digital) and social (physical) mutually interdependent components; the parts of the DIE constantly co-evolve learning how to interact effectively.

<b>Paper</b>	<b>Definition of DIE</b>
Kolloch and Dellermann (2016)	an innovation ecosystem as a social technological system (actor network) consisting of two inseparable parts: a social system (human actor network) and a technological system (non-human actor network)
Suseno et al. (2018)	DIE models the interactions and relationships between organisations and stakeholders, in creating new products and services using digital technologies in order to create value
Wang (2018)	a special type of sociotechnical system

	a complex arrangement of technologies, methodologies, concepts, business application areas, organizations, and institutional contexts; a network of heterogeneous social and technical elements, which co-evolve over time
Beltagui et al. (2020)	DIEs account for industry-spanning co-operative and competitive dynamics among firms related to innovations that combine physical and digital elements
Cvar et al. (2020)	a complex system of various actors having different roles, interacting in mutual interdependence, constantly learning how to interact effectively
Wang, (2020)	a special type of sociotechnical systems, a dynamic collective of interdependent actors and the resources they draw on to innovate with digital technology
Wang et al., (2021)	a loosely coupled set of autonomous actors (people and organizations who interact without hierarchical fiat) involved in the development and implementation of innovations enabled by digital technologies

*Table 4. DIE definitions in the literature*

### *Characteristics of the DIEs*

In order to categorize the studies under investigation, the system level approach by Vanhamaki, et al. (2019) was applied; this research introduced the system level approach to the circular economy and described the actors on macro, meso, and micro levels. The author of the study brought this model to the research on DIE, dividing the studied literature by system levels to which the DIE was applied. Some of the research studied the universal nature of DIE applicable in all the levels, so we introduced the fourth group named "Meta level". The results of the distribution are presented in Table 5.

				<b>System level</b>	<b>Actors</b>	<b>Papers</b>
<b>System level</b>	<b>Meta level</b>	<b>Papers</b>	Vasin et al. (2018); Wang, (2018); Chae, (2019); Nepelski, (2019); Wang, (2020); Xu, (2020); Wang, (2021)	<b>Macro level</b>	Supranational organizations, Nations, cities, regions	Misseri (2013); Pistorio et al. (2018); Whyte (2019); Bauman-Vitolina and Dudek (2020); Cvar et al. (2020); Filatova et al., (2020); Ruohomaa et al., (2020); Maurer, (2021)
				<b>Meso level</b>	Local ecosystems, industrial networks	Kolloch and Dellermann (2016); Gorecky et al. (2019); Beltagui et al. (2020)
				<b>Micro level</b>	Companies, consumers	Rao and Jimenez (2011); Suseno et al. (2018); Rocha et al. (2018); Rocha et al. (2019); Yin et al. (2020); Raabe et al. (2021); Rocha et al. (2021)

*Table 5. Distribution of the literature by system levels*

Figure 4 illustrates the distribution of the articles by system levels in %. As one may see, the most attention in the scientific literature was paid to the macro level (32%) – these studies explored the role of DIE in regional and national development. The studies of the DIE in the internal context of the companies take second place together with the universal meta level studies, both 28%. The studies on local ecosystems and industrial networks take third place (12%).

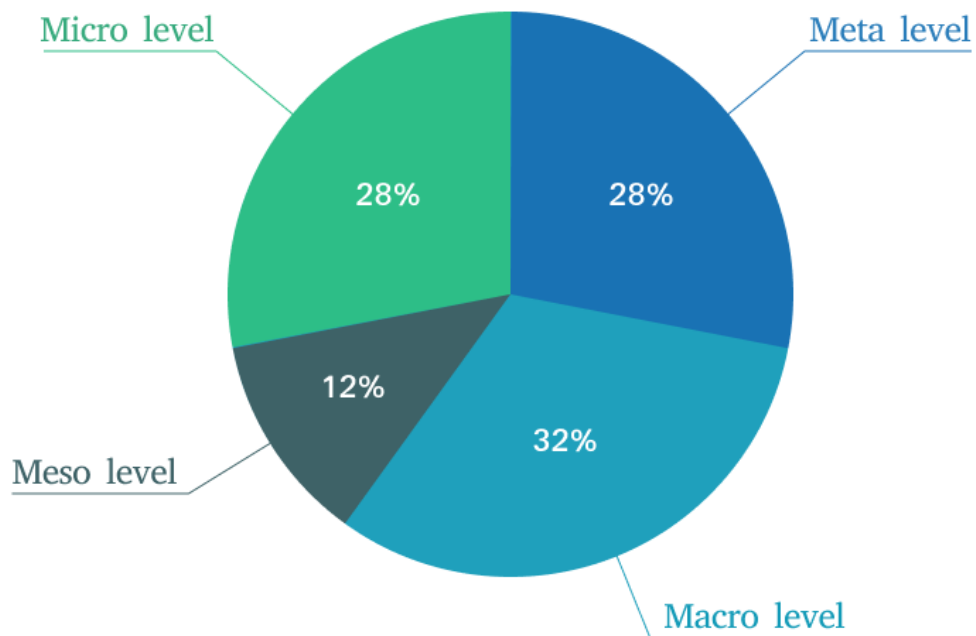


Figure 4. Distribution of the literature by system levels in %

### *Macro level DIEs*

Misseri (2013), in her qualitative analysis of the emergence of DIEs in the example of the Picardy region in France, claims that the DIE is a pathway for local innovation regardless of the characteristics of the territory; the main DIEs' goal is to support the coevolution of stakeholders involved in the growth, competitiveness, and attractiveness of the territories. DIEs will also help to promote weak and strong ties in the territory, produce knowledge and value, and provide access to knowledge and services; however, the role of "personalities" and think tanks that disseminate their ideas and vision has to be defined in the future. Misseri (2013) also highlights five major components of DIEs - innovation platforms or specific communities (API); web 3.0 principles and technologies; services related to innovation and potential customers; the business model of the platform and the production of knowledge and strategic analysis; a user-centered and personalized environment. Pistorio et al. (2018) stress the key role of policymakers in the development of DIEs; the authors state that governmental organizations can support the growth of an innovation ecosystem through a policy strategy based on a multi-sided platform and through the selection of the required standards to support the integration of the future complementary applications. Whyte (2019) analyses the developing DIE of industry/government initiatives and infrastructure megaprojects in the city of London; the research reveals that the changes distributed through government/industry initiatives and megaprojects in the DIE have implications for the strategies of associated firms. Baumanė-Vītoliņa and Dudek (2020) conducted a case study of the innovation landscape of the city of Krakow in Poland and claimed that the functioning of DIEs is possible



thanks to digital platforms, which enable customers to connect with each other and exchange value by making transactions. These platforms facilitate the interaction between producers, suppliers, and customers within the network, and those interactions lead to value co-creation. Thus, DIEs can be put into a broader category of platform-based ecosystems. The research of Cvar et al. (2020) discusses the differences and similarities of the Internet of Things (IoT) application in the DIEs of SCs and smart villages. The DIE in this research is identified as a multilevel framework of structures, strategies, tools, and people; the authors argue that the combination of different stakeholders and facilitation of participatory practice contributes to technological development and results in building DIEs based on public value. The study of Filatova et al. (2020) provides theoretical provisions, as well as methodological tools and an appropriate model for managing the innovation ecosystem in order to implement effective innovations in the digital era; based on the current trends in the digitalization development; the research identifies three elements of the DIE, which are digital infrastructure, digital tools, and digital competences. Ruohomaa et al. (2020), in their case study of Hämeenlinna city in Finland, argue that DIEs are the conductors of transdisciplinary innovation to create profitable new business models. Maurer (2021) studied the Digital Innovation Hub (DIH) on Business Intelligence & Innovation and its possible network of collaborators and co-creators in the region of the Federal State of Vorarlberg in Austria and claimed a DIH should act as a service center of a DIE providing access to services, facilities, and expertise to a wide range of stakeholders.

### *Meso level DIEs*

Kolloch and Dellermann (2016) provide a comprehensive analysis of the interaction between technological and social entities in the energy industry and its impact on the dynamics of an innovation ecosystem; the authors examined the coevolution of human and non-human actor networks, which is caused by controversies within the DIE. The authors identify DIE as an actor network with human (i.e., organizational) and non-human (i.e., technological) actors. Gorecky et al. (2019) focused their research on the acceleration of technological advancement and adoption of Industry 4.0 technologies to support modern factories' digital transformation. The authors propose a Global DIE for the Future of Production that unites three types of stakeholders together with tangible and intangible assets: smart-factory labs and technology testbeds, digital capability centers, and industrial showcase-sites and (digital) lighthouses; the stakeholders, and their assets, which are part of the ecosystem, could be connected horizontally. In their research, the authors outline the main objectives of the Global DIE, such as acceleration of the development of new industrial applications of Industry 4.0 technologies; facilitation of the testing of the interoperability of Industry 4.0 technologies; allowance of the "bench-marking" and "show-casing" of the Industry 4.0 technologies adoption; facilitation of best practices by opening selected factories as showcase-sites and promoting them as (digital) lighthouses; promotion of education and training programs to help companies adapt to Industry 4.0 technologies. Beltagui et al. (2020) investigate disruptive innovation in the 3D printing industry through the exaptation and ecosystems;

the main purpose of this research was to understand the mechanisms by which disruption takes place in DIEs. The researchers propose that the number and attractiveness of ecosystem niches grow together with an innovation ecosystem. The combination of openness to new entrants and the possibility of these entrants to exapt can increase the potential for internal disruption. The authors claim that the ecosystem must evolve sufficiently to allow an exaptation-driven innovation to achieve external disruption of incumbents in other ecosystems.

### *Micro level DIEs*

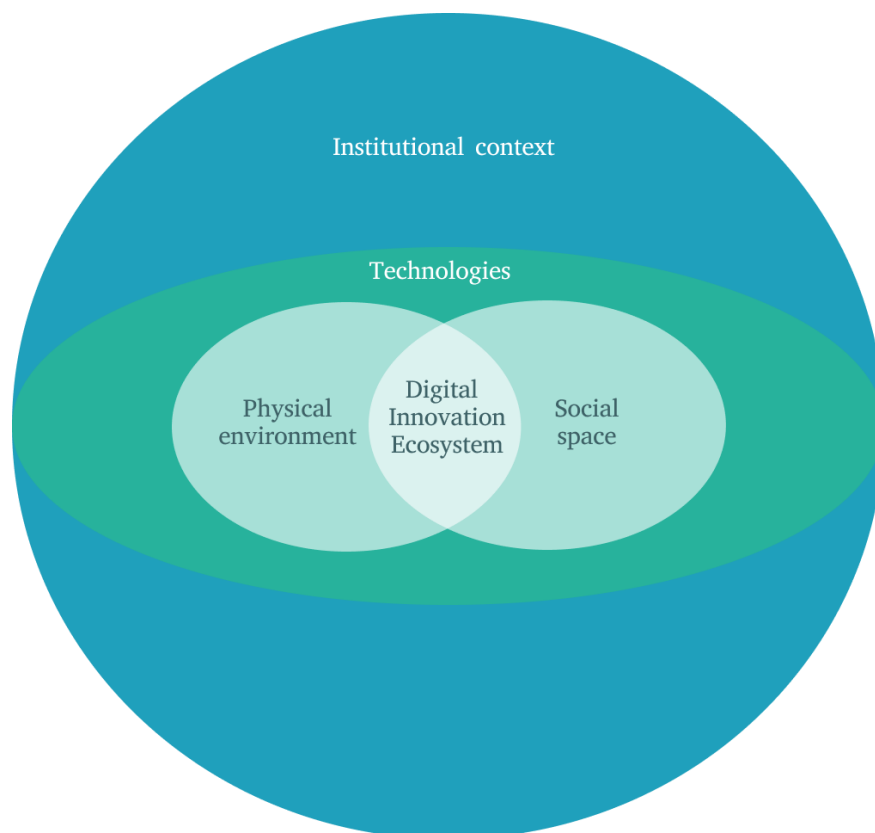
Rao and Jimenez (2011) examined how Apple and Google have used third-party-led innovation and their corporate strategy to create viable DIEs through the App Store and the Android platform, respectively. Innovation from an ecosystem-based approach could be explained by the network externalities and by understanding the mechanism that was used for relating the different actors; the role of a social network was included in the model; the components of the model are - customers, developers, suppliers, hub or disperse "app store", firms - operating system. Suseno et al. (2018) explored value creation through the interactions of consumer and professional stakeholders in DIEs and examined the resulting merging of value categories within DIEs, thus exploring value hybridization. In the case of digital innovation, value is created by organizations from their activities and interactions with stakeholders in the consumer and the professional domains that occur within the DIEs of specific market, regulatory and environmental contexts. The research of Rocha et al. (2018) explores how Research and Development (R&D) collaborations in start-ups can influence digital innovation in Brazilian manufacturers; the DIE in this research is considered a strategic asset since the various collaborations of the start-ups assist them in the development, dissemination, and commercialization of digital solutions. In the following study, Rocha et al. (2019) expand their research to open innovation and Industry 4.0 and confirm the central role of DIEs in developing and promoting digital solutions by start-ups. Yin et al. (2020), in their research on Sustainable and smart product innovation ecosystem (SSPIE), name DIE as one of the three typical innovation ecosystems together with open innovation ecosystem and platform-based ecosystem; the authors define cyberspace, social space, and physical as the components of DIE. The research of Raabe et al. (2021) explored the role of digital innovation units (DIUs) in incumbent firms and claimed that the DIEs perspective emphasizes a stronger focus on an incumbent firm's partners and its network, and DIEs are searched for solutions to business problems through the digital technologies used. Rocha et al. (2021) investigate how R&D collaborations with scientific and business partners contribute to the digital transformation of manufacturers in Brazil; the authors state that such incentives as the promotion of technological innovation in the private sector, have the potential to establish a DIE to foster the country's industrial competitiveness.

### *Meta level DIEs*

Vasin et al. (2018) explored the institutional support of innovations at all system levels, including the micro level, to explain the low efficiency of adapting the innovation system concept in the Russian economy. The authors name the characteristics of the DIEs: the possibility of unhindered interaction of participants in innovation implementation, including cooperation between scientific bodies and government; promotion of cooperation in the R&D domain; creation of an experimental platform with those involved in the joint inventive process. Wang (2018), inspired by the versatility of ecosystem analysis, offers a multilevel ecological model of a DIE. The author claims that digital technology is present in almost every ecosystem, so many innovation ecosystems are true DIEs; the business process ecosystems and industry platform ecosystems are examples of DIEs at the organizational level, centered on the focal organization. The main nutrients of the DIEs are knowledge and the value of innovation; the boundaries of the DIEs are fluid. The study by Chae (2019) presents a general framework for studying the DIE and supports the idea of the DIEs boundaries' fluidity. The author claims that DIE emerges from the interaction of diverse elements, both social and technical, and evolves over time. Nepelski, (2019) states the DIE consists of various layers. The physical layer relies on large capital and R&D expenditures, whereas the upper layers include software producers and platforms. Policies should address the characteristics and needs of the actors in each layer. Collaboration between various actors of the DIE – universities, large companies, SMEs, and start-ups is a defining characteristic of digital innovation. Large companies create ecosystems that leverage their size to attract smaller companies; the resulting open innovation models dominate the DIE. Wang, (2020) mapped the different forms of digital innovations and their ecosystems on the layers of a multilevel model of DIEs; these layers, together with interdependent and co-evolving components, corresponding to the similar processes of natural ecosystems; DIE has dynamic and open nature, its structure is complex, with actors playing different roles and interacting in different ways. Key attributes of a natural ecosystem can be applied to describe a DIE: the number of actors in an ecosystem, rates at which actors join or exit an ecosystem, differences within and between groups of actors, ways actors and their relationships and actions are arranged, and the capacity to endure disturbances. Xu, (2020) claims that DIE has become a new organizational form of enterprise innovation and inter-enterprise competition in the digital era; according to the author, the characteristics of DIE are different from traditional collaborative innovation, which requires scholars to expand research ideas and explore new research issues on the topic. Wang, (2021) synthesizes ecological and information perspectives resulting in the information ecology theory and states the DIEs provide an opportunity to explore how IT and digital technologies can match an ecosystem's information capacity with the information needs in integrating the parts into the whole ecosystem. The information ecology theory contributes to digital innovation research and new insights into the role of digital technologies in innovation and multilevel interactions in and across DIEs.

### *DIEs integrative conceptualization*

As a consequence of the in-depth study of the literature corpus, we revealed several patterns, as well as some contradictions in the DIE framework vision. Regardless of the system level at which the DIE has been considered, there is a clear tendency to mention technology as a meta-factor for the existence of the DIE. In addition, the general trend is the interconnection between the physical and social levels of the ecosystem; institutional context also has an important role in the functioning of the DIE. Figure 5 represents the DIE conceptual framework and the four main components of the DIEs. These components are: 1) technology – this component comprises digital solutions such as technologies, platforms, services, and resources that enable actors to connect with each other and exchange value and knowledge by making transactions; 2) institutional context implies institutional arrangements, public services, policies, local administrations and management that are in operation in the geography of the DIE allocation that creates an environment that shapes the activity of DIEs; 3) physical environment in terms of infrastructure, firms tangible assets, capital goods used by the actors and stakeholders (regardless the system level of DIE) to develop and implement innovations; 4) social space that includes actors and stakeholders of the DIEs, organizations, human capital.



*Figure 5. DIE conceptual framework*

There are contradictions in the literature on whether to consider the components of the DIE as levels, which means the hierarchical nature of the DIE or horizontal; when each component is equally important, there is also a discrepancy in the literature on the level of independence of the components in the literature. We believe all ecosystem components are equally important and exist autonomously, but at the same time, they

are in (close) interaction with each other. At the same time, the technology and institutional context components are meta components; they act as a background in which the other two components (Physical environment and Social space) exist. Since the DIE has no clear boundaries, technologies and the institutional context create conditions for the interaction of the physical (Physical environment) and the social component (Social space) and favor the emergence of other DIEs in the field.

## Conclusion remarks

Digital transformation occupies an important place in managerial and scientific discourses. This research discusses the phenomenon of DIEs, their definitions, and their components. The systematic literature review on the topic sheds light on the state-of-art in the scientific discussion on the topic and gives insights into the nature of the DIE that contributed to the formulation of the shared definition of the DIE and its components. Four system levels of the DIEs operation were also distinguished and discussed. The main limitation of the study is a limited literature sample; however, the literature studied represents a significant contribution to the rising scientific discourse on the topic. The author deliberately narrowed the range of literature, concentrating only on the literature that discussed DIEs and not other ecosystems with a similar nature and connotation to reveal the characteristics of the DIEs as they understand the scholars that use this definition. Thus, in the study of the DIE phenomenon at an early stage of its development, the findings of our research represent some interesting theoretical, empirical, and policy implications. So, the theoretical contribution of the present study consists of the conceptualization of the discussion on the common elements of DIE in the scientific discourse, which was previously neglected in the literature. DIEs shared definitions, and conceptual framework could raise the discussion in future scientific studies. The managerial implication of this research stage resides in the evidence of the role and place of the organizations in the DIE environment, which has a significant potential to leverage their activity. From an institutional and political viewpoint, the present results can support governments and local administration in improving their role in the DIE context through research and innovation projects and programs, aiming to increase the effectiveness and efficiency of stakeholders' engagement. These outcomes also have a strong social and economic impact on economic development; hence, the development of DIEs prompts advancements in other spheres of life.

## CHAPTER 3. UNDERSTANDING SMART TERRITORIES: A CONCEPTUAL FRAMEWORK

### Chapter Summary

Regional development initiatives and sustainability issues provoked the development of smart cities worldwide. However, the "smartization" of cities (Schiavone et al., 2019; Magnaghi et al., 2021) produces a digital gap in the territories, particularly in rural and marginal areas that do not have the same services and capabilities that citizens and organizations in urban areas enjoy (Navío-Marco et al. 2020). Therefore, the concept of smart territories emerged in the scientific literature in the 2010s as an extension of the smart city concept and in opposition to it (Navío-Marco et al. 2020). The present study aimed to deepen the existing knowledge on smart territories, providing the shared definition of the phenomenon under consideration, its dimensions, and conceptual framework based on the evidence gathered from the systematic literature review on the topic.

### Background information

As it was discussed in Chapter 1, regional development initiatives are at the heart of the national and supranational policies of the states and supranational organizations. United Nations Centre for Regional Development (UNCRD), established in 1971, strives to promote sustainable regional development in developing countries with a focus on development planning and management in the context of globalization and decentralization trends and the growing concern towards global environmental issues and their impacts. The Regional Development Policy Committee (RDPC) was created in 1999 under the auspices of the Organization for Economic Co-Operation and Development (OECD) and is aimed at identifying the nature of territorial challenges and assisting governments in the assessment and improvement of their territorial policies; the Committee aims to enhance well-being and living standards in all region types, from cities to rural areas, and improve their contribution to national performance and more inclusive and resilient societies. EU regional policy is an investment policy; it supports job creation, competitiveness, economic growth, improved quality of life, and sustainable development.

Given the fact that around 55% of the world population and 75% of the European population live in cities, by 2030, six out of every ten people are expected to live in a city, and the number will increase to seven by 2050 (World Bank 2019). Policymakers have been increasingly looking for solutions to traditional management challenges, environmental problems, as well as the necessary living conditions to raise the satisfaction and well-being of the population, so the phenomenon of SC arises (Gorelova et al., 2021a). According to the EU policy, addressing urban challenges also means promoting the development of more attractive and competitive urban areas with healthier and more sustainable living places. Undoubtedly, the development of SCs is

directly related to promoting sustainability initiatives. A number of policies and initiatives have been implemented to achieve these goals at the EU level, for example, The European Innovation Partnership on Smart Cities and Communities (EIP-SCC project), The Urban Agenda for the EU, The Smart Cities Information System (SCIS), etc. The variety of definitions (Yigitcanlar et al., 2019; Laitinen and Piazza, 2020; Salkuti, 2021) confirms that this term defines SCs through a wide range of characteristics and dimensions to provide efficient solutions for economic growth and sustainable development to create high-quality and inclusive life conditions for the citizens. One of the SC's main characteristics is its digitalization, which is not only an inevitable part of SC infrastructure - smart telecommunication networks, intelligent transportation systems, and developed energy infrastructure - but also a fertile land for talent discovery and entrepreneurship.

However, the "smartization" of cities (Schiavone et al., 2019; Magnaghi et al., 2021) can produce a digital gap in the territories, particularly in rural and marginal areas that do not have the same services and capabilities that citizens and organizations in urban areas enjoy (Navío-Marco et al., 2020). Therefore, the concept of ST emerged in the scientific literature in the 2010s as an extension of the SC concept and in opposition to it (Navío-Marco et al., 2020). This trend could not be neglected by scholars because the approaches for the development of territorial districts with low population density could become a solution for the regional development of the future.

Taking into consideration the above-mentioned, the main research question (RQ) of this research stage is:

**RQ:** What is the conceptual framework of the ST, its definition, and its dimensions?

The dissertation topic and the aim of this research phase imply the deepening of the existing knowledge on the STs, so the following sub-research questions (SRQ) should be answered in this research phase:

**SRQ1:** What is the state-of-the-art of academic literature regarding the discussion on STs?

**SRQ2:** What definitions of STs are presented in the scientific literature?

**SRQ3:** What are the common dimensions of the STs discussed in the scientific literature?

**SRQ4:** What is the relationship between SC and ST in the scientific discourse?

This research phase is organized into several parts. Section 2 illustrates the research methodology applied to the study; the steps of the research protocol of this phase coincide with the ones of Chapter 2; however, for the reader's convenience and in order to highlight the details of the methodology, section 2 provides a full description of the research protocol in the text. In section 3, the study's results are represented. Section 4 provides concluding remarks on the study.

## Research methodology

This research phase followed the research protocol already explained in Chapter 2. A systematic literature review (SRL) was applied in this research phase. SRL is a key tool of an evidence-based approach that enables a researcher to analyze and structure the knowledge existing in the scientific literature for its further practical and scientific use (Tranfield et al., 2003). Following the format of previous SLRs (Durach et al., 2017, Savastano et al., 2019) a six-step review process was carried out in this stage of the research.

(1) Stage one of our research involves *defining the research questions and keywords*. The study aims to gather evidence in the scientific discourse on the definitions and fundamental components of STs. The ST concept emerged in the scientific literature in the 2010s as an extension of the SC concept and in opposition to it. However, its characteristics are still illegible and depend on the research context. Therefore, the author of this study explores the plethora of scientific literature where STs are discussed. In order to do so, the following keyword combination was chosen (Table 6):

Database	Keyword combination	Explanation
SCOPUS	TITLE-ABS-KEY ( "smart territor*" )	a wildcard * was applied to the keyword combination in order to embrace the cases when the keyword combination was used in plural
	TITLE-ABS-KEY ("smart PRE/2 territor*")	During the first reading of the articles, the author found frequently used keyword combinations such as "smart cities and territories" or "smart and (other adjective) territory/territories" so the proximity operator was used in order to include articles we could otherwise miss
	TITLE-ABS-KEY ( "intelligent territor*" )	Adjective "Intelligent" is frequently used as synonymous to "smart", especially in the scientific literature written by the authors from the romance languages culture, so the author added this adjective to the literature retrieval
	TITLE-ABS-KEY ("intelligent PRE/2 territor*")	The proximity operator was used to include the keywords combinations such as "intelligent and (other adjective) territory/territories
WOS	smart territor* (title) or smart territor* (abstract) or smart territor* (author keywords)	a wildcard * was applied to the keyword combination in order to embrace the cases when the keyword combination was used in plural



	smart NEAR/2 territor* (title) or smart NEAR/2 territor* (abstract) or smart NEAR/2 territor* (author keywords)	During the first reading of the articles, the author found frequently used keyword combinations such as "smart cities and territories" or "smart and (other adjective) territory/territories", so the proximity operator was used in order to include articles we could otherwise miss
	intelligent territor* (title) or intelligent territor* (abstract) or intelligent territor* (author keywords)	Adjective "Intelligent" is frequently used as synonymous to "smart", especially in the scientific literature written by the authors from the romance languages culture, so the author added this adjectives to the literature retrieval
	intelligent NEAR/2 territor* (title) or intelligent NEAR/2 territor* (abstract) or intelligent NEAR/2 territor* (author keywords)	The proximity operator was used to include the keywords combinations such as "intelligent and (other adjective) territory/territories
<b>Google Scholar</b>	"smart territory" "smart territories" "intelligent territory" "intelligent territories"	Google scholar search allows the literature search using only the exact keywords or keywords combinations that are searched wherever in the document

Table 6. The keywords for literature retrieval

(2) The next step of the study is *the determination of the required characteristics of the literature and the inclusion criteria* in order to focus on relevant and rigorous literature sources only:

- The author studied the peer-reviewed articles and conference papers written in English, with no limitation on the year of publication, in this way, the whole amount of literature on the topic could be retrieved; for the same reason, no geographical limitations were applied;
- To ensure the academic quality, the Web Of Science (WOS) and Scopus online databases were used in the research because these databases guarantee peer-reviewing of the articles; the study was corroborated by supplementary materials identified in Google Scholar – so in the case when the articles were extracted from Google Scholar database the author additionally checked whether the study was subject to a peer review;
- The central theme of the studied articles was chosen intentionally in order to not limit the future results of the research and to study the discussion on STs in its wide variety.

By following these criteria, the author included all the papers relevant to the purpose of the study and ensured their quality.

The summary of the inclusion criteria and their characteristics is presented in Table 7.

<b>Type of inclusion criteria</b>	<b>Characteristic of inclusion criteria</b>
Document type	Articles and research papers
Time period	Not specified
Language	English
Geography	Worldwide
Databases	Scopus, WOS, Google Scholar

*Table 7. Inclusion criteria and their characteristics*

(3) Stage three involves the primary *retrieving a sample of potentially relevant literature* according to the above-mentioned keywords, keywords combination and inclusion criteria previously discussed in the explanation of the first and second stage of the review process description using the default search field TITLE-ABS-KEY in Scopus, Topic field in WOS, and the above-mentioned keywords combination in the search box of Google Scholar.

(4) In the fourth stage of the study, pertinent literature was selected. The Preferred Reporting Items for Systematic Review (PRISMA 2020) checklist was adopted for the stages of identification, screening, and inclusion of papers in this review (Page et al., 2021). PRISMA represents the widely accepted methodological standard for performing systematic literature reviews in business and management studies and related fields (Ambad, 2022; Sikandar and Kohar, 2021). Figure 6 represents the PRISMA flow diagram to report the different stages of literature selection.

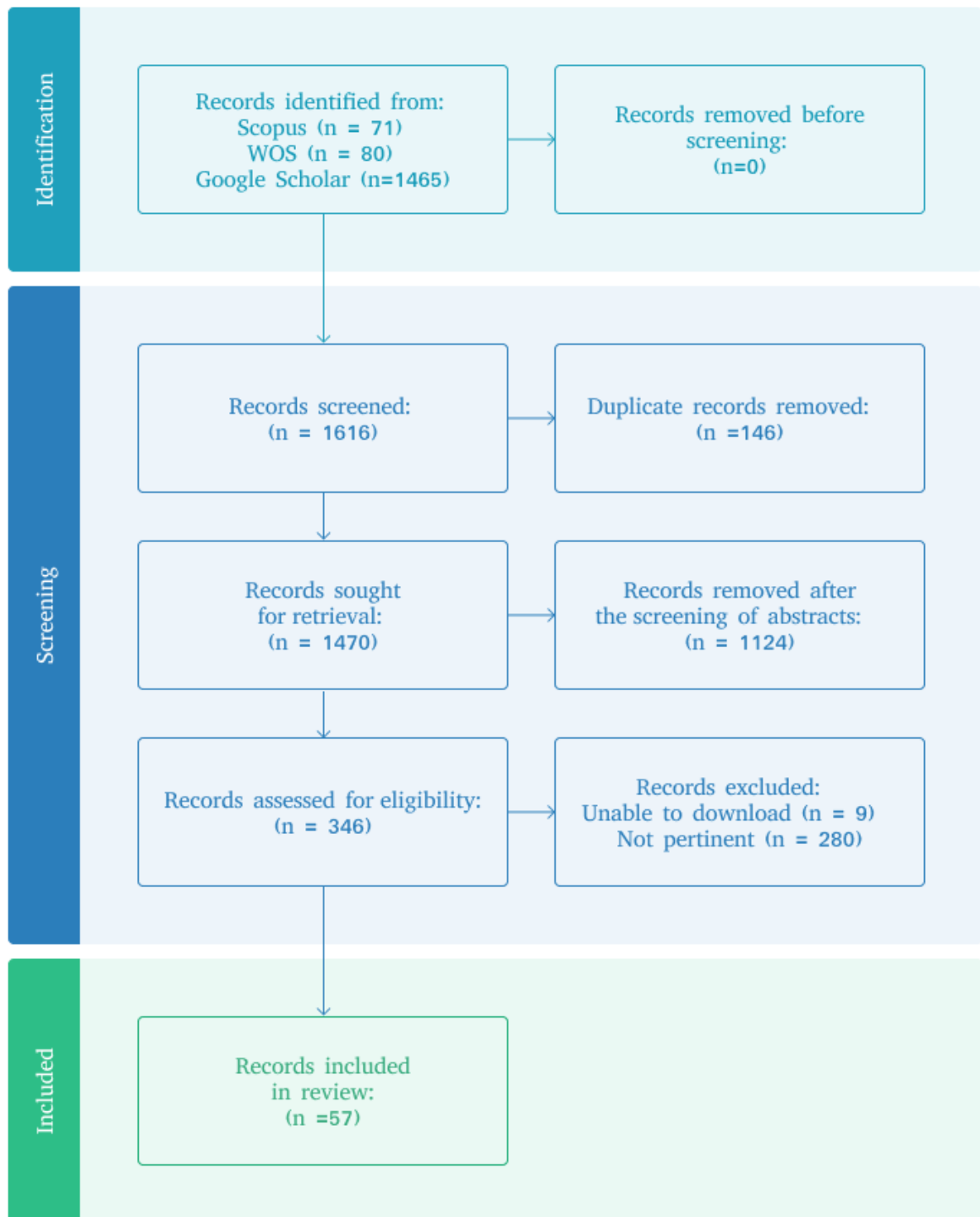


Figure 6. Articles' selection stages based on PRISMA 2020 flow diagram

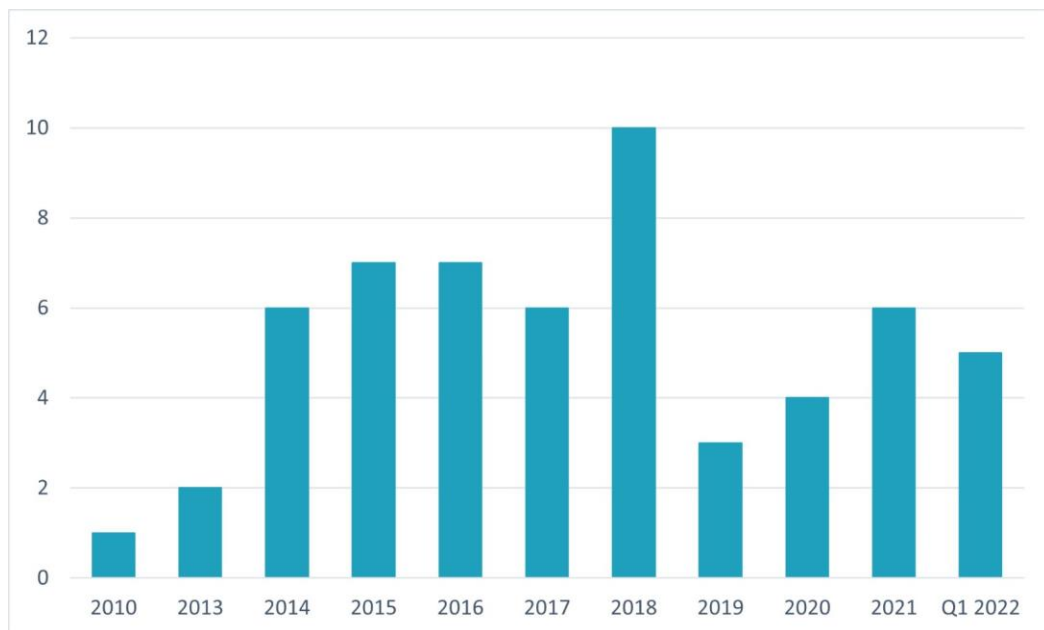
(5) The next step of the systematic review process includes *synthesizing the literature* by applying a "coding scheme to extract pertinent information from the literature and synthesizing studies by summarizing, integrating, or cumulating the different findings across the primary studies" (Durach et al., 2017). The coding categories were predefined and corresponded to the aim of the study and its RQ and SRQs.

(6) Finally, the results of the study were analyzed and reported providing a descriptive overview of the studied literature and discussing thematic findings answering the RQ and SRQs discussed above. The findings of the review process are presented in the next paragraph.

## Results and discussion

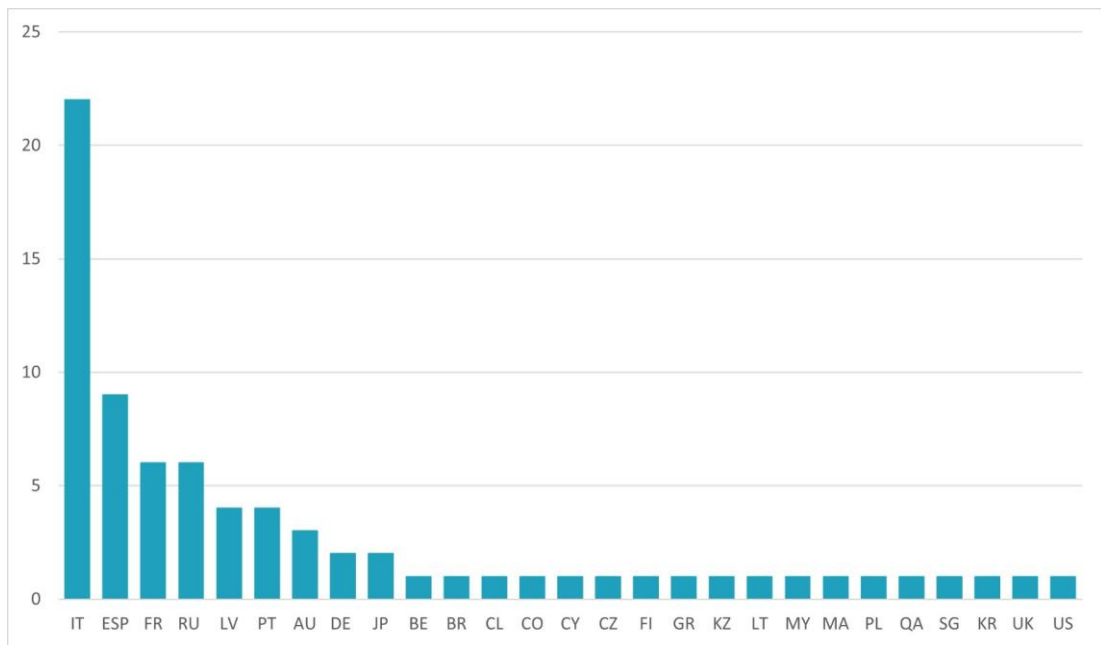
### *Characteristics of the studied literature*

Figure 7 shows the distribution of studied literature by year. The first mention of ST in our literature selection dates back to 2010; since then, the literature has been growing, showing uneven annual growth. Such a distribution of the scientific literature indicates that the ST phenomenon is at the initial stage of development in the scientific discourse, being "blurred" by related concepts such as SCs, smart villages, smart destinations, etc.



*Figure 7. Distribution of the articles by years*

Figure 8 shows the distribution of studies by country. The graph shows Italy is an absolute leader in ST research, with Spain, France, and Russia in the second and third places. Other EU countries represented in the scientific literature are Latvia, Portugal, Germany, Belgium, Cyprus, the Czech Republic, Finland, Greece, Lithuania, and Poland. In total, scholars from the EU countries account for approximately 70% of the studies.



*Figure 8. Distribution of the articles by country*

The distribution of articles in table 8 is heterogeneous; the articles under consideration are almost equally distributed between the sources and the source types – journal publications and conference proceedings. The author believes this may indicate the gradual emergence of the ST phenomenon into the scientific discourse in recent years.

Journal	'10	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22	Tot.	%
Architecture_MPS							1					1	1,8
Chemical Engineering Transactions				1								1	1,8
Concurrency Computation							1					1	1,8
Dyna (Spain)											1	1	1,8
Economics & Sociology						1						1	1,8
Electronics (Switzerland)										1		1	1,8
European Planning Studies									1			1	1,8
F1000Research											1	1	1,8
Herald of the Russian Academy of Sciences								1				1	1,8
Interaction Design and Architecture(s)		1	2									3	5,3
International Journal of Sustainable Agricultural Management and Informatics					1							1	1,8
Journal of Cleaner Production							1					1	1,8
Journal of Security and Sustainability Issues							1					1	1,8
Land Use Policy									1			1	1,8
Renewable and Sustainable Energy Reviews										1		1	1,8
Sensors (Switzerland)										1		1	1,8
Simulation Modelling Practice and Theory						1						1	1,8
Smart Cities and Regional Development Journal							1					1	1,8
Sustainable Development, Culture, Traditions					1							1	1,8
Sustainability (Switzerland)										1		1	1,8
Technological Forecasting and Social Change											1	1	1,8
TeMA-Journal of Land Use, Mobility and Environment			1									1	1,8
Urbani izziv				1								1	1,8
<b>Conference proceedings</b>	<b>'10</b>	<b>'13</b>	<b>'14</b>	<b>'15</b>	<b>'16</b>	<b>'17</b>	<b>'18</b>	<b>'19</b>	<b>'20</b>	<b>'21</b>	<b>'22</b>		<b>%</b>
12 <sup>th</sup> European Conference on Innovation and Entrepreneurship						1						1	1,8
17 <sup>th</sup> Annual International Conference on Digital Government Research					1							1	1,8
1 <sup>st</sup> ACM International Workshop on Technology Enablers and Innovative Applications for Smart Cities and Communities								1				1	1,8
2010 International Symposium on Ubiquitous Virtual Reality	1											1	1,8
2013 World Electric Vehicle Symposium and Exhibition			1									1	1,8
2014 International Conference on Extending Database Technology and International Conference on Database Theory			1									1	1,8
2014 International Conference on Virtual Systems and Multimedia			1									1	1,8
2015 Digital Heritage International Congress				1								1	1,8

2015 International Conference on Sustainable Design, Engineering and Construction				1								1	1,8
2016 IEEE Symposium on Computers and Communication					1							1	1,8
2016 International Conference on High Performance Computing and Simulation,					1							1	1,8
2018 Global Internet of Things Summit							1					1	1,8
2018 International Joint Conference on Neural Networks							1					1	1,8
2019 International SPBPU Scientific Conference on Innovations in Digital Economy								1				1	1,8
2020 IEEE International Conference "Quality Management, Transport and Information Security, Information Technologies", IT and QM and IS									1			1	1,8
2021 IEEE Chilean Conference On Electrical, Electronics Engineering, Information and Communication Technologies										1		1	1,8
2022 Smart City Symposium Prague (SCSP)											1	1	1,8
2 <sup>nd</sup> International Conference on Systems and Computer Science		1										1	1,8
2 <sup>nd</sup> International Symposium New Metropolitan Perspectives - Strategic Planning, Spatial Planning, Economic Programs and Decision Support Tools, Through the Implementation Of Horizon/Europe2020					1							1	1,8
3 <sup>rd</sup> International Conference organized by the International Association of Cultural and Digital Tourism						1						1	1,8
3 <sup>rd</sup> International Congress on Blockchain and Applications											1	1	1,8
3 <sup>rd</sup> Renewable Energies, Power Systems and Green Inclusive Economy, REPS and GIE							1					1	1,8
5 <sup>th</sup> INTBAU International Annual Event							1					1	1,8
7 <sup>th</sup> International Conference on Information and Communication Technologies in Agriculture, Food and Environment				1								1	1,8
8 <sup>th</sup> International Scientific Conference Rural Development 2017: Bioeconomy Challenges						2						2	3,5
CHItaly 2015 Doctoral Consortium				1								1	1,8
Congress of the Italian Association for Artificial Intelligence				1								1	1,8
International Conference on Civil, Architectural and Environmental Sciences and Technologies								1				1	1,8
New Challenges of Economic and Business Development - 2016					1							1	1,8
SPIE Photonics Applications in Astronomy, Communications, Industry, and High-Energy Physics Experiments 2018							1					1	1,8
Ural Environmental Science Forum "Sustainable Development of Industrial Region"										1		1	1,8
<b>Total</b>	<b>1</b>	<b>2</b>	<b>6</b>	<b>7</b>	<b>7</b>	<b>6</b>	<b>10</b>	<b>4</b>	<b>3</b>	<b>6</b>	<b>5</b>	<b>57</b>	<b>100</b>

Table 8. Distribution of selected articles by journals and publication date

Table 9 represents the most frequently used keywords in the studied literature ranked from 1 to 7, given that other collected keywords have the frequency 1, which is explained by the thematic heterogeneity of the literature. In addition to the keywords and keyword combinations used to retrieve the scientific literature (explained in the previous paragraph of this chapter), the other most frequently used keywords and keywords combinations are predictably connected to the sustainability issues, digitalization domain, and concepts related to the ST and SC phenomena, such as a smart island, smart region, smart community, etc. and different aspects of ST organization, for example, cultural development, energy efficiency, and management, social networks, mobility issues.

<b>Keyword</b>	<b>Frequency</b>	<b>%</b>	<b>Rank</b>
Smart cities	12	4,9	1
Smart territory	9	3,6	2
Smart territories	9	3,6	2
IoT	6	2,4	3
Smart city	5	2	4
Simulation	4	1,6	5
Sustainable development	4	1,6	5
ICT	3	1,2	6
QR code	3	1,2	6
Regional development	3	1,2	6
Digitalization	2	0,8	7
Information	2	0,8	7
Parallel and Distributed Simulation (PADS)	2	0,8	7
Smart development index	2	0,8	7
Smart heritage	2	0,8	7
Smart learning ecosystems	2	0,8	7
Smart specialization	2	0,8	7

*Table 9. Distribution of the keywords by frequency*

### *Research domains*

Each paper is focused on a particular research domain. The research domains were classified according to the scope and the research field declared by the scholars in the studied literature. The results retrieved employing the content analysis are presented in the table 10; the table presents the main retrieved domains, their explanation (codes), and a number of articles that included the research in a particular domain. Some articles enter several research domains. As the table shows, more than half of the studied articles consider digital technologies in STs as the main topic of the research or the main key driver of territorial development. The territorial management research domain is in second place; about 5,7% of articles were devoted to this topic. The innovation domain,



with the codes associated with innovation ecosystems, industrial and digital innovation, and collective innovation processes, takes third place.

<b>Domain</b>	<b>Codes retrieved</b>	<b>Number of articles</b>
Digital technologies	ICT, IoT, digital transformation, distributed ledger technologies, AR, digitalization, cloud technologies, GIS, NSS, interactive technologies, cyber technologies, AI, digital maturity; ubiquitous computing	31
Territorial management	smart management, management platform, decision support system, management of the infrastructure, smart growth, smart governance	10
Innovation	innovation ecosystems, industrial innovation, collective innovation processes, digital innovation	7
Rural development	sustainable agriculture, landscape planning, land consumption, rural spatial planning	5
Public services	healthcare services, smart services; intelligent transportation and logistics systems, smart energy, pedestrian traffic	5
Community engagement	co-creation, impact communities, co-design, participation	4
Education	smart learning, learning ecosystems, urban studies	4
Tourism	virtual tourism, integrated tourism	4
Entrepreneurship	social entrepreneurship, business competitiveness	2
Environment	environmental citizenship, environmental protection	2
Housing	housing, smart homes, near-zero energy buildings, buildings energy management	2

*Table 10. Research domains of the studied literature*

### *Geography of the case studies*

Table 11 shows the geographical distribution of the case studies in the studied literature. 35 articles out of 57 presented case studies in their research. The territorial divisions represented in the studies shed light on the comprehension of the territorial dimension of the STs; the case studies were divided into countries, regions, and municipalities, so the ST approach could potentially be adopted in different geographical dimensions.

<b>Territory</b>	<b>Authors</b>
<b>Country</b>	
Italy	Giovanella (2014) Poletti (2015) Ciani et al. (2017)
Morocco	Rochdane and Hamdani (2018)
France, Cambodia, Haïti	Galli et al. (2019)
Russia	Pogosyan et al. (2019) Kapkaev and Kadyrov, 2021
Russia, Germany	Danilina and Harder (2020)
<b>Region</b>	
Autonomous Province of Trento	Conci et al. (2015)
Mediterranean region	Garcia-Ayllon and Miralles (2015)
Apulia, Italy	Lisi and Esposito (2015)
Vidzeme region, Latvia	Melbarde and Ore (2016)
Canaries, Spain	Priano et al. (2016)
Latgale region, Latvia	Aleksejeva et al. (2017) Jermolajeva et al. (2017) Aleksejeva et al. (2018)
Northern parts of Finland, Norway, and Sweden	Cartaxo and Hossain (2018)
Umbria, Italy	Filippucci and Bianconi (2018)
Mediterranean coastline, Spain	García-Ayllón (2018)
Araucania, Chile	Garcia-Lara et al. (2021)
Walloon Region, Belgium	Nishimwe and Reiter (2021)
<b>Municipality</b>	
Cosenza, Italy	Citrigno et al. (2014)
L'Aquila, Italy	Di Ludovico et al. (2014)
Pompei, Italy	Gambardella et al. (2014)
Lecce, Italia	Gabellone et al. (2015)
Catania, Italy	Sturiale and Trovato (2015) Trovato and Sturiale (2016)
Aveiro, Portugal	Galego et al. (2016)
Vila Real, Portugal	Melro and Oliveira (2017)
Salento, Italy	Paiano et al. (2017)
Grasse, France	Orazi et al. (2018)
Paris, France	Corchado et al. (2021)
Melbourne, Australia	Garcia-Retuerta et al. (2021)
Bucaramanga, Colombia	Carrillo et al. (2022)
French cities, France	Leroux and Pupion (2022)

*Table 11. Geographical distribution of the case studies*

## Evidence on STs in the studied literature

The studied literature provides insight into the ST definitions, dimensions, and their relationship to the SC concept. Some studies provide well-articulated, clear evidence on the ST attributes that is presented in the table 12, while others give the field for the discussion providing useful considerations on the characteristics and scope of the STs.

### *Definitions of STs*

Table 12 presents the ST definitions retrieved from the literature. The presented ST definitions combine the considerations on the quality of life of the population of the territory and its sustainable development by means of digital technologies and innovation. There is not much of a significant discussion on the geographic boundaries of the ST; also, there is no unanimous consent on the boundaries of the STs in the presented definitions; the proposed variants of the ST boundaries are geographically defined bounded spaces from communities to regions.

<b>Paper</b>	<b>Definition of the STs</b>
Gambardella et al. (2014)	“Intelligent” territories capable of combining innovation, environment and quality of life; the “smart” dimension is the integrated result of a structural cognitive, and public-political dimension, of the different territories, promoting regeneration in function of sustainable development and greater ease of access and quality of life
Conci et al. (2015)	An innovative model of governance, which integrates business, higher education, universities and research institutions in an ecosystem aimed at implementing sustainable solutions and smart services for residents; the territory becomes a carrier of values, people and instruments that together contribute to its sustainable development. Research activities are developed in the field together with local residents, who have the possibility to actively participate in the innovation process and can be responsible for its outcomes.
Lisi and Esposito (2015)	A multiplayer system able to improve, by means of an adequate technological and digital infrastructure, its attitude to innovation as well as its skills in managing the knowledge assets of the regional stakeholders.
Sturiale and Trovato (2015) Trovato and Sturiale (2016)	An extension to the field of the SCs concept, and, therefore, of the methodologies and tools of support, can usher in a new era, in which territorial management is of the smart type.
Barbosa et al. (2018)	A bounded space (from communities to a region) with particular features due to the anthropic influence and which the digital transformation is an outcome of a

	participatory, rational and comprehensive planning strategy thus creating new values without compromising the territorial capital of the territory at issue and its adjacent.
Galli et al. (2019)	A territory where school children produce innovative multimedia content on dedicated points of interest of invisible paths and share them with tourists (or citizens) thru their smartphones
Karpova et al. (2019)	A geographically defined region, in which a number of processes are digitized, networked using the Internet, and multifunctional.
Navío-Marco et al. (2020)	A geographical space, which seeks to solve public problems through technology-based solutions within the framework of a partnership between multiple participants from different sectors.

Table 12. ST definitions in the literature

Figure 9 represents a word cloud of the most frequently used words in the ST definitions presented in the table 12. The most frequently used words are territory (an obvious result since it is a part of a definition), innovation, quality of life, and sustainable development.

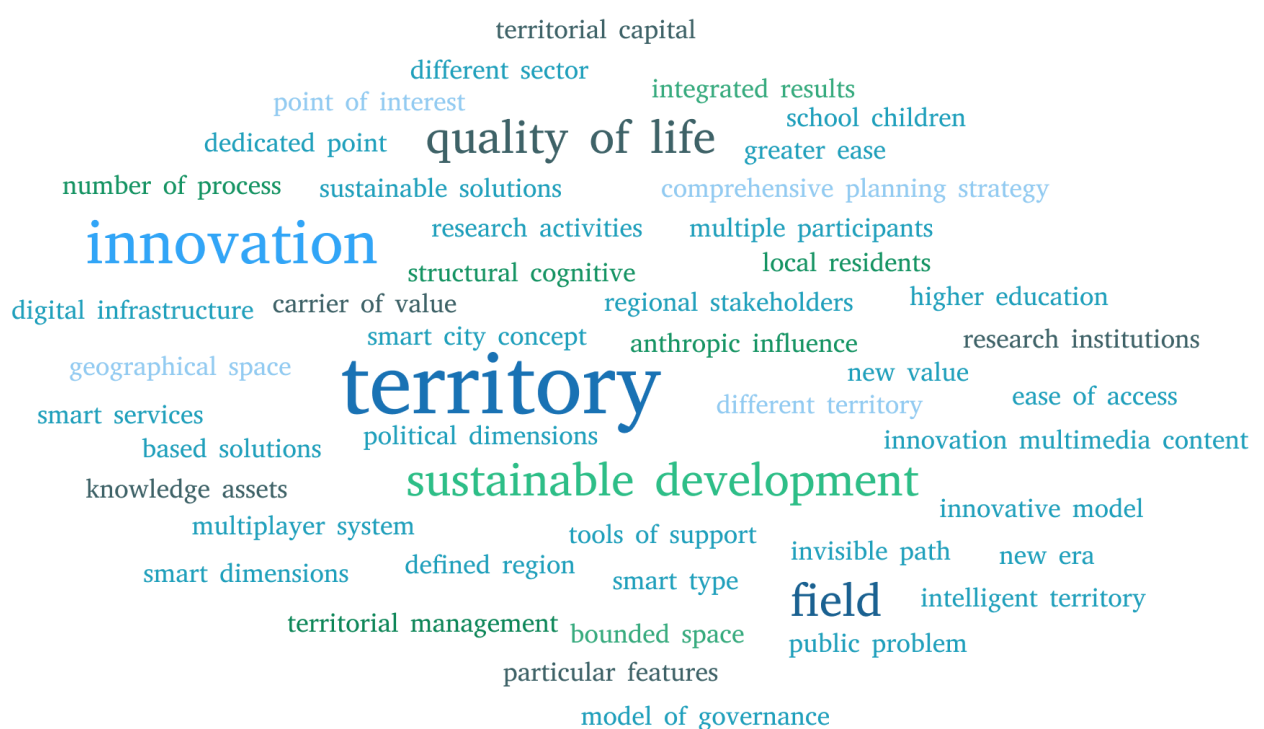


Figure 9. Word cloud of the most frequently used words in the ST definitions

Some authors do not propose ST definitions but provide considerations on the scope of STs' establishment, which helps to understand better the concept under consideration. Carroll et al. (2014) claim that people-centered STs can enhance community awareness by reminding people of placed-based history, heritage, current issues, discussions, and

plans for the future in the community through a smart social grid of community information services; smart social grids help to share online a collective knowledge, resources, and awareness on STs. According to Opromolla (2015), the territories are constantly (re)defined by the interaction among people; these activities allow the city users to continuously re-semanticize spaces by ensuring to meet their needs and desires; these places become carriers of meanings always different over time. Ciani et al. (2017) state that Smart Communities and STs are the new paradigms in the 21<sup>st</sup> Century to solve the question of adaptation to Climate Change and to guarantee, for the future generation, the conservation and promotion of all potentialities of each territory and identity of areas. Goint et al. (2022) declare the STs are developed to manage in an integrated way the services offered to citizens, territory planning, economic development, and quality of life by promoting the sensitivity of citizens and businesses to the environmental aspects. Rosado-García (2022) proclaim that the territory has become a model of collective innovation, of social and cultural sustainability.

### *ST dimensions*

Since there is no universally accepted and official definition of the ST and this concept has different approaches, the discussion on the ST dimensions arises. The studied scientific literature provides evidence of different ST dimensions that help to better define the STs from different points of view. These dimensions define core components for a comprehensive conceptualization of the ST phenomenon. Table 13 represents the ST definitions retrieved from the literature.

<b>Paper</b>	<b>ST dimensions</b>
Gambardella et al. (2014)	structural cognitive, public-political
Garcia-Ayllon and Miralles (2015)	R&D, transport, ICT, sustainable energy, natural resources. cultural resources, economic resources, governance, landscape management
Conci et al. (2015)	transportation, utilities, healthcare, education, public safety, building management, constituent services, city management
Ferretti and D'Angelo (2016)	goals, people, soft infrastructure, shire systems, hard infrastructure
Priano et al. (2016)	rural, tourist, industrial
Aleksejeva et al. (2017)	governance, resources, people/population,
Aleksejeva et al. (2018)	economy
Melro and Oliveira (2017)	economy, mobility, environment, people, living, governance
Barbosa et al. (2018)	sustainable territorial development, strategic spatial planning, smart governance
Filippucci and Bianconi (2018)	economic, social, environmental, governance, ICT

Nishimwe and Reiter (2021)	connectivity, governance, living environment, mobility, energy, environmental impacts
Carrillo et al., 2022	quality of life, economic development, governance, habitat, environment, persons

*Table 13. ST dimensions*

The evidence presented in the table above is corroborated by the findings on the characteristics and challenges of the STs. Giovanella (2013) claims the ST issues mainly concern the accessibility of resources; shortening the supply chain between rural and urban areas; building a network of villages or cultural heritage by means of tourism development; connection of local networks to widespread networks, bringing territories out of isolation. Gambardella et al. (2014) argue the necessity to consider both the city and the territory as resources and raw materials, the hardware to discretize and cross with thought, the only software that can produce the regenerative humus of the towns, of the production supported by training and research, working with art, the quality of the environment, landscape and life. Gabellone et al. (2015) state the ST's sustainable development is possible by capitalizing on its cultural assets and environmental resources and promoting and marketing its touristic offerings. Garcia-Ayllon and Miralles (2015) declare the concept of ST, by its nature, is consistent with the very purpose of sustainability and efficiency. Sturiale and Trovato (2015) claim the prevailing criteria of the ST are efficiency, clarity, democracy, and knowledge as a tool for enhancing the different forms of territorial capital. According to Galego et al. (2016), a smart ecosystem can offer technology-mediated solutions which are personalized for each individual's needs and foster adaptable learning solutions based on new needs or to change environment elements, services, or infrastructures; it is evolved by application of bottom-up approach involving human actors. Priano et al. (2016) argue that regional smartness depends on such elements as coordination, the definition of services, prioritization of actions, information management, the selection of information, the projects' extrapolation potential, and defining beforehand the most suitable set of indicators. The research of Ciani et al. (2017) reveals the territory is the reservoir of resources to be put into the cycle of a sustainable production system of goods and ecosystem services; it is an intelligent cognitive system that educates and learns with smart use of ICT. Navío-Marco et al. (2020) state that the concept of ST they proposed goes beyond the rigid urban/rural dichotomy and forces policymakers to design and implement policies that do not prioritize cities over rural areas or vice versa. According to Garcia-Lara et al. (2021), the paradigm shift from a static to a dynamic ST involves using autonomous systems capable of interacting with and sensing the environment. Rosado-García et al. (2021) argue that STs are made up of a network of buildings, infrastructure, communications, and communities whose elements are monitored so that data nourish this system; this requires collaborative environments, citizen interaction, and their involvement in new models of coexistence. Goint et al. (2022) state that many territories are implementing development strategies strongly rooted in ambitions in terms of digital innovation; these strategies aim not only regional planning but also economic development and people's quality of life; STs achieve these objectives using citizens' data to offer them services and

support them in better-individualized decision-making. Rosado-García (2022) claims STs are made up of a network of infrastructures, communications, and municipalities whose elements are monitored in such a way that the system is nourished by the amount of data necessary as basic information for the different actions; this requires collaborative environments, citizen interaction, and their involvement in new models of coexistence.

### *The nature of the ST concept*

Since the ST concept emerges strongly not only as an extension of the SC concept but also as opposed to it (Navío-Marco et al., 2020), comparing these two concepts seems inevitable in the scientific literature. We observe the discussion developed in the two directions. The first group of authors claims the ST is an extension of the SC concept - it means the application of the SC concept, approach, and tools to the STs. The second group of scholars sees ST as a phenomenon developing independently of the SCs concept, providing different approaches to the ST characterization even if the ST concept emerged from the discussion on the SCs.

### *ST as an extension of the SC concept*

Giovanella et al. 2013 in their study of the interplay among ubiquitous computing combined with cultural heritage as a factor contributing to living quality, use the term ST and SC interchangeably. Citrigno et al. 2014 claim that the definition of technological tools and intelligent platforms, which enable local organizations to acquire, represent and manage data and information, helps provide innovative services applicable to SCs and STs. Couzineau-Zegwaard et al. (2014) present the study of the impact of smart grid development on the Utility/Energy service providers' legitimacy applied indistinctly on STs and SCs. Giovanella (2014) explores possible relationships between territories and learning systems and discovers the existence of a strong correlation between SCs' and universities' rankings, i.e., between learning ecosystems and their territories of reference, speaking about a "smart context" - a context where the human capital, (and more, in general, each individual/citizen) owns not only a high level of skills (possibly innovative ones) but is also strongly motivated by continuous and adequate challenges, while its needs are reasonably satisfied. Opromolla (2015) uses ST and SC terms as synonyms claiming that the territories are constantly (re)defined by the interaction among people; these activities allow the city users to continuously re-semanticize spaces by ensuring to meet their needs and desires; these places become carriers of meanings always different over the time. Conci et al. (2015) borrowed the concept of SC to create an ST across the province; this required that the SC concept be extended beyond the boundaries of urban areas, encompassing rural regions. The studies of Sturiale and Trovato (2015) and Trovato and Sturiale (2016) claim an extension to the field of the SC concept and, therefore, of the methodologies and tools of support can usher in a new era in which territorial management is of the smart type, so it is possible to talk about ST. The research of Artopoulos et al. (2018) contributes to the debate about smart communities and their role in the sustainable management of housing developments and settlements that are

designed and developed with the concept of ST (SC); the integration of ICT and spread of IoT, AI, machine learning are fundamental in a city since it influences the quality of everyday life in a city becomes active and resilient against every type of external and internal change. Pieta et al., 2018 describe a method for simulating IoT-based theme parks, making it consonant with the SC, providing smart capabilities and hence improving the process of tourists management within an ST. Rochdane and Hamdani (2018) use the terms territory and city interchangeably; territorial intelligence is then defined as the application of economic intelligence principles as part of public action, serving a territory's economic and industrial development. Cartaxo and Hossain (2018) declare the idea of STs originates from the SC term, which is widely considered broadly inclusive, so the same tools and criteria can be applied to the rest of the territories, beyond the borders of cities, for a definition of STs. The study of Karpova et al. (2019) article reveals the tools for an increase in the level of digitalization of the territory, and ST is one of them; examples of STs include the cities such as Singapore, New York, Barcelona, and Moscow. In the study of Danilina and Harder (2020), the idea «from SCs to STs» determines the current interest in the introduction of software systems that allow the creation and studying of a smart urban environment, providing future specialists with a comprehensive understanding of the reciprocal relationship between urban processes and the urban environment development, and what consequences will follow their decisions. Garcia-Retuerta et al. (2021) have introduced the concept of "city-as-a-platform" that is driving the technological development of SCs; the authors also presented an example of an efficient crowd management system, implemented and operated via a platform that offers many possibilities for the management of the data collected in STs and SCs. Kapkaev and Kadyrov (2021) show the evolution of the formation of an ST on the example of the concept of SC 1.0 to SC 2.0 and SC 3.0, demonstrating the shift from the city of technologies to the city of high tech and then intelligent integration. Goint et al. (2022) presented a generic platform model based on blockchain technology to manage consent in STs; in their research, the authors claim SC is one of the most popular variations of STs. Leroux and Pupion (2022), in their study of the adoption of IoT tools to foster participatory democracy, improve the quality of services, and increase efficiency, use the terms ST and SC interchangeably. Carrillo et al. (2022) study the opportunity for a small city to implement the SC concept and use the terms ST and SC interchangeably.

### *ST as opposition to SC*

Duval and Woo (2010) studied actual and potential relationships in a global ecosystem in ubiquitous computing and distinguished ST as a separate ecosystem that could collaborate with other territories, nearby cities, and visitors. In the study of emergent behaviors on STs by Giovanella (2013), the STs consist of SC, metropolitan city, and the space of fluxes; the boundaries of an ST are constantly redefined by the fluxes relevant to its functioning. Di Ludovico et al. (2014) place the ST concept as a transition from SC to Smart Up-Country (smart inland areas). Garcia-Ayllon and Miralles (2015) claim that despite the SC concept having a strong theoretical philosophy, in practice, it represents a



set of isolated and unrelated actions; the possible solution for improving this state of affairs is to govern the territory so to make the SC concept evolve towards a more broad and comprehensive concept of ST; in their research, the authors consider the Mediterranean region as an ST. Poletti (2015) claims the transition from the SC concept to that of ST represents an element of territorial and institutional development recognizing the role of industrial innovation; ST is considered as a number of municipalities joined together. Vinieratou–Bossinakis and Patargias (2016) discuss a culture-driven ST and the emergence of a new model of local and regional development in Europe, with culture as a vehicle of "smart specialization" of "functional territories". D'Angelo et al. (2016), D'Angelo et al. (2017), and D'Angelo et al. (2018), in their discussion on the simulation of the IoT, have developed a term for smart shire and claim that ST is more decentralized areas than cities, such as rural areas and countryside. Priano et al. (2016) incorporate the ST concept into the smart region concept, which coordinates the available – and usually limited – resources to yield the maximum productivity of the areas that comprise it; combining a number of SCs within the same territory will not necessarily lead to a smart region, the regional view is more strategic. Melro and Oliveira (2017), in their research on social entrepreneurship and impact communities, use the term ST, as it comprises urban and rural spaces and its stakeholders that use endogenous resources to contribute to local sustainability, to promote reflection on the territory and spaces in it. Barbosa et al. (2018) highlight the ST concept as an independent phenomenon, formulating a definition that embraces the spaces from communities to regions. García-Ayllón (2018) claims the shift from the SC concept to that of ST is revealed as a necessary leap to address the management of our environment in a comprehensive manner; the framework of ST could be more consistent with the original purpose of sustainability and efficiency from the SC concept. The idea of the Jimage project presented by Galli et al. (2019) is to use the smartphone as a guide and provider of multimedia augmented reality, making the SC and ST an open-air museum; the authors of the research separate the two concepts under consideration. Pogosyan et al. (2019) claim STs can become an attractive alternative to megacities in developing construction and transportation, with the most advanced technologies being used in the sociocultural sphere. Matern et al. (2020) state that STs take a leap from the local to the regional scale by means of integrated territorial planning; debates on STs thus contribute to the development of integrated planning strategies on the regional level, with a predominant techno-centric perspective. Desvatirikova et al. (2020) discuss the development of a mathematical model for managing subsystems for the life support of a residential building; the analysis of the infrastructure objects by categories: smart territory - smart city - smart home. Corchado et al. (2021) claim the SC approach, which manages the modernization of an entire megacity, is evolving and adapting to new applications; the new opposite trend to create smart neighborhoods, districts, or territories is becoming increasingly popular, this new trend consists in deploying smart micro territories (or villages) within megacities and in their neighboring regions, serving as smart satellites. The study of Nishimwe and Reiter (2021) aims to create tools related to building energy management on the territories; such tools should facilitate the transition toward ST. According to Rosado-García et al. (2021), the climate crisis and the Covid-19 pandemic

have increased the need for new approaches, expanding the concept of SCs to STs, taking into account participation in society and general inclusivity. Suyendikova et al. (2022) consider STs on the regional scale. This idea is partly supported by the study of Rosado-García (2022), who claim that the SC concept refers to what would be a city or urban nucleus and the ST concept to a larger territory or region.

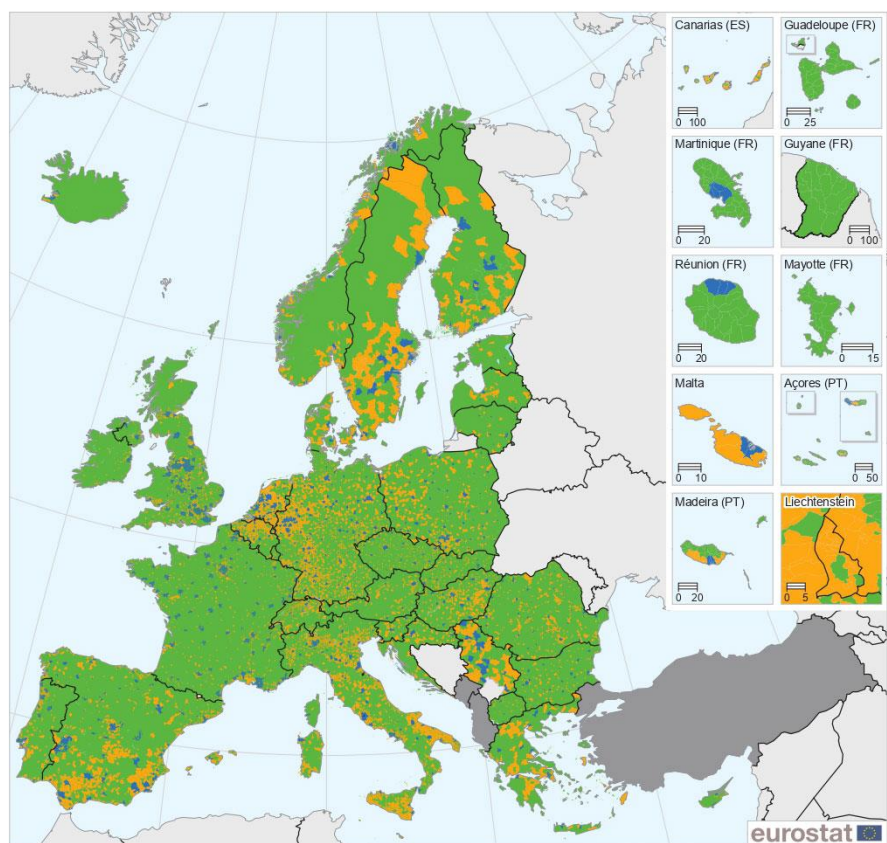
## Conceptualization of the ST

In order to proceed with the discussion of the interrelation between DIES and ST, we need to elaborate on the shared definition of the ST, its dimensions, and a conceptual framework. In order to fulfill this goal, the author decided to take the better of the two approaches of the ST conceptualization presented in the previous paragraph – ST as an extension and (or) opposition of the SC concept.

### *ST geographical boundaries*

As we explored in the previous paragraph, the ST boundaries in the scientific literature are rather indistinct and range from the communities to the regions. We believe the small administrative units are the best choice for the definition of the ST. Such administrative units are third-level administrative divisions, such as townships, towns, municipalities, villages, etc., and their name varies by country. In the EU, they are called Local Administrative Units (LAUs). LAUs are the building blocks of the NUTS (Nomenclature of territorial units for statistics) and statistical regions and comprise the municipalities and communes of the European Statistical System (ESS). LAUs are a subdivision of the NUTS 3 regions covering the whole economic territory of the Member States. In Italy, LAUs correspond to the communes. LAUs comprise large metropolitan areas, where at least 50% of the population lives in the urban area, but they also include communes that consist of predominantly rural areas. Figure 10 shows the distribution of the rural and urban areas among LAUs.

Degree of urbanisation for local administrative units (LAU)



Administrative boundaries: © EuroGeographics © UN-FAO © Turkstat  
Cartography: Eurostat — GISCO, 05/2018

- **Cities**  
(Densely populated areas: at least 50 % of the population lives in urban centres)
- **Towns and suburbs**  
(Intermediate density areas: less than 50 % of the population lives in rural grid cells and less than 50 % of the population lives in urban centres)
- **Rural areas**  
(Thinly populated areas: more than 50 % of the population lives in rural grid cells)
- **Data not available**

0 200 400 600 800 km

Note: based on population grid from 2011 and LAU 2016.  
Source: Eurostat, JRC and European Commission Directorate-General for Regional Policy

*Figure 10. Degree of urbanization for LAUs*

We believe the third-level administrative division is the best choice for the geographical definition of the ST since 1) a small number of citizens and smaller territories permit to get the fastest feedback from the population, providing a bottom-up approach for the development of the territories; 2) other "smart" approaches such as smart towns, smart villages, smart islands (Navío-Marco et al., 2020) are a part of the third-level administrative divisions, so the ST concept can embrace these "smart" approaches too; 3) STs as the third-level administrative divisions are a part of the upper-level administrative divisions such as provinces or regions, so the consideration of the third-level administrative division as smart will force the regional development process.

## ST dimensions

When the ST geographical boundaries are specified, there is a need to define the smart dimensions of the STs. As we discovered from the evidence in the scientific literature on the topic, both STs and SCs pursue the same objective of sustainable development of the space by raising the population's quality of life through several domains – economy, environment, mobility, etc. The longstanding scientific work elaborated the balanced set of SC dimensions that could be applied to the ST reality. Table 14 shows the smart dimensions recently applied in the scientific literature elaborated by Gorelova et al. (2021a). The SC model of Van der Hoogen et al. (2019), which includes nine smart dimensions, was adopted in this table and was integrated by adding a number of recent studies on the topic (indicated as references in the table) in order to explore the complexity of its dimensions. We will apply the SC dimensions to the ST concept as a part of the approach to consider the ST as an extension of the SC concept.

<b>Smart dimensions</b>	<b>Comments from the recent scientific literature</b>
Smart economy	<p>Smart economy is identified in terms of urban economic growth and together with the development of ICT technologies (Anthopoulos, 2017).</p> <p>Smart economy is one of the key strategic action fields for SC development and describes as a set of measures to transform and strengthen the urban economy (beesmart. city 2019).</p> <p>Smart economy concept is based on three pillars: enterprise and innovation, productivity, and local and interconnectedness (Yodono et al., 2018).</p> <p>Smart economy is the area where the new economic phenomena take place (Popova and Popovs, 2022).</p>
Smart technology & ICT infrastructure	<p>SCs need a flexible, up-to-date ICT platform that becomes real technical support for SC development (Chichernea, 2015).</p> <p>The main indicators of the smart ICT system in an urban environment are mobile communication environment, urban hardware facilities, and logistics systems (Cai et al., 2020).</p> <p>The smart technology can be defined as a general term for smart factories, IoT, AI, big data, robotics, 3D printing, AR, VR, and auto driving, which are the key technologies of the 4th industrial revolution (Chung et al., 2022).</p>
Smart environment	<p>Smart environment is a knowledge-based system aimed at building a sustainable and harmonious environment. Ecological issues and biodiversity play a vital role in citizens' welfare and can be reached by implementing smart resource management and using ICT and IoT technologies (Vinod Kumar, 2020).</p> <p>The role of technology is important for the efficient use of resources, improving knowledge about environmental services, and changing people's habits (Aletà et al., 2017)</p>

Smart mobility	<p>Smart mobility is based on applying innovative technical solutions and different alternative mobility services (Schulz et al., 2021).</p> <p>Reduced ecological footprint due to traffic congestion decrease and route optimization is one of the essential factors of smart mobility together with the promotion of active and inclusive mobility, encouraging the use of environmentally friendly vehicles and citizens' engagement (Paiva et al., 2021).</p> <p>Smart mobility concept includes improving public transport services, real-time traffic monitoring, and management (Prakash, 2021).</p> <p>The infrastructure needed for smart mobility are, sensors, smartphones, camera sensors, roadside units, and good communication wired/wireless network with the internet (Savithramma et al., 2022).</p>
Smart people	<p>The smart people dimension refers to the social and human capital in terms of qualification, lifelong learning, inclusiveness, creativity, and participation level in public life (Giffinger and Gudrun, 2010).</p> <p>Smart people are very important to our future because only humans can utilize technology and improve economic and political efficiency, and play a role in social, cultural and urban progress (Mun Chye et al., 2022).</p>
Smart governance	<p>Three main components of the smart governance dimension: are societal goals, collaboration, and technologies (Tomor, 2021).</p> <p>The role of technology is important in achieving effective governance and better outcomes for the urban environment (Jiang, 2021).</p> <p>The main goal of smart governance is to achieve sustainable urban development and improved coordination of the stakeholders in the process (Nguyen and Dao, 2020).</p> <p>The outcomes of smart governance include performance (economy, ecological), citizen-centric services, social exclusion, public interaction, city branding, efficient government, educated citizens, and readiness (Ependi et al., 2022).</p>
Smart living	<p>Smart living is based on three main pillars: energy, mobility, and waste. These categories are applicable on both local and global levels in rural and urban environments (Zavratnik et al., 2020).</p> <p>Smart living dimension includes the following components: smart people, smart mobility, smart economy, smart environment, and smart government (Vinod Kumar, 2020).</p> <p>The smart living is an inclination towards those improvements that enable people benefit from new life styles which includes innovative solutions aiming to make an efficient life, have more</p>

	control, and create a constructive, integrated, and sustainable economy (Shami et al., 2022).
Smart organisation	Smart organizations should support more flexible processes and collaboration between the stakeholders and adapt their knowledge management systems to promote more collaborative and innovative communities in their ecosystems, encouraging a more transparent and inclusive environment (Lima, 2020). Harmonious interaction of a smart organization and a smart city for activating digital transformations should be based on a set of methods: informing; dialogue; studying opinions, goals and interests; joint activities, etc. (Kalynychenko et al., 2022).
Smart policy	The local administration's policy directions are directly connected to the strategies to make the urban environment smarter. In some cases, direct support of the mayor significantly impacts the implementation of smart initiatives. (Alawadhi et al., 2012). Smart policy and planning is connected to the future of Internet. This future impacts the spatialisation of telecommunications and information and communications technologies (Randell-Moon and Hynes, 2022).

Table 14. Smart dimensions retrieved in the literature (source: Gorelova et al., 2021a, corroborated by recent studies)

### *ST definition and the conceptual framework*

Despite the STs having the SC dimensions in the core, the main difference with the SC is that the SC is a fully independent ecosystem while the STs cannot always afford all the smart infrastructure on their territory, but the quality of life of the population could not be neglected. We believe ST can outsource some of the components of the smart dimensions from the neighboring territories, larger territorial divisions, or states. Table 15 represents the components of ST dimensions retrieved from the literature and also from the research conducted by the author previously (Giffinger and Gudrun, 2010; Chourabi et al., 2012; Gil-Garcia et al., 2015; Alexopoulos et al., 2018; Van der Hoogen et al., 2019; Savastano et al., 2020a; Savastano et al., 2020b; Savastano et al., 2020c; Gorelova et al., 2021a; Gorelova et al., 2021b; Savithramma et al., 2022). The components evidenced in grey are supposed to be possibly outsourced by the STs.

ST dimensions	Components of the dimensions	Comments
Smart economy	Knowledge economy	Knowledge economy and business environment as the drivers of the smart economy should be presented in the STs; while creative and high-tech industries could be outsourced from the
	Business environment and entrepreneurship	
	Creative industry	
	High-tech industry	

		neighboring territories or be available online
<b>Smart technology &amp; ICT infrastructure</b>	Broadband, wireless	Smart technologies and infrastructure cross the boundaries of the STs, providing solutions for multiple geographical units
	Virtual technologies	
	Ubiquitous accessibility	
	Computing network	
	Service-oriented architecture	
<b>Smart environment</b>	Ecological sustainability	Monitoring systems and landscape management are to be used by multiple areas or to be applied on the regional/national level
	Attractive natural conditions	
	Environmental sustainability	
	Monitoring system	
	Landscape management	
<b>Smart mobility</b>	Pedestrians management	While pedestrian management, transport services, and traffic management are onsite components of the STs, the navigation and e-ticketing systems are usually applied on higher territorial levels
	Transport services (public transport, sharing mobility, MaaS, mobility on demand)	
	Traffic management	
	Navigation system	
	E-ticketing system	
<b>Smart people</b>	Stakeholder, citizen, community engagement	Educational facilities such as universities and colleges could be situated in the neighboring territories but be easily approachable by the citizens
	Network, partnership, and collaboration	
	Education facilities	
<b>Smart governance</b>	E-government	The components of smart government are usually common on the regional/national level
	Performance management	
<b>Smart living</b>	Public services (safety, housing, health, social services, water/waste management)	Smart living components represent an important part of the everyday life of the citizens but could be approachable in the neighboring territories
	Cultural facilities	
	Tourism facilities	
	Recreation services	
<b>Smart organisation</b>	Knowledge management system	The ST should provide collaborative and innovative communities also by means of outsourcing the business incubation and e-commerce/business facilities
	Business incubation	
	E-commerce/business	
<b>Smart policy</b>	Leadership Vision	Leadership and the political vision are the inevitable parts of the

Policy instruments	smart policy of the ST, while political instruments and policy learning are usually unified on the level of region/nation
Policy learning	

Table 15. Components of smart dimensions retrieved in the literature

Based on the above-mentioned, the STs could be defined as the third-level administrative units developing across smart dimensions that could outsource the missing services across jurisdictional boundaries for smart and sustainable development and enhancing the population's quality of life. At the same time, the ST could be a provider of smart components for other territories launching the process of smartization for other territories. Figure 11 represent a conceptual framework of the ST.

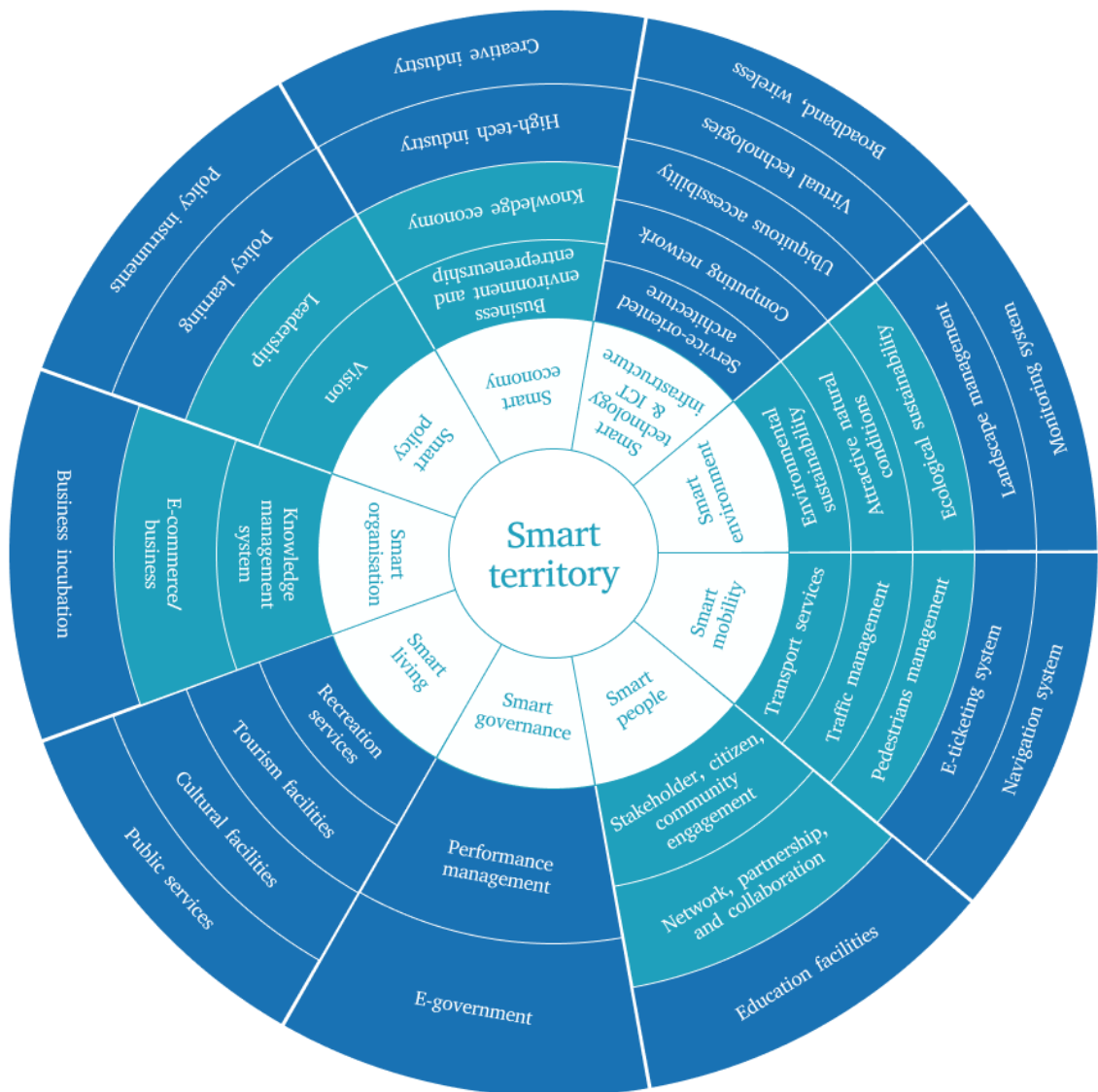


Figure 11. The conceptual framework of the ST

The ST definition and concept are in line with the regional development initiatives applied on European and International levels, for example: 1) Smart Specialisation (S3)



approach characterized by the identification of strategic areas for intervention based both on the analysis of the strengths and potential of the economy and on an Entrepreneurial Discovery Process (EDP) with wide stakeholder involvement; 2) functional area approach introduced by EU and Organization for Economic Co-operation and Development (OECD) that is aimed at enhancing coordination and cooperation across administrative boundaries of the different territories.

## Conclusion remarks

The present study aimed to deepen the existing knowledge on STs, providing a shared definition of the ST phenomenon, its dimensions, and conceptual framework based on the evidence gathered from the systematic literature review on the topic. The ST phenomenon is gaining attention in the scientific literature even if it is often associated with or merged into the discussion on the SCs. The ST definitions presented in the studied literature provide the considerations on the quality of life of the population of the territory and its sustainable development by means of digital technologies and innovation. There is not much of a significant discussion on the geographic boundaries of the ST; also, there is no unanimous consent on the boundaries of the STs in the presented definitions; the proposed variants of the ST boundaries are geographically defined bounded spaces from communities to regions. Since there is no universally accepted ST definition, the discussion on the ST dimensions arises. The studied scientific literature provides evidence of different ST dimensions that help to better define STs from different points of view. These dimensions define core components for the comprehensive conceptualization of the ST phenomenon. Since the ST concept emerges strongly not only as an extension of the SC concept but also as opposed to it (Navío-Marco et al., 2020), comparing these two concepts seems inevitable in the scientific literature. We observe the discussion developed in the two directions. The first group of authors claims the ST is an extension of the SC concept - it means the application of the SC concept, approach, and tools to the STs. The second group of scholars sees ST as a phenomenon developing independently of the SCs concept, providing different approaches to the ST characterization even if the ST concept emerged from the discussion on the SCs. The in-depth analysis of the evidence discussed above allowed the author to formulate the ST's definition and dimensions and build up the ST conceptual model. The study's main limitation is a limited range of literature on the ST that could present significant evidence on the topic; however, the present study could offer a field for a discussion on the topic providing new directions for ST research. Since the new viewpoint on STs was presented in this study, it also provides managerial and political implications. With the view on the third-level administrative divisions as the providers of "smartness" for the population, the national and supranational regional development strategies could strengthen their approach to creating smart conditions across jurisdictional boundaries for its smart and sustainable development and enhance the quality of life of the population. There are several directions for future research: 1) the local characteristics of the STs in different countries or regions should be studied in order to provide the recommendation for the ST's development at national levels; 2) it is also

important to explore the role of the stakeholders of the territory (representatives of local government, industries, academy, and local communities) in the process of territory smartization; 3) another interesting consideration could be the interrelationship between ST development and circular economy issues.

# CHAPTER 4. INTERACTION PROCESS BETWEEN DIGITAL INNOVATION ECOSYSTEMS AND SMART TERRITORIES

## Chapter Summary

This chapter is aimed at understanding the interaction process between DIE and ST concepts. It provides the results of the empirical study on the issues of digital technologies and innovations in the context of ST development. The DIE components and their interconnection with STs are examined to understand the ST's role in DIE development, so an interconnection between DIE components and the ST environment was established. The interplay between DIE components and the ST environment revealed that STs represent a fertile ground for effective DIE development by providing the necessary infrastructure, institutional environment, and cultural and creative human capital. The evidence from this chapter showed that DIE also contributes to ST dimensions and components influencing their mutual development and growth. As the main result of this research stage, the model of DIE engagement in the ST environment shows the bilateral nature of their mutual interaction process.

## Background information

Some aspects and initiatives at the international and national level on regional development and the application of digital technologies to support digital transformation initiatives were reviewed in the previous chapters. Regional development initiatives follow the SDG agenda, aiming at improving the quality of life of the society by achieving a balance of social, economic, and environmental development through the rational use of all the resources of the regions. To promote regional development, supranational organizations such as the UN, OECD, and EU, as well as local governments, are developing and applying holistic and integrated place-based approaches and policies that favor participatory planning and social cohesion; to reduce disparities in order to enhance well-being and living standards. The incentives adapted are mainly focused on specific territorial assets, provide investment and attractiveness strategies, optimize complementarities, develop efficient multi-level governance systems, and favor stakeholders' involvement. Regional development strategies contribute to national performance and more inclusive, resilient societies. Digital transformation and digital innovation initiatives are becoming an inevitable part of regional development. The ubiquitous penetration of digital technologies helps to accelerate economic growth and the quality of life of the population; digital technologies are changing the ways of social interaction in politics, education, everyday life, and culture. The range of policies adopted on supranational and national levels support the diffusion of digital technologies helping to reduce digital cap between countries and regions.

Despite the fact that the role of digital innovation and transformation for regional development is actively discussed on scientific and political levels, this research is a first attempt to understand the interaction process between the two phenomena relating to

this issues – DIEs and STs. Taking into consideration all the above-mentioned, the research questions under investigation in this chapter are the following:

**RQ:** What is the interaction between DIE and ST?

The sub-research questions that will help to shed the light on the DIE-ST interplay are:

**SRQ1:** What is the contribution of digital technologies and innovations to STs' development?

**SRQ2:** What is the ST contribution to DIE development?

**SRQ3:** What is the DIE contribution to ST development?

This research stage is organized as follows: firstly, evidence from the literature on the issues of digital technologies and innovations in the context of ST development was presented. The research methodology part describes the methods used to explore the interconnection between the DIE and ST. As a further step, the author considers the interconnection between DIE and ST dimensions and components through their mutual confrontation. As the main result of this research phase, the bilateral nature of DIE-ST interplay is discovered, and the DIE-ST interaction model is presented.

## Evidence from the literature

### *Digital technologies in the context of STs' development*

Digital technologies penetrate the everyday life of STs, providing opportunities for territorial problem-solving and generating synergies to tackle urban and rural problems. Digital technologies enhance performance and well-being on the territory, improve the population's quality of life, reduce costs and resource consumption, and promote more effective and active public engagement and territorial government on the STs. Giovanella et al. (2013) claim the integration of many technologies and infrastructures: web, mobile, and smart spaces (Internet of Things, IoT, and Points of Interaction, i.e., PoInts, based on multimodal and natural interactions) enhance learning experiences from the cultural background on the territory. Citrigno et al. (2014) declare that ICT tools can enable an efficient and innovative model for resource coordination and for the improvement of citizen quality of life, making them an integral part of good administrative practices in the territories. In the research of Gabellone et al. (2015), innovative models and tools were designed and developed for capitalizing on and exploiting cultural heritage, considered as an integrated and complex system designed as a holistic model strongly based on the use of ICT technologies on STs. Poletti (2015) stresses the sound role of technologies in finding unreleased territorial government tools on the territories; the technology is the asset from which projects arise and develop. Conci et al. (2015) claim that digital technologies, such as ICT, micro- and nano-electronics, nanotechnology, advanced materials, and industrial biotechnology, enhance performance and well-being, improve the quality of life, reduce costs and resource consumption, and promote more effective and active public engagement on the STs. Sturiale and Trovato (2015) consider ICTs as a

way to create new knowledge of territory; the combined use of the Internet, GIS, and Geo Tools allow to develop and get access to digital content and additional services and to exchange experiences through social networks; the ability to interconnect territorial resources through ICTs transforms the territory into an ST and defines the direction of the further development. A further study by the same group of scholars (Trovato and Sturiale, 2016) stipulates that new technologies (ICTs) can find applications for the use, promotion, and enhancement of cultural and tourism resources. According to the research of D'Angelo et al. (2016), thousands of interconnected devices will compose even a small size ST. Ferretti and D'Angelo (2016) provide examples of technologies that develop the ST context, such as mobile multihoming services, mobile ad-hoc networks, opportunistic networks, peer-to-peer and cloud (or alternatively, fog) computing systems. Galego et al. (2016), in their research of a "people-centered" and multidimensional definition of the "smartness" of an ecosystem on the example of a university campus, claim that the installed services and technologies classify the usefulness and smartness of the space. Priano et al. (2016) propose the deployment of technological platforms within the islands' territories to offer the possibility to connect with services to/from the local governments. D'Angelo et al. (2017) declare that enabling technologies, wireless networks, with a specific focus on 5G Device-to-Device (D2D) communications, IoT, mobile and pervasive computing has great significance for the organization of an ST; STs should be able to exploit pervasive solutions, where IoT, wireless sensor networks and ubiquitous computing are merged in a single platform. The case study of Aleksejeva et al. (2018) reveals that productivity increase in the context of smart growth is particularly necessary for the sectors of high-technology and medium-high-technology manufacturing industries and knowledge-intensive services. The research of Artopoulos et al. (2018) highlights the importance of using smart technologies to activate people in settlements and cities in order to expand their interest beyond the efficient function of their houses and ease of use of public infrastructures; the authors claim the spread of such concepts as IoT, ICT, AI, and machine learning could make the ST more active and resilient. The research of Barbosa et al. (2018) contributes to the discourse of STs by providing a comprehensive vision of the impact of novel digital technologies (CI, IoT, DLT, ICT) on the territory; the above-mentioned technologies help to transform the social, cultural and political characteristics of the ST context. Cartaxo and Hossain (2018) declare that the use of new solutions based on ICTs, such as open data, monitoring, and public participation (e.g., through online tools), is an inevitable opportunity for creating STs. The study of Danilina and Harder (2020) claims that the technologies related to Big Data, VR, and information modeling provide opportunities for territorial problem-solving. According to Navío-Marco et al. (2020), the adoption of digital technologies benefits the entire territory and generates synergies to tackle both urban and rural problems. Garcia-Lara et al. (2021), in their research on the territory with a high symbolic cultural value, claim that digital technologies are the critical element for the preservation of intangible cultural heritage. The research of Garcia-Retuerta et al. (2021) states the application of digital technologies promotes collaboration and democratization of information and knowledge on STs. Rosado-García et al. (2021) highlight the importance of collaborative digital technologies such as BIM for the

development of collective intelligence while creating an environment in which opportunities and synergies can arise. Goint et al. (2022) propose a generic blockchain-based model for consent-based data sharing in the ST context while putting users at the center of control of their data; a diversity of ST services digitize more and more data, which requires trust between actors in order to create synergy within different services of the territory. Suyendikova et al. (2022) claim that the digital transformation of STs could positively affect achieving sustainable development's environmental and social goals by improving ecology and healthcare.

### *The role of innovations and innovation ecosystems for STs' development*

Innovation activities and, in particular, the open innovation approach applied on the territory is a pathway to the emergence and strengthening of local creative and innovative communities. Innovative solutions are aimed at the regeneration of the territory and the smart management of urban and suburban territories; they facilitate the engagement of stakeholders of the territory. The territory becomes a place where innovation occurs by means of innovative technologies and services, the respond to people's needs and having an actual positive impact on their daily lives. Giovanella et al. (2013) consider education as a factor stimulating innovativeness on the STs able to stem and reduce the digital divide, favor e-inclusion, and foster citizens to innovate, also for increasing the level of participation in governance. The study of Misseri (2013) considers innovation ecosystems as a pathway for local innovation that facilitates the emergence and strengthening of communities of practice creating and capturing the value that has the ability to impact significantly local development through open innovation approaches and strategic resources mobilized on the territory. Carroll et al. (2014) see the smart social grids of collective knowledge, resources, and awareness shared online as a potential for STs to adapt, learn, and innovate. According to Citrigno et al. (2014), innovative services are aimed at the intelligent management of urban and suburban territories; innovative solutions and technology platforms enable a new way of working for the stakeholders of the territory. Couzineau-Zegwaard et al. (2014) assume that business ecosystems in the STs foster a collective innovation process on the territory; companies should switch from a closed innovation model to an open model, exploiting the sources of innovation available on the territory. According to Gambardella et al. (2014), the regeneration of the territory can only occur through projects suitable to the area, supported by research, education, and innovation; in this study, the 'Knowledge Factory' represents a specific territorial infrastructure that may serve as the driver of innovation for protection and regenerative development of the cultural, environmental, landscape and industrial assets of the territory. The study of Conci et al. (2015) suggests that territory becomes a place where innovation occurs by means of technologies, services, and innovative that respond to people's needs and have an actual positive impact on their daily lives. The research of Melbarde and Ore (2016) is focused on the identification of the factors that influence balanced and sustainable rural and regional development in the context of smart development; among the economic factors, the authors mention the proportion of innovative companies on the territory. D'Angelo et al. (2017) claim that making a territory smart involves leading innovative solutions in the

countryside; the authors call this novel view of equipping smart services in the countryside "smart shires"; the domain of services that may provide some benefit to these areas ranges from services to citizens to services for municipalities. Pistorio et al. (2018) underline the pivotal role that policymakers can play in the development of innovation ecosystems; the study describes how a governmental organization is able to become the hub of an ecosystem developing digital innovation in healthcare settings and how it supports the diffusion of digital innovations through a specific set of policies. The study of Cartaxo and Hossain (2018) demonstrates that smart technological innovation in public governance, where human well-being can be secured in the best possible ways by smartly tackling the prevailing challenges in a socio-cultural and environmental context, is a way to achieve sustainable development of the territories. Whyte (2019) considers the digital innovation ecosystem in the city of London as a tool for the development of new digitally enabled project delivery models involving industry/government initiatives that provide experiments and learning from digital delivery on infrastructure megaprojects. Baumanė-Vitoliņa and Dudek (2020) provide a comprehensive overview of the innovation ecosystem on the example of the innovation landscape in Kraków, Poland; according to the authors, the innovation ecosystems can be important vehicles in the process of transitioning to a technology-driven economy and that externalities created by technology itself can be neutralized through innovation. The study of Cvar et al. (2020) provides considerations on the concept of a digital innovation ecosystem in urban and rural environments and underlines the sound role of digital transformation with all its accompanying phenomena, including the application of the IoT (technology) in both environments. Filatova et al. (2020) consider universities, research organizations, and innovative business enterprises as the drivers of innovative development in the region. Ruohomaa et al. (2020) claim that transdisciplinary innovation happens through a digital innovation ecosystem to create profitable new business models on the territories. Rosado-García et al. (2021) carried out research on the New European Bauhaus as an ecosystem of innovation, as well as the perspectives of the actors within it; policymakers are seen as the providers of financial, physical and legislative infrastructure; the industry should create an environment in which opportunities and synergies can arise; academia is considered as a provider of a niche for disruptive innovation development; sustainable society should embrace aesthetic and cultural dimensions; full life cycle inclusion, circularity, the integration of ecological infrastructure and landscape are critical for the sustainable natural environment. Maurer (2021) studies the role of DIHs and their critical role as intermediate for increased service interaction and system innovation within the regional innovation system. According to Goint et al. (2022) digital innovation domain is a fertile ground for the elaboration and implementation of development strategies on the territories.

## Research methodology

This chapter aims to bridge the knowledge gap on the interaction process between the DIE and ST concepts. Once the definitions and dimensions of DIE and ST are identified, the present research stage will conduct their mutual confrontation. The nature of this

stage of the study is exploratory. It aims to explore and understand the relationship and characteristics of the interplay between DIE and ST concepts. The DIE and ST dimensions and components elaborated at the previous stages of the study and their causal nexus will be further investigated to explore the mutual interconnection between DIE and ST. The author considers the interconnection between DIE and ST dimensions and components through mutual confrontation. This approach was previously applied in another study by the author (Gorelova et al., 2021a). As the main result of this research phase, the bilateral nature of DIE-ST interplay is discovered, and the DIE-ST interaction model is presented. The results of the study will be corroborated by the evidence from the literature on digital technologies and innovations contributing to STs' development.

## Results and discussion

### *STs contribution to DIEs*

DIEs are complex innovation ecosystems of sociotechnical nature aimed at creating new products and services using digital technologies in order to create value. As demonstrated above, digital technologies and innovation are the critical factors of the ST's formation and development, but at the same time, we can assume the sound role of DIEs in the development of STs. In order to understand the correlation between the two phenomena, we proceed with their mutual confrontation by discussing the ST contribution to every DIE component.

### *Institutional context*

STs create a productive environment for effective and active public engagement, promoting eGovernment solutions and digital public services. Regional and ST institutions should support initiatives at the legislative level in favor of digital transformation, attracting cultural and creative human capital and maximizing the economic and social effects of the DIEs presence in the ST environment. The governance of the territory is considered "smart" when technological developments and solutions are integrated as with the changes taking place in socio-cultural, economic, and environmental settings in a given region; the smart governance approach must, therefore, be prepared for accumulating digital transformation (Cartaxo and Hossain, 2018). The institutional framework should be readapted to respond to the needs of STs, especially in the technological domain, focusing on innovation and smart specialization (Vinieratou–Bossinakis and Patargias, 2016). Municipalities are interested in the experimentation of innovative IT solutions and techniques since their intent is to pursue the realization of an ST (Citrigno et al., 2014). The initiatives to support smartness should encourage local authorities to coordinate their interventions; local actors should be required to design their projects so that the adoption of digital technologies benefits the entire territory and generates synergies to tackle both urban and rural problems (Navío-Marco et al., 2020). The various levels of government present (regional, island, and local)



on the territory mean that the planning and deployment of smart solutions require the highest coordination; these levels of government existed long before the arrival of the smart movement; as a result, the mechanisms for the ST development are not yet well established (Priano et al., 2016). At the same time, the logic 'local content' still dominates the interventions at the local level of individual municipalities or public bodies, which instead should be designed at least at the level of the ST; the municipalities should systematize their experiences and knowledge and join together to identify a shared vision (Poletti, 2015). Territorial intelligence policies are essential for the territories to value their specific assets in the cooperation context (Rochdane and Hamdani, 2018). The approach to the management of ST must be holistic and systemic, with the sound presence of local communities, as well as sustainability paradigms and the complexity that the territory has with its innumerable eco-systemic services; territorial development is based on understandings and agreements between local communities and institutions (Ciani et al., 2017; Filippucci and Bianconi, 2018). The measurement indicators for the institutional context on STs, among others, could be the total local government expenditure, the number of municipal website visits by citizens, the proportion of residents who participated in local elections (Melbarde and Ore, 2016).

### *Technologies*

Digital technologies and data are transformational; people, firms, and governments live, interact, work and produce differently than in the past, and these changes are accelerating rapidly (OECD, 2019). Nowadays, digital technologies are used to track and diagnose problems in different domains of life activities - agriculture, health services, environmental protection, smart mobility or to perform everyday tasks such as bills payment; governments and businesses have an increasing number of tools to search, analyze and use data for financial and other purposes<sup>38</sup>. As we saw from the literature review, digital technology is an inevitable part of STs that helps to develop them in the most sustainable way. At the same time, smart technologies and ICT infrastructure are one of the core components of the STs that can serve as a fertile ground for the DIEs development. The installed services and technologies classify the usefulness and smartness of the space (Galego et al., 2016), and ST is a territory based on digital technologies applications. Digital technologies on STs enhance performance and well-being, improve the quality of life, reduce costs and resource consumption, promote more effective and active public engagement on the STs, enable an efficient and innovative model for resources coordination, and involve residents in the activities on the territory (Citrigno et al., 2014; Conci et al., 2015). The integration of digital technologies creates new learning experiences and new knowledge on a territory (Giovanella et al., 2013; Sturiale and Trovato 2015; Garcia-Retuerta et al., 2021). Apart from activating people on the ST and transformation of social, cultural, and political characteristics of the ST context, smart technologies ease the use of public infrastructures (Artopoulos et al., 2018; Barbosa et al., 2018) that further development of other components of DIE – institutional, social and physical. The ST context generates a diversity of ST services that digitize more

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<sup>38</sup> <https://www.un.org/ru/un75/impact-digital-technologies>

and more data, which requires trust between actors in order to create synergy within different services of the territory (Goint et al. 2022). ST infrastructures provide great opportunities for data collecting, and this allows DIE to be successfully implemented. It would be difficult to imagine a DIE without the possibility of making data-driven decisions.

### *Social space*

ST provides compelling cooperation opportunities for the actors and stakeholders of the territory. STs also attract cultural and creative human capital that advances knowledge on the territory and improves the innovative and entrepreneurial potential of the territory affecting the creation and development of DIEs. The initiatives to create a ST are based on a set of social goals, such as offering improved wealth, health, opportunity, safety, sustainability, independence, and choice; digital technologies ease the creation of an interaction process between the population and the territory (Ferretti and D'Angelo, 2016). Technological innovation on STs relies on an ecosystem that integrates business, higher education, universities, and research institutions (Conci et al., 2015). The more technological innovation adapted to the sustainable and efficient use of the existing management services, the more local communities mobilize themselves to competently tackle the challenges on the territory (Cartaxo and Hossain, 2018). The ST as an ecosystem vision promotes the idea of the networked 'place for life', as well as the creation of public space; so the SC phenomenon makes a shift to an ST concept that revolves around the co-habiting of the planet Earth by both humans and nature (Rosado-García et al., 2021). The affordability of the ST could be characterized by involving human actors, their motivation, and their feedback on how to improve the conditions of the population living on the territory; citizens are becoming "the social sensors" of the territory (Citrigno et al., 2014; Galego et al., 2016). STs must inextricably count on the participation of society; the data from the community could be used for usability improvements on the territory or for malfunction prevention or warning (Rosado-García, 2022). The solutions found for social problems aim to create a positive impact on people and, consequently, on the territory (Melro and Oliveira, 2017). Indeed the population is the most important cornerstone of smart growth of the rural territories; citizens' initiatives and activities play an important role in ensuring smart territorial development. Attracting and retaining inhabitants and successful exploitation of their potential are important factors in ensuring sustainable territorial development; it is essential to promote the involvement of all social actors, such as local communities, young people, elected officials, farmers, or community service managers, in order to implement collective solutions (Aleksejeva et al., 2018; Filippucci and Bianconi, 2018; Orazi et al., 2018). Availability of residents with higher education, community activity, number of NGOs, and the availability of lifelong learning are among the social factors that influence the smartness of the territory (Melbarde and Ore, 2016).

### *Physical environment*

The physical environment in terms of civil engineering and infrastructure construction has always been the tool with which people adapted their environment, facilitating coexistence, the residence itself, the transport of goods, people, and communication, or the capture of natural resources; nowadays infrastructures must be the backbone of the territorial development; the concept of smart infrastructure encompasses and in turn relates multiple aspects, whether social, technological or engineering, that lead to the generation of STs (Rosado-García, 2022). A smart physical place is always in interaction with the virtual components of the technological environment (Giovannella et al., 2013). Indeed technological infrastructure and innovative ICT tools can deliver high-value-added services for citizens and operators (Citrigno et al., 2014). Physical and virtual means, spaces and people, individuals and organizations, connections, relationships, communication, and dependencies should feed the objective of achieving territorial development (Melro and Oliveira, 2017). ST infrastructure has improved dramatically, raising our attention from merely aggregating feeds in mobile applications to mining and organizing community information through ontologies of community assets (i.e., people, places, institutions, and events) (Carroll et al., 2014). Physical components of smart environments extend and complement the traditional webs – social, economic, etc. and should be maximally used by the public, accessible, and reliable. These infrastructures should favor symbioses within the urban environment (i.e., with smart buildings, robots, smart artifacts, and wearables) and with local STs for both everyday life and emergencies (e.g., diagnosis and reaction after a fire or earthquake) (Duval&Woo, 2010). Digital technologies should be coupled with physical interfaces for the shared use of communal facilities and infrastructures; it enquires whether designers need to offer spatial programs and interfaces that make datasets intelligible, operational, and exchangeable for citizens (Artopoulos et al., 2018). A physical interface to the smart infrastructure, such as energy regeneration systems, is to be installed in communal spaces of the settlements and is expected to be formally and structurally integrated into the communal spaces of each settlement (Artopoulos et al., 2018). Apart from the infrastructure to allocate smart solutions, physical environment indicators of the ST also comprise geographical location, landscape, and biological diversity, the proportion of cultivated agricultural land, and the total density of the road network (Melbarde and Ore, 2016).

In Table 16, the summary of the evidence from the literature on the interconnection of DIE components with ST is reported.

*Institutional context*

STs create a productive environment for effective and active public engagement, promoting eGovernment solutions and digital public services. Regional and ST institutions should support initiatives at the legislative level in favor of digital transformation, attracting cultural and creative human capital and maximizing the economic and social effects of the DIEs presence in the ST environment.

<i>Social space</i>
ST provides compelling cooperation opportunities for the actors and stakeholders of the territory. STs also attract cultural and creative human capital that advances knowledge on the territory and improves the innovative and entrepreneurial potential of the territory affecting the creation and development of DIEs.
<i>Physical environment</i>
The physical environment in terms of infrastructure, firms' tangible assets, and capital goods used by the actors and stakeholders should be represented on ST to help to allocate smart solutions for the DIE development.

*Technologies*

Digital technologies are an inevitable part of STs that helps to develop a smart environment in the most sustainable way. At the same time, smart technologies and ICT infrastructure are one of the core components of the STs that can serve as a fertile ground for the DIEs development.

Table 16. STs contribution to DIEs

*Contribution of DIE to ST dimensions and components*

The analysis presented in Table 17 reveals the connection between ST dimensions and components and DIE components; the following table represents the nine ST dimensions discussed in Chapter 3 and their components. The components evidenced in grey are supposed to be outsourced from other environments, neighboring or regional. The ST dimensions and their components are analyzed from the perspective of the DIE contribution to ST development. DIE stimulates the emergence and development of ST's fundamental components, helping ST become an attraction point for the investments, knowledge, skilled cultural and creative human capital that maximize economic efforts

and promotes further territory development. In the same way, DIEs favor the development of neighboring territories, allowing the exchange of public and private services to leverage regional development processes and initiatives.

ST dimensions	Components of the ST dimensions	Contribution of DIE to ST dimensions
Smart economy	Knowledge economy	Since creative and high-tech industries could be outsourced from the neighboring territories or be available online, DIEs can create an online environment for representatives of the creative and high-tech industries, allowing the ST residents to work in these domains without living in their territory. In this way, the territory does not risk missing its skilled and knowledgeable human capital. At the same time, digital solutions could develop the high-tech business environment making the territory more attractive to investors and professionals.
	Business environment and entrepreneurship	
	High-tech industry	
	Creative industry	
Smart technology & ICT infrastructure	Broadband, wireless	Smart technologies and infrastructure cross the boundaries of the STs, providing solutions for multiple geographical units. Smart technology is an inevitable part of DIEs that benefits the distribution of technologies among the territories. Also, DIE makes digital technologies profitable by creating new products and services using digital technologies in order to create value on the territory.
	Virtual technologies	
	Ubiquitous accessibility	
	Computing network	
	Service-oriented architecture	
Smart environment	Ecological sustainability	The debate on environmental pollution of digital technologies
	Environmental sustainability	

	<p>Attractive natural conditions</p> <hr/> <p>Monitoring system</p> <hr/> <p>Landscape management</p>	<p>is ongoing; however, with the help of innovative digital technologies, the DIEs may serve to develop digital tools and infrastructure for effective on-site pollution monitoring and landscape management.</p>
<p><b>Smart mobility</b></p>	<p>Pedestrians management</p> <hr/> <p>Transport services (public transport, sharing mobility, MaaS, mobility on demand)</p> <hr/> <p>Traffic management</p> <hr/> <p>Navigation system</p> <hr/> <p>E-ticketing system</p>	<p>Smart mobility challenges are directly connected to the implementation of digital technologies in order to constantly monitor data on citizens' mobility, the state of public transport and infrastructure, and other services. DIEs on the territory could provide smart solutions for mobility services on the SC quality level; these solutions will likely expand across the boundaries of the single ST.</p>
<p><b>Smart people</b></p>	<p>Stakeholder, citizen, community engagement</p> <hr/> <p>Network, partnership, and collaboration</p> <hr/> <p>Education facilities</p>	<p>DIEs gather cultural and creative human capital, favoring the development of partnerships, networks, and collaborations. Educational facilities such as universities and colleges are one of the critical components of this dimension; they could be situated in the neighboring territories but be easily approachable by the citizens through smart solutions.</p>
<p><b>Smart governance</b></p>	<p>E-government</p> <hr/> <p>Performance management</p>	<p>Smart government solutions are usually shared on the regional/national level; however, DIEs could provide local digital solutions to ensure the higher performance of local authorities and their interaction with the citizens to favor inclusiveness and facilitate public engagement.</p>

<b>Smart living</b>	Public services (safety, housing, health, social services, water/waste management)	Smart living components play a critical role in everyday life of the residents but could be approachable on the neighboring territories. DIEs could provide comfortable infrastructure for the ST residents; developing innovative products and services eases the everyday life of the ST residents.
	Cultural facilities	
	Tourism facilities	
	Recreation services	
<b>Smart organisation</b>	Knowledge management system	The ST should also provide collaborative and innovative communities by outsourcing business incubation and e-commerce/business facilities. DIEs favor attracting talented people and outstanding companies from all over the world or providing opportunities for their development on-site. The DIE stakeholders could bring innovative business models to the ST.
	Business incubation	
	E-commerce/business	
<b>Smart policy</b>	Leadership	As full-fledged territory actors, the DIE stakeholders influence the political processes, development and implementation of local policies, providing leadership and vision of the STs' development strategies.
	Vision	
	Policy instruments	
	Policy learning	

*Table 17. Contribution of DIE to ST dimensions development*

The research conducted in this phase of the study allowed us to design the DIE-ST interaction model (see Figure 12). This interaction model represents the mutual interconnection between the ST and DIE concepts and their dimensions and components. ST favors the development of the DIEs, representing the fertile ground for its development by providing the necessary infrastructure, institutional environment, and cultural and creative human capital. At the same time, DIEs could provide further opportunities for the territory to support its development and growth.

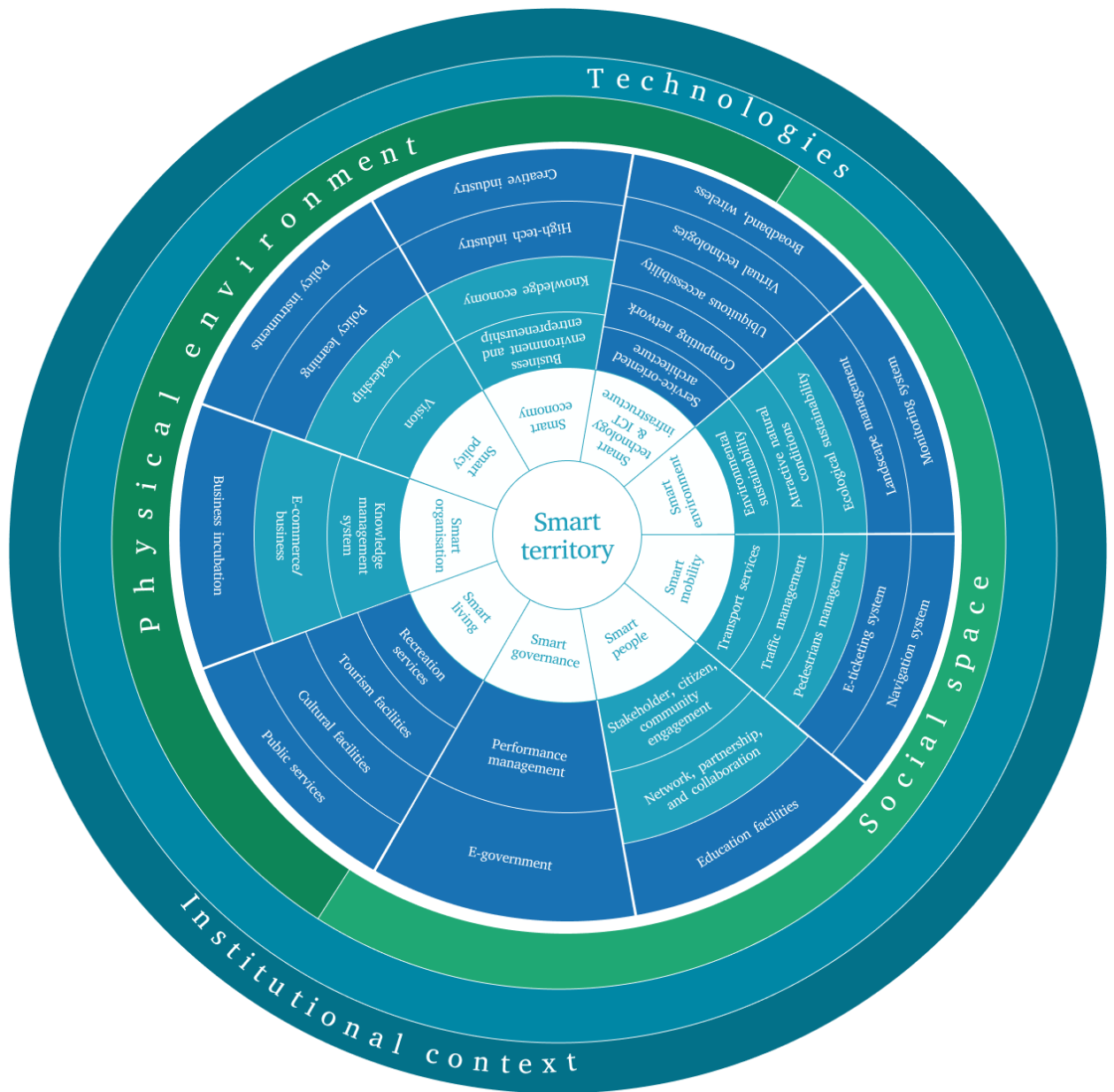


Figure 12. DIE-ST interaction model

### Conclusion remarks

Digital transformation occupies one of the central places in developing regions and cities. Digital technologies have developed significantly in recent years, becoming an integral part of various SC domains, and nowadays, they are penetrating the STs' environment. This chapter studied the interplay between STs and DIEs and their mutual contribution to their development and growth.

A reciprocal interconnection was established due to the contribution of the STs to the DIE components—institutional, technological, social, and physical. STs create a productive environment for effective and active public engagement, promoting eGovernment



solutions and digital public services. Regional and ST institutions support initiatives at the legislative level in favor of digital transformation, attracting cultural and creative human capital and maximizing the economic and social effects of the DIEs presence in the ST environment. ST provides compelling cooperation opportunities for the actors and stakeholders of the territory. STs also attract cultural and creative human capital that advances knowledge on the territory and improves the territory's innovative and entrepreneurial potential, affecting the creation and development of DIEs. The physical environment in terms of infrastructure, firms' tangible assets, and capital goods used by the actors and stakeholders is represented on ST to help to allocate smart solutions for the DIE development. Digital technologies are an inevitable part of STs that helps to develop a smart environment most sustainably. At the same time, smart technologies and ICT infrastructure are one of the ST's core components that can serve as a fertile ground for the DIEs development.

At the same time, it was established that DIES create viable conditions for effective ST development. DIE makes digital technologies profitable by creating new products, services, and business models using digital technologies in order to create value, ease the everyday life of the citizens, and gather cultural and creative human capital, favoring the development of partnerships, networks, and collaborations. DIEs can create an online environment for representatives of the creative and high-tech industries, allowing the ST residents to work in these domains without living in their territory. In this way, the territory does not risk missing its skilled and knowledgeable human capital. At the same time, digital solutions could develop the high-tech business environment making the territory more attractive to investors and professionals. DIEs may serve to develop digital tools and infrastructure for effective on-site pollution monitoring and landscape management. DIEs in STs could provide smart solutions for mobility services on the SC quality level; these solutions will likely expand across the boundaries of the single ST. DIEs could also provide local digital solutions to ensure the higher performance of local authorities and their interaction with the citizens to favor inclusiveness and facilitate public engagement. As full-fledged territory actors, the DIE stakeholders influence the political processes, development, and implementation of local policies, providing leadership and vision of the STs' development strategies.

The main outcome of this research phase is elaborating the DIE-ST interaction model. This model illustrates the bilateral nature of the interplay between DIE and ST. This study has some limitations that mainly lie in its exploratory nature. In order to obtain a more profound analysis of the DIE-ST interaction, the engagement of different stakeholders in the research is needed. Thereby, the future study (Chapter 5) will be aimed at conducting interviews with ST stakeholders to provide evidence on the DIE-ST interaction from the practical side.

## CHAPTER 5. TOWARD APPLICATION OF THE DIE-ST MODEL: INSIGHTS FROM A CASE STUDY

### Chapter Summary

This chapter provides an overview of the application of the DIE-ST model in real-life conditions. The Municipality of Corropoli (Italy) case study was applied in this research. The Municipality of Corropoli is an independent actor, but at the same time, it joins the Union of Municipalities of Val Vibrata together with the other eleven municipalities of this territory. This positioning of Corropoli helps to study the state of DIE in this municipality and to trace the role of cross-boundary cooperation, an inevitable characteristic of ST, as stated in Chapter 3. The study results reveal the shared understanding of the ST by the stakeholders of the territory, the current state of adoption of digital technologies, and the DIEs for the development of STs.

### Case study of the Municipality of Corropoli (Italy)

In order to understand the overview of the interconnection between DIE and ST in real-life conditions, a case study of the Municipality of Corropoli (Italy) was conducted. The Municipality of Corropoli is located in the province of Teramo, in the Abruzzo region (Italy); it is a medieval town with deep historical roots. According to the most accredited sources, its name comes from the Latin "Collis Ruppuli" or "Colle di Ripoli." Ripoli, in fact, is the name of the Neolithic settlement that stood in part on the territory of the current municipality of Corropoli. Today Corropoli is a municipality that keeps its rich historical and cultural heritage alive and is experiencing a period of development favored by economic activities, food, and wine tourism. Table 18 summarizes some of the characteristics of the Municipality of Corropoli.

<b>Country</b>	Italy
<b>Region</b>	Abruzzo
<b>Province</b>	Teramo (TE)
<b>Surface</b>	22.11 km <sup>2</sup>
<b>Density</b>	229.90 inhabitants / km <sup>2</sup>

*Table 18. Characteristics of the Municipality of Corropoli*

Corropoli is one of the twelve municipalities of the Union of Municipalities of Val Vibrata (Vibrata Stream). The Union is located on the extreme northern edge of the Abruzzo region, on the border with the coastal area of the Marche region. All 12 municipalities are rich in history, and traditions, dedicated to agricultural and wine-growing activities, industry, and trade in the leather goods, textiles, music, and mechanics sectors. The Union of Municipalities of Val Vibrata includes about 80,000 inhabitants, about 5,000 of whom live in Corropoli. Figure 13 presents a map of the Union for a better understanding of its geographic position.



Figure 13. The Union of Municipalities of Val Vibrata<sup>39</sup>

The Union, established in the year 2000, is a local authority dealing with the management of social services, integrated waste management, the single commissioning center, and the single evaluation unit. Corropoli, being a part of the Union, is involved in a series of recent joint activities. The *Comune Ciclabile* initiative provides a cycling route in the municipality of Corropoli. The route connects the historic center of the town to the commercial/residential area of Corropoli and represents a first and important infrastructure for alternative mobility to the use of motor vehicles. The cycle/pedestrian path intends to respond to the need to defend and spread the use of bicycles as a means of transport, capable of satisfying even systematic home-work trips and access to services, and not just recreational or sports or very short-range ones. The itinerary connects to another circular cycling route along the Val Vibrata area. The Union of Municipalities of Val Vibrata has designed and is currently under construction, the cycle path along the Vibrata Stream within a broader tourist-cultural route. Once completed, the track will also connect the territory of the municipality of Corropoli to the coastal itineraries of the Adriatic cycle route, a route which, in Abruzzo, is almost completely completed for a total of 131 km. *Raccolta differenziata*, which is aimed at waste sorting is another common sound initiative; the municipalities of the Union have established integrated management of environmental services in Val Vibrata. Every day it manages urban hygiene services throughout the Val Vibrata territory, cleaning the streets and all the services necessary for the management of the entire waste cycle: collection, treatment, disposal, recycling, and energy recovery.

<sup>39</sup> <http://www.unionecomunivalvibrata.it/mappaterritorio.php>

Table 19 represents the ST dimensions discussed in the previous chapters and initiatives presented in the Municipality of Corropoli to better understand the current state of the municipality's development.

<b>ST dimensions</b>	<b>Incentives presented in the Municipality of Corropoli</b>
Smart economy	Single Desk for Productive Activities ( <i>Sportello Unico per le Attività Produttive</i> ) is a service that simplifies the relations between business and public administration. It is the only territorial point of reference for all procedures connected to business activities
Smart technology & ICT infrastructure	Participation in the WindTre Connected Villages ( <i>Borghi connessi</i> ) initiative will make it possible to digitize the municipality through Wi-Fi
Smart environment	The Cycling route ( <i>Comune Ciclabile</i> ) and Waste sorting ( <i>Raccolta differenziata</i> ) initiatives represent the solutions for the support of ecological and environmental sustainability
Smart mobility	The Cycling route ( <i>Comune Ciclabile</i> ) initiative promotes bicycles as a means of transport, capable of satisfying systematic home-work trips and access to services
Smart people	The municipal resources have been allocated to improve the services relating to compulsory education; to the structural interventions are added, other services and initiatives, such as the provision of school labs and school buses
Smart governance	"Open Administration" ( <i>Amministrazione trasparente</i> ) initiative introduced by the National Legislative Decree in 2013 is understood as the total accessibility of information concerning the organization and activity of public administrations in order to favor control over the pursuit of institutional functions and the use of public resources
Smart living	The Municipality of Corropoli disposes of various cultural and tourism facilities and recreation services. Public services are partly divided with The Union of Municipalities of Val Vibrata
Smart organisation	N/A

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Smart policy	Political vision and instruments are developed in conformity with the strategic vision of The Union of Municipalities of Val Vibrata development
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*Table 19. ST dimensions and initiatives in the Municipality of Corropoli*

## Research methodology

After the DIE-ST model was established, the demonstration of its applicability to the real-life context through an empirical study was conducted. Empirical case study design results in the most suitable approach for the exploratory nature of this stage of the study. The application of this approach in the research is constrained by the desire to understand the overview of the interconnection between DIE and ST in real-life conditions. Finding strong evidence for building theories from case studies is a research strategy that involves using one or more cases to build theoretical constructs, propositions, or theories from case-based, empirical evidence; case studies might provide rich empirical descriptions of particular instances of a phenomenon typically based on a large variety of data sources from which a theory can be developed inductively (Eisenhardt, 1989). Based on the research background, the present study, through an exploratory research design, aims to answer the following research questions:

**RQ:** What is the interconnection between DIE and ST in real-life conditions?

**SRQ1:** What is the current state of understanding of the STs among the stakeholders of the territory?

**SRQ2:** How do the stakeholders of the territory adopt digital technologies and innovations? What are the barriers and key drivers?

**SRQ3:** What is the role and the current state of the DIEs for the development of STs according to the stakeholders of the territory?

For the implementation of this stage of the study, in-depth interviews were conducted with three samples of respondents to gain a deeper understanding of the dynamics behind the DIE-ST interaction by obtaining direct testimony from those who operate daily in this environment at public and private levels. The author followed the quadruple-helix innovation model to identify the respondents to the interview; this approach was already applied by several scholars for empirical studies and proved its efficiency (Cai and Lattu, 2022; Del Vecchio et al., 2017). However, the specificity of the municipality made some adjustments to the methodology of the study. Since no representatives of the Academic helix are presented on the territory, the respondents of the interviews are the following – policymakers, entrepreneurs, managers, and representatives of local communities. The interview questions were formulated with

respect to both a thematic dimension—regarding the research topic and to the subsequent analysis of the interview—and a dynamic dimension—stimulating the interviewees to talk about their experiences and feelings (Kvale and Brinkmann, 2009). Therefore, data triangulation was implemented, combining both primary and secondary data to guarantee greater validity to the investigation. The primary data collected through the in-depth interviews were analyzed using sentence and paragraph analysis for open coding the text and then by applying axial and selective coding to derive the most important evidence for the purposes of this research and in respect of the RQs stated above.

In-depth interviews, which lasted about 1 hour each, were based on a semi-structured protocol with open-ended questions to solicit interviewees to talk freely, describe their opinions in detail, and give explanations. Separate questionnaires for the interviews were prepared for three groups of respondents: 1) respondents of the local administration of the Municipality of Corropoli (see protocol 1); 2) representatives of the industrial circles located in the Municipality of Corropoli (see protocol 2); 3) representatives of local communities (see protocol 3). Particularly, the three interview guidelines were structured on the following topics represented in Table 20 that will be further reflected in the key results presented in the next section of this chapter.

<b>Protocol 1</b>	<b>Protocol 2</b>	<b>Protocol 3</b>
Degree of experience in the field	Degree of experience in the field	Degree of experience in the field
Interviewee's opinion on the nature of the ST concept and its perception	Interviewee's perception of the ST concept	Interviewee's perception of the ST concept
Local authorities' contribution to the ST's development	Interviewee's perceived contribution to the ST's development	Local communities' perceived contribution to the ST's development
Interviewee's understanding of the role of digital transformation in the territorial development	Interviewee's understanding of the role of digital transformation for the activity on the territory; the importance of digital technologies and innovation in the activity of the interviewee	Interviewee's understanding of the role and perception of digital technologies and innovations among the residents of the territory
Interviewee's perception of the current situation, barriers, and key drivers for the digital transformation of the territory	Interviewee's perception of the current situation, barriers, and key drivers of the digital transformation of the territory	Interviewee's perception of the current situation, barriers, and key drivers of the digital transformation of the territory

Interviewee's perception of the state of DIEs components on the territory	Interviewee's perception of the state of DIEs components on the territory	Interviewee's perception of the state of DIEs components on the territory
Opportunities for DIE competence enhancing and future ST growth, actions to be taken	Opportunities for DIE competence enhancing and future ST growth, actions to be taken	Opportunities for DIE competence enhancing and future ST growth, actions to be taken

*Table 20. The three interview protocols*

By using these three questionnaire layouts, the author was able to summarize and analyze the evidence of the three different viewpoints on the topics of interest, understanding common traits and peculiarities related to the issue under investigation.

## Results and discussion

### *The current state of understanding of the ST*

The respondents perceive ST context and nature as a connected and dynamic territory, within reach of the citizen, where infrastructure and people are interconnected. ST is also commonly defined as a geographical point where citizens easily access information, from the most ordinary, such as online access to gas or electricity bills, to environmental and pollution conditions, public lighting, and other services. Furthermore, STs must provide easy access to public administration (open administration) information, possibly through a single portal. Hence, the ST is a territory connected using digital technologies between citizens and public administration. A further aspect is that the ST grants fast and stable access to public and private services, from the most important, such as hospitals and schools to the recreational and cultural services, such as museums and public spaces, in terms of making reservations and payments.

Digital technologies aim to facilitate the everyday life of the citizens and activities of industries and local authorities on the ST. However, the central objective of the ST is the citizen, so the simplification of citizens' lives through the provided services and improvement of life conditions could be considered the most important goal of the ST, according to the interviewees. Being a central player in the territory, the citizen of the ST may not only use the technologies and smart services provided by the municipality for private purposes but also apply them for personal growth as an entrepreneur and game changers. STs' initiatives application in the municipality under consideration can serve a twofold purpose – to ease the citizens' life and empower them, thus providing a further change of the territory.

The respondents claim that converting a conventional territory (municipality) into a smart one is an inevitable process because of the ubiquitous progress, diffusion of technologies, and public policies aimed at their introduction to the territories. It is important to develop a territory smartly “because it cannot exist otherwise”. However, the development of the ST and its infrastructure must be diversified with respect to the

size of the territory. The larger the territory under consideration, the more the underlying infrastructure and the processes on the territory can be complex. A small step for a large municipality is a significant step for a small municipality like Corropoli; for example, having Wi-Fi internet in this municipality is already a big step that allows the flow of information and the development of the hardware network, which makes significant change for the citizens. Therefore, it is essential to continuously improve the state of smartness of the ST, albeit in a different way than it is done in SCs; however, the implementation of digital technologies is the inevitable step and an impetus to become a smart territory.

This understanding of ST as a connected, citizen-oriented environment coincides with the scientific discourse presented in the previous chapters. However, the perceived scale of developments in the municipality has more local and place-based connotations; the insignificant adjustments of the SC level could become a breakthrough for the future ST. The evidence presented in the next paragraph confirms this conclusion.

### *Adoption of digital technologies and innovations on the territory*

The technologies have spread naturally over the years and inevitably reached Corropoli; digital technologies and infrastructure are becoming important issues for the municipality's development under consideration. However, the municipality is still at the beginning of the journey; there is still a lot of effort needed to establish the digital infrastructure. The first steps are already done – several residential areas and all the public schools of the municipality that not even had an ADSL connection were finally covered with Wi-Fi, this is an ongoing process, and Wi-Fi is spreading across the territory. Despite this important progress, the basic concepts of a smart environment such as smart devices or smart infrastructure, are still missing. With the wireless connection arrived at the municipality, future developments are being planned. The possible next step will be to proceed with the WindTre initiative Connected Villages (Borghi connessi) which will make the digitalization of the whole municipality through Wi-Fi possible. This leads to further improvements in the territory. For example, the air conditioning of the buildings is expected to be managed via Wi-Fi technologies, and this step will reduce waste and optimize thermal comfort.

As barriers to the adoption of digital technologies and innovations, and ST development, the interviewees name the obsolescence of the infrastructure that must convey information, which would be necessary to radically replace the data transmission network; this holds back due to operational costs, so ad hoc funds are needed. Sometimes some initiatives are implemented precisely because of the funds' availability. However, these initiatives are not useful to citizens or, perhaps above the technical possibilities, are carried out (e.g., an app is developed, but there is no connection). The citizens themselves represent another difficulty in the adoption of digital technologies since their understanding of technologies and innovative processes are fairly low, and further training to develop digital skills is needed. The local authorities are the ones to explain the role of technology, so communication is important. The dialogue between the



administration and the citizen seems a solution to strengthen the development of digital innovation in Corropoli; nowadays, citizens often communicate with the municipality via social media. The skilled and capable citizens will help to organize the infrastructures and services, providing progress and prosperity to their territory. Therefore, the driver of change in the territory is the will to make a change and the strong professionalism with clear ideas on the objectives and ways of achieving them. The ST needs smart people; human intelligence accelerates and speeds up technology diffusion on the territory, and these dimensions are interconnected.

It becomes increasingly important and more and more useful for providing digital services to citizens who increasingly need to be able to carry out operations and use services provided by the territory independently. However, Corropoli is a small environment, and therefore it does not create much attraction for external companies that bring technologies, the joint effort is needed. Corropoli, being a part of the Union of Municipalities of Val Vibrata, should share services and infrastructure, attracting the contractor companies with the prospect of operating in all municipalities with the consequent reduction in costs and unification of the range of services on the territory. Furthermore, in this way, a shared service is truly offered to citizens because all municipalities will have the same infrastructure. In addition to information concerning the individual citizen, it is also important to provide and have access to information of a more general nature of larger territories, such as environmental, municipal, and regional conditions, in order to feel like a part of a large regional or national community in an active way.

### *The role and current state of the DIEs for the development of STs*

The evidence presented in this paragraph was gathered on the basis of respondents' answers about the level of development of DIEs – institutional, technological, social space, and physical environment.

European, national and regional policies on the digital transformation of the territory is a positive aspect that provides a shared vision and allows municipalities to raise funds for the construction of infrastructures. There are specific calls for digitalization in the framework of industry 4.0 initiatives that favor the development of industries; the important thing is to know how to channel the funds to do something useful for the territory and how to incorporate these policies to maximize results. The municipality of Corropoli has always been able to seize opportunities to grow and has won several European and regional tenders for the construction of urban planning works for public use such as nursery schools, sports fields, and building renovations. All these projects were done without burdening municipal expenses, which allowed us to invest in other initiatives. The municipality regularly participates in tenders aimed at implementing digital innovation on the territory; one of the most important tenders nowadays is the one to develop an online payment system; such a system will provide transparency and efficiency of the transactions. There is a shared perception among the interviewees that the policies will remain the main engine of the future development of the territory.

Even though digital technologies are ubiquitous nowadays and penetrate the environments of most territories, there is still a need for modern infrastructure. Various works have been carried out in this regard, such as installing cameras, free wireless internet in some public areas, etc. However, much still needs to be done to reach a sufficient level for the use of the most modern smart technologies. Therefore, through greater efforts, it will be possible to achieve the objective of obtaining the funds and exploiting them to provide modern infrastructure to deploy digital technologies. With the switching of the municipality's infrastructure to the use of smart technologies, the citizens will be more disposed to the change also because citizens already use innovative digital technologies but not on the municipality or public platforms in general.

Speaking about the social dimension, with the citizens that already use technologies for other types of services and are ready to the scaling of the technologies on the municipal level, it is also important to attract cultural and creative human capital as it becomes the driving force for the subsequent phases of digitalization in a virtuous circle of progress. It is important to ensure that digitalization continues its growth because if companies know the capabilities of the municipality, they are attracted to come and establish themselves in Corropoli, which leads to the digital transformation processes. More innovative industries attracted to the territory mean greater economic returns that can be invested in future digitalization and more capable, suitable people who make the innovation usable. Specialized personnel is needed, dedicated exclusively to the implementation of digitization projects. This inevitably leads to improved services for citizens who can take advantage of the progress and improve living conditions. Currently, this specialized staff is absent, and those involved in digitalization often carry out other tasks. If a territory becomes flourishing from a technological and economic point of view, this also becomes attractive for human cultural capital. From a cultural point of view, the same discourse can be extended to cultural private and public companies such as museums, theaters, or creative labs that attract creative social capital. For example, the archaeological museum in Ripoli could be developed (at European and world levels), and a new theater could be built. Therefore, there must be this attraction for companies also thanks to the ST development.

Sometimes small settlements do not need or do not see the need for digitalization and digital transformation because of the citizens' and local authorities' usual customs and habits; also, a certain parochialism makes every municipality want individual development. In this case, a shared "global" vision is needed on the territory, and Val Vibrata environment is a good example. The Union of Municipalities of Val Vibrata could become a useful tool or platform to build a single network for development to eliminate or diminish the disparities between neighboring municipalities in the same area. Important work in this direction is still ahead. Hence, DIE could be built with joint efforts of the Union of Municipalities of Val Vibrata and generate value across the boundaries of the municipalities.

## Conclusion remarks

The case study conducted in the Municipality of Corropoli revealed several outcomes. Firstly, the respondents from different groups have similar definitions and perceptions of the ST as a connected and dynamic territory within reach of the citizen where digital infrastructure and citizens are interconnected; it is a territory that provides strong collaboration between industries, residents, and local authorities. Secondly, the resident of the territory is a central element of the smart environment; the final objective of making a territory smart is to satisfy the citizen. Being a central player in the territory, the citizen of the ST may not only use the technologies and smart services provided by the municipality for private purposes but also apply them to the entrepreneurial activities that would further change the current state of affairs on the territory. STs' initiatives application in the municipality under consideration can serve a twofold purpose – to ease the citizens' life and empower them, thus providing a further change of the territory. Third, the development of the municipality in a smart way implies close collaboration with neighboring municipalities that allows sharing of infrastructure and services, the Union of the municipalities of Val Vibrata is an example of such a fruitful collaboration. Lastly, the DIE application in the Municipality of Corropoli is in the initial stage. At the same time, the institutional and technological components are well developed, there is still a lack of infrastructure and skilled human capital to manage digital technologies. However, the Municipality of Corropoli is moving towards implementing digital technologies and innovations, and the study results could become a starting point for further developments. An essential outcome of the research is that DIE could be established with joint efforts of the Union of Municipalities of Val Vibrata. In this way, DIE could promote further development of the municipality under consideration and in neighboring municipalities bringing smart solutions to the territory and hence paving the way to further ST initiatives.

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# CONCLUSION

## Outcomes of the research

The main objectives of this dissertation were to provide a conceptualization and definition of the DIEs, to get an in-depth understanding of the ST concept and to build a comprehensive model of the interplay between DIEs and ST, to provide an overview of the application of the DIE-ST model in real life conditions.

In the dissertation, we reviewed some aspects and initiatives at the international and national levels on regional development and the application of digital technologies to support digital transformation initiatives. Regional development initiatives follow the SDG agenda, aiming to improve the society's quality of life by achieving a balance of social, economic, and environmental development through the rational use of all the resources of the regions. To promote regional development, supranational organizations such as the UN, OECD, and EU are developing and applying holistic and integrated place-based approaches and policies that favor participatory planning and social cohesion; to reduce disparities and enhance well-being and living standards. The incentives adapted are mainly focused on specific territorial assets, provide investment and attractiveness strategies, optimize complementarities, develop efficient multi-level governance systems, and favor stakeholders' involvement. Regional development strategies contribute to national performance and more inclusive, resilient societies. Digital transformation and innovation initiatives are becoming inevitable in regional development. The ubiquitous penetration of digital technologies helps accelerate economic growth and the population's quality of life; digital technologies are changing the ways of social interaction in politics, education, everyday life, and culture. The range of policies adopted on supranational and national levels support the diffusion of digital technologies helping to reduce digital cap between countries and regions.

Considering that digital transformation occupies an important place in managerial and scientific discourses, this research discusses the phenomenon of DIEs, their definitions, and their components. The systematic literature review on the topic sheds light on the state-of-art of scientific discussion. It gives insights into the nature of the DIE that contributed to formulating the shared definition of the DIE and its components. Four system levels of the DIEs operation were also distinguished and discussed. The author deliberately narrowed the range of literature, concentrating only on the literature that discussed DIEs and not other ecosystems with a similar nature and connotation to reveal the characteristics of the DIEs as they understand the scholars that use this definition. Thus, the research findings represent some interesting theoretical, empirical, and policy implications. Therefore, the theoretical contribution of this part of the study consisted in the conceptualization of the discussion on the common elements of DIE in the scientific discourse, which was previously neglected in the literature; DIEs shared definition, and conceptual framework could raise the discussion in future scientific studies. The managerial implication of this research resides in the evidence of the role and place of the

stakeholders in the DIE environment, which has a significant potential to leverage their activity. From an institutional and political viewpoint, the present results can support governments and local administration in improving their role in the DIE context through research and innovation projects and programs, aiming to increase the effectiveness and efficiency of stakeholders' engagement. These outcomes also have a strong social and economic impact on economic development; hence, the development of DIEs prompts advancements in other spheres of life.

The next stage of the research aimed to deepen the existing knowledge on STs, providing a shared definition of the ST phenomenon, its dimensions, and conceptual framework based on the evidence gathered from the systematic literature review on the topic. The ST phenomenon is gaining attention in the scientific literature even if it is often associated with or merged into the discussion on the SCs. The ST definitions presented in the studied literature provide the considerations on the quality of life of the population of the territory and its sustainable development employing digital technologies and innovation. There is not much of a significant discussion on the geographic boundaries of the ST; also, there is no unanimous consent on the boundaries of the STs in the presented definitions; the proposed variants of the ST boundaries are geographically defined bounded spaces from communities to regions. Since there is no universally accepted ST definition, the discussion on the ST dimensions arises. The studied scientific literature provides evidence of different ST dimensions that help to better define STs from different points of view. These dimensions define core components for a comprehensive conceptualization of the ST phenomenon. Since the ST concept emerges strongly not only as an extension of the SC concept but also as opposed to it (Navío-Marco et al., 2020), comparing these two concepts seems inevitable in the scientific literature. We observe the discussion developed in the two directions. The first group of authors claims the ST is an extension of the SC concept - it means the application of the SC concept, approach, and tools to the STs. The second group of scholars sees ST as a phenomenon developing independently of the SCs concept, providing different approaches to the ST characterization even if the ST concept emerged from the discussion on the SCs. The in-depth analysis of the evidence discussed above allowed the author to formulate the ST's definition and dimensions and build up the ST conceptual framework. The main limitation of this phase of the study is a confined range of literature on the ST that could present significant evidence on the topic; however, the present study could offer a field for a discussion on the topic providing new directions for the ST research. Since the new viewpoint on STs was presented in this study, it also provides managerial and political implications. With the view on the third-level administrative divisions as the providers of "smartness" for the population, the national and supranational regional development strategies could strengthen their approach to creating smart conditions across jurisdictional boundaries for its smart and sustainable development and enhance the quality of life of the population. There are several directions for future research: 1) the local characteristics of the STs in different countries or regions should be studied in order to provide the recommendation for the STs' development on national levels; 2) it is also important to explore the role of the stakeholders of the territory (representatives of local

government, industries, academy, and local communities) in the process of territory smartization; 3) another interesting consideration could be the interrelationship between ST development and circular economy issues.

The following research stage explored the interconnection between STs and DIES and their contribution to mutual development and growth. A reciprocal interconnection was established due to the contribution of the STs to the DIE components—institutional, technological, social, and physical. STs create a productive environment for effective and active public engagement, promoting eGovernment solutions and digital public services. Regional and ST institutions support initiatives at the legislative level in favor of digital transformation, attracting cultural and creative human capital and maximizing the economic and social effects of the DIES in the ST environment. ST provides compelling cooperation opportunities for the actors and stakeholders of the territory. STs also attract cultural and creative human capital that advances knowledge on the territory and raises the territory's innovative and entrepreneurial capacity, affecting the creation and development of DIES. The physical environment in terms of infrastructure, firms' tangible assets, and capital goods used by the actors and stakeholders is represented on ST to help to allocate smart solutions for the DIE development. Digital technologies are an inevitable part of STs that helps to develop a smart environment most sustainably. At the same time, smart technologies and ICT infrastructure are one of the ST's core components that can serve as a fertile ground for the DIES development. At the same time, it was established that DIES create viable conditions for effective ST development. DIE makes digital technologies profitable by creating new products, services, and business models using digital technologies in order to create value, ease the everyday life of the citizens, and gather cultural and creative human capital, favoring the development of partnerships, networks, and collaborations. DIES can create an online environment for representatives of the creative and high-tech industries, allowing the ST residents to work in these domains without living in their territory. In this way, the territory does not risk missing its skilled and knowledgeable human capital. At the same time, digital solutions could develop the high-tech business environment making the territory more attractive to investors and professionals. DIES may serve to develop digital tools and infrastructure for effective on-site pollution monitoring and landscape management. DIES in STs could provide smart solutions for mobility services on the SC quality level; these solutions will likely expand across the boundaries of the single ST. DIES could also provide local digital solutions to ensure the higher performance of local authorities and their interaction with the citizens to favor inclusiveness and facilitate public engagement. As full-fledged territory actors, the DIE stakeholders influence the political processes, development, and implementation of local policies, providing leadership and vision of the STs' development strategies.

In the final phase of the study, the case study in the Municipality of Corropoli revealed several outcomes. Firstly, the respondents from different groups have similar definitions and perceptions of the ST as a connected and dynamic territory within reach of the citizen where digital infrastructure and citizens are interconnected; it is a territory that provides strong collaboration between industries, residents, and local authorities. Secondly, the

resident of the territory is a central element of the smart environment; the final objective of making a territory smart is to satisfy the citizen. Being a central player in the territory, the citizen of the ST may not only use the technologies and smart services provided by the municipality for private purposes but also apply them to the entrepreneurial activities that would further change the current state of affairs on the territory. STs' initiatives application in the municipality under consideration can serve a twofold purpose – to ease the citizens' life and empower them, thus providing a further change of the territory. Third, the development of the municipality in a smart way implies close collaboration with neighboring municipalities that allows sharing of infrastructure and services, the Union of the municipalities of Val Vibrata is an example of such a fruitful collaboration. Lastly, the DIE application in the Municipality of Corropoli is in the initial stage. At the same time, although the institutional and technological components are well developed, there is still a lack of infrastructure and skilled human capital to manage digital technologies. However, the Municipality of Corropoli is moving towards implementing digital technologies and innovations, and the study results could become a starting point for further developments. An essential outcome of the research is that DIE could be established with joint efforts of the Union of Municipalities of Val Vibrata. In this way, DIE could promote further development of the municipality under consideration and in neighboring municipalities bringing smart solutions to the territory and hence paving the way to further ST initiatives.

The present research provides insight into the state of DIE and ST but also presents opportunities for future research on the topic. Further case studies in the LAUs in Italy and abroad can contribute to developing new multi-stakeholders and multidimensional performance measurements in specific contexts to stimulate further development of the DIEs and STs. Finally, a digital tool for assessing the efficiency of digital innovation processes in a ST environment could be created to facilitate the process of assessing the current state of digital innovation systems, finding weaknesses and possible solutions.

## Scientific contribution and managerial implications of the research

This research intends to offer a scientific and concrete advancement on how the DIE can interact on the ST level. The relationship between DIE and ST is the most important aspect of the research. The results of this research lie both in theoretical and practical fields. From a theoretical point of view, the research results will contribute to advancing knowledge on the interplay between DIEs and territories, providing an interdisciplinary and modern reading of traditional research issues in business networks and districts. The application potentialities of the research are practical ones and are aimed at the potential stakeholders and actors involved in the DIEs in ST environments – policymakers, firms, entrepreneurs, institutions, and local communities. The geography of the application of the research results is not limited by regional or national borders and may be expanded outside Italy and the EU. The expected application potential of this research could be

expressed in developing economic policy recommendations and managerial guidelines for policymakers, organizations, and other institutions and creating a digital tool for assessing the efficiency of digital innovation processes in an ST environment. In particular, the development of recommendations and guidelines for the stakeholders of the DIEs in the ST context may be possible due to the findings of this research that reveal the nature of the DIE and ST concepts in terms of their definitions, dimensions, and interrelations. The evidence on the trends in the topic and the definition of the role and place of DIEs in the development of STs gained in the research could be used as a basis for the formulation of the recommendations and guidelines to be included in the current political and business agenda in order to make the process of mutual development of the DIEs and STs in a more efficient and sustainable way.

This research intends to highlight how digital technologies are redesigning the territory in a smart way. Referring to DIE as a point of economic development, it would mean triggering a new process of technological innovation, the emergence of new technological clusters, incubators and accelerators, and other innovation actors in different productive sectors from manufacturing to services. In other words, more emerging technologies are poised to have strong implications for regional development. While digital innovation remains at the heart of the concepts of DIE and ST, a key question is how to make the most of costly investments in smart digital technologies, applications, and innovations for citizens' well-being in a short time. Such actions affect not only the economic sphere but also the institutional, social and ethical one.

This research is also consistent with the current EU and UN vision of the future society based on sustainable development and the transition towards an integrated and inclusive development model, particularly from a horizontal geographical point of view. Social well-being and cultural development of territory are directly related to the growth rate and other indicators of social well-being. The development of DIEs and STs will become a stimulus for economic activities at different levels, private or public. At the same time, the development of governmental and entrepreneurial activities in the STs context may have a positive socio-economic effect concerning several UN Sustainable Development Goals (SDGs) in terms of sustainability transitions and regional diversification: help reduce poverty and hunger, promote the (digital) well-being of the citizens, raise gender equality, create opportunities for decent work and support economic growth. Entrepreneurs and public entities, in turn, stimulate the technological development of the territories through attractions of investments and creative and cultural human capital, turning the territory into a smart one.

Mutual development of DIEs and STs paves the way for developing the digital and green sustainable transition in the regions. The green economy is related to a wide economic context which includes a set of industrial services attentive to the ecological aspects such as eco-innovation, efficiency, energy saving, supporting-resource-efficiency, development of renewable energy sources, efficient use of resources, waste prevention and recycling, eco-agricultural sectors, sustainable mobility. Within this context, the outcomes of this research could support a preventive approach to environmental



challenges, promote greater environmental responsibility, and encourage the development and dissemination of technologies that respect the environment.

## ABBREVIATIONS

AI – Artificial Intelligence

API – Application Programming Interface

AR – Augmented Reality

AT – Austria

AU – Australia

BE – Belgium

BR – Brazil

CH – Switzerland

CI – Computational Intelligence

CL – Chile

CN – China

CO – Colombia

CY – Cyprus

CZ – Czech Republic

DE – Germany

DIE – Digital Innovation Ecosystem

DIH – Digital Innovation Hub

DIU – Digital Innovation Unit

DLT – Distributed Ledger Technologies

EAFRD – European Agricultural Fund for Rural Development

EC – European Commission

EDP – Entrepreneurial Discovery Process

EIP-SCC – European Innovation Partnership on Smart Cities and Communities

EMFF – European Maritime and Fisheries Fund

ERDF – European Regional Development Fund

ES – Spain

ESF – European Social Fund

ESIF – European Structural and Investment Funds

ESS – European Statistical System

EU – European Union

FI – Finland

FR – France

GDP – Gross Domestic Product

GIS – Geographic Information System

GR – Greece

ICT – Information and Communication Technologies

IoT – Internet of Things

IRDP – Integrated Regional Development Planning

IS –Iceland

IT –Italy

JP –Japan

KR – South Korea

KZ – Kazakhstan

LAC – Latin America and the Caribbean countries

LAU – Local Administrative Unit

LT – Lithuania

LV – Latvia

MA – Morocco

MaaS – Mobility as a Service

MX – Mexico

MY – Malaysia

NGO – Non-Governmental Organization

NSS – Network Supply System

NUTS – Nomenclature of territorial units for statistics

OECD – Organization for Economic Co-operation and Development

PL – Poland

PT – Portugal

QA – Qatar

RDPC – Regional Development Policy Committee  
RQ – Research Question  
RU – Russia  
S3 – Smart Specialisation Strategy  
SC – Smart City  
SCIS – Smart Cities Information System  
SDG – Sustainable Development Goal  
SE – Sweden  
SG – Singapore  
SI – Slovenia  
SME – Small and Medium Enterprise  
SRL – Systematic Literature Review  
SRQ – Sub-Research Question  
SSPIE – Sustainable and Smart Product Innovation Ecosystem  
ST – Smart Territory  
UK – United Kingdom  
UN – United Nations  
UNCRD – UN Centre for Regional Development  
UNDP – United Nations Development Programme  
UNEP – United Nations Environmental Programme  
UNESCO – United Nations Educational, Scientific and Cultural Organization  
US – United States of America  
VR – Virtual Reality

## BIBLIOGRAPHY

1. Adner R., (2006). Match your innovation strategy to your innovation ecosystem, *Harvard Business Review*84(4): 98 – 107
2. Adner R., Kapoor R., 2010. Value creation in innovation ecosystems: how the structure of technological interdependence affects firm performance in new technology generations, in *Strategic Management Journal* 31, 306 – 333
3. Alawadhi, S., Aldama-Nalda, A., Chourabi, H., Gil-Garcia, J.R., Leung, S., Mellouli, S., Nam, T., Pardo, A.T., Scholl, H.J., Walker, S., 2012. Building Understanding of Smart City Initiatives. In *Electronic Government*. Edited by Hans Jochen Scholl, Marijn Janssen, Maria Wimmer, Carl Erik Moe and Leif Skiftenes Flak. EGOV 2012. Lecture Notes in Computer Science. Berlin/Heidelberg: Springer, vol. 7443.
4. Aleksejeva, L., Šipilova, V., Jermolajeva, E., Ostrovska, I., Olehnovics, D., 2017. Smart growth in latgale region of latvia: an overview of multiple-helix actors, in: Raupeliene, A. (Ed.), 8th international scientific conference rural development 2017: bioeconomy challenges. Lithuanian Minist Agr; Res Council Lithuania, pp. 868–873.
5. Aleksejeva, L., Šipilova, V., Jermolajeva, E., Ostrovska, I., Olehnovics, D., 2018. Regional risks and challenges in smart growth in Latgale Region (Latvia). *Journal of Security and Sustainability Issues* 7, 727–739.
6. Aletà, N.B., Alonso, C.M., Ruiz, R.M.A., 2017. Smart mobility and smart environment in the Spanish cities. *Transportation Research Procedia* 24: 163–70.
7. Alexopoulos, C., Charalabidis, Y., Vogiatzis, N., Kolokotronis, D.E., 2018. A Taxonomy for Analysing Smart Cities Developments in Greece. ICEGOV '18: Proceedings of the 11th International Conference on Theory and Practice of Electronic Governance, pp. 537–549.
8. Ambad, S.N.A., 2022. "A Systematic Literature Review on Social Entrepreneurial Intention: Citation, Thematic Analyses and Future Research Directions", Crowther, D. and Quoquab, F. (Ed.) *Social Entrepreneurs (Developments in Corporate Governance and Responsibility, Vol. 18)*, Emerald Publishing Limited, Bingley, pp. 93-124.
9. Anthopoulos, L. G., 2017. *Understanding Smart Cities: A Tool for Smart Government or an Industrial Trick?* Berlin: Springer International Publishing
10. Artopoulos, G., Pignatta, G., Santamouris, M., 2018. From the Sum of Near-Zero Energy Buildings to the Whole of a Near-Zero Energy Housing Settlement: Accessing Data in Performance-Driven Design. *ARCHITECTURE\_MPS* 14, 1+.
11. Barbosa, A.C., Oliveira, T.A., Coelho, V.N., 2018. Cryptocurrencies for Smart Territories: An exploratory study, in: *Proceedings of the International Joint Conference on Neural Networks*.
12. Basole, R. C. 2009. "Structural Analysis and Visualization of Ecosystems: A study of Mobile Device Platforms" *Americas Conference on Information Systems (AMCIS) Proceedings*

13. Baumane-Vītoliņa, I., Dudek, D., 2020. Innovation ecosystems in the context of economic development: a case study of Kraków, Poland. *Studies of Transition States and Societies* 12
14. Beltagui, A., Rosli, A., Candi, M., 2020. Exaptation in a digital innovation ecosystem: The disruptive impacts of 3D printing. *RESEARCH POLICY* 49
15. Božić, S., 2021. Smart urban–smart rural: innovation in local and regional development. *Innovation: The European Journal of Social Science Research* 34, 133–135.
16. Breschi S., Malerba F., 1997. Sectoral innovation systems: technological regimes, Schumpeterian dynamics, and spatial boundaries, *Systems of Innovation: Technologies, Institutions and Organizations*, Routledge, pp. 130-156
17. Cai, Y., Lattu, A. 2022. Triple Helix or Quadruple Helix: Which Model of Innovation to Choose for Empirical Studies?. *Minerva* 60, 257–280
18. Cai, Z., Cvetkovic, V., Page, J., 2020. How does ICT expansion drive “smart” urban growth? A case study of Nanjing, China. *Urban Planning and the Smart City: Projects, Practices and Politics* 5: 1.
19. Carrillo, E., Vecino-Pico, H., Kozhevnikov, S., 2022. Smart city as an opportunity towards urban transformation in a small city (Bucaramanga, case study), in: *2022 Smart City Symposium Prague (SCSP)*. IEEE, pp. 1–5.
20. Carroll, J.M., Kropczynski, J., Han, K., 2014. Grounding activity in people-centered smart territories by enhancing community awareness. *Interaction Design and Architecture(s)* 2014, 9–22.
21. Cartaxo, T.D.M., Hossain, K., 2018. Digitalization and smartening public governance of the European high north regions. *Smart Cities and Regional Development (SCRD) Journal* 2, 65–80.
22. Cassia F., Castellani P., Rossato C., Baccarani, C. 2020. Finding a Way towards High-quality, Accessible Tourism: the Role of Digital Ecosystems. *The TQM Journal*, 22 (1): 205-221.
23. Chae, B.K., 2019. A General framework for studying the evolution of the digital innovation ecosystem: The case of big data. *International Journal of Information Management* 45, 83–94
24. Chaplitskaya, A., Heijman, W., Van Ophem, J., Kusakina, O., 2021. Innovation policy and sustainable regional development in agriculture: A case study of the Stavropol Territory, Russia. *Sustainability (Switzerland)* 13.
25. Chichernea, V., 2015. Smart cities communities and Smart ICT platform. *Journal of Information Systems & Operations Management* 9, pp. 1–11.
26. Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J.R., Mellouli, S., Nahon, K., Pardo, T.A., Scholl, H. J., 2012. Understanding Smart Cities: An Integrative Framework. Paper presented at 45th Hawaii International Conference on System Sciences, Maui, HI, USA., January 4–7.
27. Christensen C.M., Rosenbloom R.S., 1995. Explaining the attacker’s advantage: technological paradigms, organizational dynamics, and the value network, *Research Policy* 24(2), 233 – 257

28. Chung, J.-E., Oh, S.-G., Moon, H.-C. 2022. What drives SMEs to adopt smart technologies in Korea? Focusing on technological factors. *Technology in Society*, vol. 71, p. 102109.
29. Ciani, A., Raupeliene, A., Tamuliene, V., 2017. The territorial management contracts as innovative new governance of the territory in the framework of the European Union CLLD programme and ecosystem services policy, in: Raupeliene, A (Ed.), 8th international scientific conference rural development 2017: bioeconomy challenges. Lithuanian Minist Agr; Res Council Lithuania, pp. 949–954.
30. Citrigno, S., Graziano, S., Lupia, F., Saccà, D., 2014. Smart applications for smart city: A contribution to innovation, in: CEUR Workshop Proceedings. pp. 365–366.
31. Conci, M., Mion, L., Morganti, E., Nollo, G., 2015. Smart Trentino: An inclusive territory for the wellbeing of all. *Presentations and information* 25.
32. Corchado, J.M., Chamoso, P., Hernández, G., Roman Gutierrez, A.S., Camacho, A.R., González-Briones, A., Pinto-Santos, F., Goyenechea, E., Garcia-Retuerta, D., Alonso-Miguel, M., Hernandez, B.B., Villaverde, D.V., Sanchez-Verdejo, M., Plaza-Martínez, P., López-Pérez, M., Manzano-García, S., Alonso, R.S., Casado-Vara, R., Tejedor, J.P., Prieta, F., Rodríguez-González, S., Parra-Domínguez, J., Mohamad, M.S., Trabelsi, S., Díaz-Plaza, E., Garcia-Coria, J.A., Yigitcanlar, T., Novais, P., Omatu, S., 2021. Deepint.net: A rapid deployment platform for smart territories. *Sensors (Switzerland)* 21, 1–22.
33. Couzineau-Zegwaard, E., Barabel, M., Meier, O., 2014. From smart grid to smart city business ecosystem: Strategy to define the proper legitimacy for an energy utility firm, in: 2013 World Electric Vehicle Symposium and Exhibition, EVS 2014.
34. Cvar, N., Trilar, J., Kos, A., Volk, M., Duh, E.S., 2020. The use of iot technology in smart cities and smart villages: Similarities, differences, and future prospects. *Sensors (Switzerland)* 20, 1–20
35. D'Angelo, G., Ferretti, S., Ghini, V., 2016. Simulation of the Internet of Things, in: 2016 International Conference on High Performance Computing and Simulation, HPCS 2016. pp. 1–8.
36. D'Angelo, G., Ferretti, S., Ghini, V., 2017. Multi-level simulation of Internet of Things on smart territories. *Simulation Modelling Practice and Theory* 73, 3–21.
37. D'Angelo, G., Ferretti, S., Ghini, V., 2018. Distributed hybrid simulation of the Internet of things and smart territories. *Concurrency Computation* 30.
38. Danilina, N.V., Harder, R., 2020. “mobility game”: Interactive technology for urban planning education, in: IOP Conference Series: Materials Science and Engineering.
39. De Laurentis, C., Pearson, P.J.G., 2021. Policy-relevant insights for regional renewable energy deployment. *Energy, Sustainability and Society* 11.
40. Deegan, J., Solheim, M.C.W., Jakobsen, S.-E., Isaksen, A., 2022. One coast, two systems: Regional innovation systems and entrepreneurial discovery in Western Norway. *Growth and Change* 53, 490–514.
41. Del Vecchio, P., Elia, G., Ndou, V., Secundo, G., Specchia, F. 2017. Living lab as an approach to activate dynamic innovation ecosystems and networks: An

- empirical study,” *International Journal of Innovation and Technology Management*, vol. 14, no. 5.
42. Desvatirikova, E.N., Polukazakov, A.V., Akimov, V.I., Tzaregorodtceva, O.V., Khrinunov, Y.V., 2020. Software infrastructure management systems for smart territories, in: *Proceedings of the 2020 IEEE International Conference “Quality Management, Transport and Information Security, Information Technologies”, IT and QM and IS 2020*. pp. 202–205.
  43. Di Ludovico, D., Properzi, P., Graziosi, F., 2014. From a smart city to a smart up-country. The new city-territory of L’Aquila. *TeMA-Journal of Land Use, Mobility and Environment*.
  44. Ding, C., Liu, C., Zheng, C., Li, F., 2022. Digital economy, technological innovation and high-quality economic development: Based on spatial effect and mediation effect. *Sustainability (Switzerland)* 14.
  45. Dodgson M., Gann D.M., Phillips N., 2014. *The Oxford Handbook of Innovation Management*, Oxford University Press
  46. Dovlen, S., Hilding-Rydevik, T., 2016. Sustainable development in regional development practice: a socio-cultural view of evaluation, *New Principles in Planning Evaluation*.
  47. Dubou, G., Bichueti, R.S., Costa, C.R.R.D., Gomes, C.M., Kneipp, J.M., Kruglianskas, I., 2022. Creating Favorable Local Context for Entrepreneurship: The Importance of Sustainable Urban Development in Florianópolis, SC, Brazil. *Sustainability (Switzerland)* 14.
  48. Durach, C.F., Kembro, J. and Wieland, A., 2017. A New Paradigm for Systematic
  49. Duval, S., Woo, W., 2010. Ubiquity: Micro to macro ecosystems?, in: *Proceedings - 2010 International Symposium on Ubiquitous Virtual Reality, ISUVR 2010*. pp. 28–31.
  50. Eisenhardt K.M. 1989. Building Theories from Case Study Research. *Academy of Management Review*, 14 SRC-(4): 532–550.
  51. ElMassah, S., Mohieldin, M., 2020. Digital transformation and localizing the Sustainable Development Goals (SDGs). *Ecological Economics* 169.
  52. Ependi, U., Rochim, A. F., Wibowo, A. 2022. Smart City Assessment for Sustainable City Development on Smart Governance: A Systematic Literature Review. *International Conference on Decision Aid Sciences and Applications, DASA 2022, 2022*, pp. 1088–1097.
  53. EU, *Open Innovation, Open Science and Open to the World – a vision for Europe*, 2016
  54. European Union, 2020 *Shaping Europe’s Digital Future*, [https://ec.europa.eu/info/sites/default/files/communication-shaping-europes-digital-future\\_feb2020\\_en\\_4.pdf](https://ec.europa.eu/info/sites/default/files/communication-shaping-europes-digital-future_feb2020_en_4.pdf) Last accessed 10 June 2022
  55. Ferreira, J.J., Farinha, L., Rutten, R., Asheim, B., 2021. Smart Specialisation and learning regions as a competitive strategy for less developed regions. *Regional Studies* 55, 373–376.
  56. Ferretti, S., D’Angelo, G., 2016. Smart shires: The revenge of countrysides, in: *2016 IEEE Symposium on Computers and Communication (ISCC)*. IEEE, pp. 756–759.



57. Filatova, M.V., Sirotkina, N.V., Nerozina, S.Y., Stukalo, O.G., Slepokurova, A.A., Tsukanova, K.A., 2020. Innovation Ecosystem Management Within the Framework of Digitalization, in: Russian Conference on Digital Economy and Knowledge Management (RuDEcK 2020). Atlantis Press, pp. 183–188
58. Filippucci, M., Bianconi, F., 2018. Codesign, social contracts, environmental citizenship. The case study of Umbrian region's atlas of objectives and lake Trasimeno landscape contract. *Lecture Notes in Civil Engineering* 3, 1432–1441.
59. Florida, R., 2021. High-tech innovation, creativity, and regional development, *Creativity and Innovation: Theory, Research, and Practice*.
60. Fomina, I.B., Kushnarenko, T.V., Tabakov, A.N., Jakovenko, V.V., 2020. Analysis of Clustering Processes in the Regions' Innovative Sustainable Development Formation. *Lecture Notes in Networks and Systems* 111, 213–220.
61. Freeman, R., Freeman, C., & Freeman, S., 1987. *Technology, policy, and economic performance: lessons from Japan*. Burns & Oates
62. Gabellone, F., Ferrari, I., Giuri, F., Chiffi, M., 2015. The Palmieri Hypogeum in Lecce From the integrated survey to the dissemination of contents, in: Guidi, G., Torres, J., Scopigno, R., Graf, H., Remondino, F., Brunet, P., Barcelo, J., Duranti, L., Hazan, S. (Eds.), 2015 digital heritage international congress, vol 1: digitization & acquisition, computer graphics & interaction. IEEE Comp Soc, Spanish Chapter, pp. 247–254.
63. Galego, D., Giovannella, C., Mealha, O., 2016. Determination of the Smartness of a University Campus: the case study of Aveiro, in: Calabro, F., DellaSpina, L. (Eds.), 2nd international symposium new metropolitan perspectives - strategic planning, spatial planning, economic programs and decision support tools, through the implementation of horizon/europe2020, (ISTH2020), *Procedia Social and Behavioral Sciences*. pp. 147–152.
64. Galli, G., Mosbah, Y., Felin, R., Montorsi, B., Miranda, S., 2019. School-driven ubiquitous invisible paths management for smart territories (Imagine APPLICATION), in: TESCA 2019 - Proceedings of the 2019 1st ACM International Workshop on Technology Enablers and Innovative Applications for Smart Cities and Communities, Co-Located with the 6th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation, ACM BuildSys 2019. pp. 54–57.
65. Gambardella, C., Pisacane, N., Avella, A., Argenziano, P., 2014. Pompei Knowledge Factory: Cultural Heritage and ICT for a smart city, in: Proceedings of the 2014 International Conference on Virtual Systems and Multimedia, VSMM 2014. pp. 132–139.
66. García-Ayllón, S., 2018. Retro-diagnosis methodology for land consumption analysis towards sustainable future scenarios: Application to a mediterranean coastal area. *Journal of Cleaner Production* 195, 1408–1421.
67. Garcia-Ayllon, S., Miralles, J.L., 2015. New Strategies to Improve Governance in Territorial Management: Evolving from “smart Cities” to “smart Territories,” in: *Procedia Engineering*. pp. 3–11.

68. Garcia-Lara, L.E., Bugueno-Cordova, I.G., Ehijo-Benbow, A.O., 2021. AraucanAI: A proposal for recovery and intelligent landscape design, enabled by native cultural patterns, in: 2021 IEEE Chilean conference on electrical, electronics engineering, information and communication technologies (IEEE CHILECON 2021), pp. 19–26.
69. Garcia-Retuerta, D., Chamoso, P., Hernández, G., Guzmán, A.S.R., Yigitcanlar, T., Corchado, J.M., 2021. An efficient management platform for developing smart cities: Solution for real-time and future crowd detection. *Electronics (Switzerland)* 10.
70. Giffinger, R., Gudrun, H., 2010. Smart cities ranking: An effective instrument for the positioning of cities? *ACE: Architecture, City & Environ* 4: 7–25.
71. Gil-Garcia, J. R., Pardo, T.A., Nam, T., 2015. What makes a city smart? Identifying core components and proposing an integrative and comprehensive conceptualization. *Information Polity* 20: 61–87.
72. Giovannella, C., 2013. “Territorial smartness” and emergent behaviors, in: 2nd International Conference on Systems and Computer Science. IEEE, pp. 170–176.
73. Giovannella, C., 2014. Where’s the smartness of learning in smart territories? *Interaction Design and Architecture(s)* 22, 60–68.
74. Giovannella, C., Iosue, A., Tancredi, A., Cicola, F., Camusi, A., Moggio, F., Baraniello, V., Carcone, S., Coco, S., 2013. Scenarios for active learning in smart territories. *Interaction Design and Architecture(s)* 16, 7–16.
75. Giustolisi, A., Benner, M., Trippl, M., 2022. Smart specialisation strategies: towards an outward-looking approach. *European Planning Studies*.
76. Goint, M., Bertelle, C., Duvallet, C., 2022. Establish Trust for Sharing Data for Smart Territories Thanks to Consents Notarized by Blockchain, in: Prieto, J., Partida, A., Leitao, P., Pinto, A. (Eds.), *BLOCKCHAIN AND APPLICATIONS, Lecture Notes in Networks and Systems*. IBM; Indra; Inst Politecnico Porto; Univ Rey Juan Carlos; Inst Politecnico Braganca; Univ Salamanca; Int Inst Informat Technol; Univ Montreal; Alma Mater Studiorum, pp. 261–271.
77. Gong, C., Ribiere, V., 2021. Developing a unified definition of digital transformation. *Technovation* 102.
78. Gorecky, D., Romer, D., Kim, D.Y., 2019. Accelerating technological advancement and adoption of industry 4.0 technologies: smart-factory labs, digital capability centers and lighthouses networks, in: International Congress and Conferences on Computational Design and Engineering
79. Gorelova, I., Dmitrieva, D., Dedova, M., Savastano. M., 2021a. Antecedents and Consequences of Digital Entrepreneurial Ecosystems in the Interaction Process with Smart City Development. *Administrative Sciences* 11: 94.
80. Gorelova, I., Savastano, M., Spremic, M., Dedova, M., 2021b. Region-specific institutional context for citizen-driven entrepreneurship in smart cities: Evidence from Rome and Berlin, 2021 IEEE Technology and Engineering Management Conference - Europe, TEMSCON-EUR 2021.
81. Granstrand O., Holgersson M., 2020. Innovation ecosystems: A conceptual review and a new definition, *Technovation*, pp. 90-91

82. Gussen, B.F., 2020. Sharing City Seoul and the Future of City Governance. *Perspectives in Law, Business and Innovation* 21–45.
83. Guzmán, P.C., Roders, A.R.P., Colenbrander, B.J.F., 2017. Measuring links between cultural heritage management and sustainable urban development: An overview of global monitoring tools. *Cities* 60, 192–201.
84. Hagedoorn J., 1996. Innovation and Entrepreneurship: Schumpeter Revisited, *Industrial and Corporate Change*, Volume 5, Issue 3, 1996, Pages 883–896
85. Harrison, J., Delgado, M., Derudder, B., Angelovski, I., Montero, S., Bailey, D., De Propris, L., 2020. Pushing regional studies beyond its borders. *Regional Studies* 54, 129–139.
86. Hauge, E.S., Pinheiro, R.M., Zyzak, B., 2018. Knowledge bases and regional development: collaborations between higher education and cultural creative industries. *International Journal of Cultural Policy* 24, 485–503.
87. Helman, J., 2020. Analysis of the local innovation and entrepreneurial system structure towards the 'Wrocław innovation ecosystem' concept development. *Sustainability (Switzerland)* 12, 1–17.
88. Hsu, A., Höhne, N., Kuramochi, T., Vilariño, V., Sovacool, B.K., 2020. Beyond states: Harnessing sub-national actors for the deep decarbonisation of cities, regions, and businesses. *Energy Research and Social Science* 70.
89. Iansiti M, Levien R., 2004. *The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability.*, Harvard Business School Press: Boston, MA
90. Jermolajeva, E., Rivža, B., Aleksejeva, L., Šipilova, V., Ostrovska, I., 2017. Smart growth as a tool for regional convergence: evidence from Latgale region of Latvia. *Economics & Sociology* 10, 203–224.
91. Jiang, H., 2021. Smart urban governance in the 'smart' era: Why is it urgently needed? *Cities* 111: 103004.
92. Kalynychenko, M., Stepanov, A., Shmarlouskaya, H., Egorushkina, T., Mishchuk, O., Judin, S., Boroukhin, D. 2022. Harmonious interaction of a smart organization and a smart city to activate digital transformations. *Transportation Research Procedia*, vol. 63, pp. 2243–2250.
93. Kapkaev, Y., Kadyrov, P., 2021. Digital maturity of territories during digital transformation, in: *E3S Web of Conferences*. EDP Sciences, p. 01001.
94. Karpova, G.A., Kuchumov, A.V., Testina, Y.S., Voloshinova, M.V., 2019. Digitalization of a Tourist Destination, in: *ACM International Conference Proceeding Series*.
95. Khurana, I., Dutta, D.K., Singh Ghura, A., 2022. SMEs and digital transformation during a crisis: The emergence of resilience as a second-order dynamic capability in an entrepreneurial ecosystem. *Journal of Business Research* 150, 623–641.
96. Kim, J., Lee, K., 2022. Local–global interface as a key factor in the catching up of regional innovation systems: Fast versus slow catching up among Taipei, Shenzhen, and Penang in Asia. *Technological Forecasting and Social Change* 174.

97. Kolloch, M., Dellermann, D., 2018. Digital innovation in the energy industry: The impact of controversies on the evolution of innovation ecosystems. *Technological Forecasting and Social Change* 136, 254–264
98. Kraus, S., McDowell, W., Ribeiro-Soriano, D.E., Rodríguez-García, M., 2021. The role of innovation and knowledge for entrepreneurship and regional development. *Entrepreneurship and Regional Development* 33, 175–184.
99. Kuandykovna Suyendikova, G., Evgenievich Barykin, S., Mikhailovich Sergeev, S., Vasilievna Kapustina, I., Krupnov, Y., Nikolaevna Shchepkina, N., 2022. Sustainable development of smart cities and smart territories based on the model of minimizing externalities. *F1000Research* 11, 522.
100. Kvale S., Brinkmann S. 2009. *Inter Views: Learning the Craft of Qualitative Research Interviewing*, Sage, Los Angeles, CA.
101. Laitinen, I., Piazza, R., 2020. Smart City Community Engagement Through Learning, *Smart Innovation. Systems and Technologies* 158: 177–80.
102. Leroux, E., Pupion, P.-C., 2022. Smart territories and IoT adoption by local authorities: A question of trust, efficiency, and relationship with the citizen-user-taxpayer. *Technological Forecasting and Social Change* 174.
103. Likhacheva, A.B., Stepanov, I.A., 2021. Russian Arctic Policy: Opportunities for the Development of the Siberian and Far Eastern Regions. *Regional Research of Russia* 11, S13–S22.
104. Lima, M., 2020. Smarter organizations: Insights from a smart city hybrid framework. *International Entrepreneurship and Management Journal* 16: 1281–300.
105. Lisi, F.A., Esposito, F., 2015. An AI application to integrated tourism planning, in: *Congress of the Italian Association for Artificial Intelligence*. Springer, pp. 246–259.
106. *Literature Reviews in Supply Chain Management*. *J Supply Chain Manag*, 53: 67–85
107. Liu, J., Gao, Y., 2022. The role of education in regional repositioning: experiences of Hainan. *Asia Pacific Education Review* 23, 87–99.
108. Loos E., Sourbati M., Behrend F. 2020. The Role of Mobility Digital Ecosystems for Age-Friendly Urban Public Transport: A Narrative Literature Review. *International Journal of Environmental Research and Public Health* 17, (20): 7465.
109. Magnaghi, E., Flambard, V., Mancini, D., Jacques, J., Gouvy, N., 2021. *Organizing Smart Buildings and Cities. Promoting Innovation and Participation*, LNISO, Springer, Cham, 36, XII, 139.
110. Mally, K.V., 2021. Trends in regional development in Slovenia in the light of the goals of sustainable development. *European Journal of Geography* 12, 036–051.
111. Marques Santos, A., Edwards, J., Neto, P, *Smart Specialisation Strategies and Regional Productivity: A preliminary assessment in Portugal*, EUR 30623 EN, Publications Office of the European Union, Luxembourg, 2021
112. Marques, P., Morgan, K., 2021. Innovation without Regional Development? The Complex Interplay of Innovation, Institutions, and Development. *Economic Geography* 97, 475–496.

113. Martinus, K., Suzuki, J., Bossaghzadeh, S., 2020. Agglomeration economies, interregional commuting and innovation in the peripheries. *Regional Studies* 54, 776–788.
114. Matern, A., Binder, J., Noack, A., 2020. Smart regions: insights from hybridization and peripheralization research. *European Planning Studies* 28, 2060–2077.
115. Maurer, F., 2021. Business Intelligence and Innovation: A Digital Innovation Hub as Intermediate for Service Interaction and System Innovation for Small and Medium-Sized Enterprises, in: *Working Conference on Virtual Enterprises*. Springer, pp. 449–459
116. Megyesiova, S., Lieskovska, V., 2018. Analysis of the sustainable development indicators in the OECD countries. *Sustainability (Switzerland)* 10.
117. Melbarde, V., Ore, M., 2016. Influencing factors of rural areas development Vidzeme region case analysis, in: *new challenges of economic and business development - 2016*, pp. 484–495.
118. Melro, A., Oliveira, L., 2017. Social entrepreneurs' communities as a way to sustainably develop smart territories, in: *Proceedings of the European Conference on Innovation and Entrepreneurship, ECIE*. pp. 441–448.
119. Misséri, V., 2013. Local ecosystem versus digital ecosystem: A different purpose than multiple innovation platforms, in: *Proceedings - 2013 8th International Conference on P2P, Parallel, Grid, Cloud and Internet Computing, 3PGCIC 2013*. pp. 688–694
120. Mun Chye, C., Fahmy-Abdullah, M., Sufahani, S. F., Bin Ali, M. K. 2022. A Study of Smart People Toward Smart Cities Development. *Lecture Notes in Networks and Systems*, vol. 348, pp. 257–271.
121. Navío-Marco, J., Rodrigo-Moya, B., Gerli, P., 2020. The rising importance of the “Smart territory” concept: definition and implications. *Land Use Policy* 99.
122. Nepelski, D., 2019. How to facilitate digital innovation in Europe. *Intereconomics* 54, 47–52
123. Nguyen, Q. T., Thi, N. D.. 2020. Smart urban governance in smart city 2020. *IOP Conference. Series: Materials Science and Engineering* 869: 022021.
124. Nieth, L., 2019. Understanding the strategic ‘black hole’ in regional innovation coalitions: reflections from the Twente region, eastern Netherlands. *Regional Studies, Regional Science* 6, 203–216.
125. Nishimwe, A.M.R., Reiter, S., 2021. Building heat consumption and heat demand assessment, characterization, and mapping on a regional scale: A case study of the Walloon building stock in Belgium. *Renewable and Sustainable Energy Reviews* 135.
126. Nugroho M., Cahyono B. 2021. How to Push Digital Ecosystem to Explore Digital Humanities and Collaboration of SMEs. In Barolli L., Yim K., Enokido T. (eds) *Complex, Intelligent and Software Intensive Systems. CISIS 2021*. LNNS, Springer, Cham. 278.
127. OECD, 2019. *Going Digital: Shaping Policies, Improving Lives*, OECD Publishing, Paris
128. OECD, *Innovation-driven Growth in Regions: The Role of Smart Specialisation*,

129. Öjehag-Pettersson, A., 2022. Making space for competition: The rationalities of contemporary regional development. *Environment and Planning C: Politics and Space*.
130. Opromolla, A., 2015. "Gamified" social dynamics in the interactive systems as a possible solution for increasing co-design of emerging services in smart territories, in: *CEUR Workshop Proceedings*. pp. 46–57.
131. Orazi, G., Fontaine, G., Chemla, P., Zhao, M., Cousin, P., Gall, F.L., 2018. A first step toward an IoT network dedicated to the sustainable development of a territory, in: *2018 Global Internet of Things Summit, GIoTTS 2018*.
132. Page M. J., Moher D., Bossuyt P. M., Boutron I., Hoffmann T. C., Mulrow C. D. et al.. 2021. PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews *BMJ*; 372 :n160
133. Paiano, A.P., Passiante, G., Valente, L., Mancarella, M., 2017. A Hashtag Campaign: A Critical Tool to Transmedia Storytelling Within a Digital Strategy and Its Legal Informatics Issues. A Case Study, in: *Springer Proceedings in Business and Economics*. pp. 49–71.
134. Paiva, S., Ahad, M. A., Tripathi, G., Feroz, N., Casalino, G., 2021. Enabling Technologies for Urban Smart Mobility: Recent Trends, Opportunities and Challenges. *Sensors* 21: 2143.
135. Pięta, P., Deniziak, S., Belka, R., Płaza, M., Płaza, M., 2018. Multi-domain model for simulating smart IoT-based theme parks, in: *Proceedings of SPIE - The International Society for Optical Engineering*.
136. Pistorio, A., Gastaldi, L., Corso, M., 2018. The Development of Digital Innovation Ecosystem: The Key Role of Policymakers, in: *40th R&D Management Conference "R&Designing Innovation: Transformational Challenges for Organizations and Society."* pp. 1–17
137. Pogosyan, M.A., Strelets, D.Y., Vladimirova, V.G., 2019. Territorial connectivity of the Russian Federation: from the statement of complex problems to drawing up integrated scientific and technical projects. *Herald of the Russian Academy of Sciences* 89, 179–184.
138. Poletti, A., 2015. Italian smart environment: The contribution of the evaluation. *Chemical Engineering Transactions* 43, 1903–1908.
139. Popova, Y. and Popovs, S. 2022. Impact of Smart Economy on Smart Areas and Mediation Effect of National Economy. *Sustainability*, 14, 2789.
140. Prakash, A., 2021. Smart Mobility Solutions for a Smart City. *IEEE Potentials* 40: 24–29.
141. Priano, F.H., Armas, R.L., Guerra, C.F., 2016. A model for the smart development of island territories, in: *ACM International Conference Proceeding Series*. pp. 465–474.
142. Raabe, J.-P., Drews, P., Horlach, B., Schirmer, I., 2021. Towards an Intra-and Interorganizational Perspective: Objectives and Areas of Activity of Digital Innovation Units., in: *HICSS*. pp. 1–10

- 143.Randell-Moon, H. E. K. and Hynes, D. 2022. 'Too smart': Infrastructuring the Internet through regional and rural smart policy in Australia. *Policy & Internet*, 14, 151– 169.
- 144.Randolph, R., 2019. Regional development policies and the challenge to reduce spatial inequalities in Brazil. *Area Development and Policy* 4, 271–283.
- 145.Rao, B., Jimenez, B., 2011. A comparative analysis of digital innovation ecosystems, in: PICMET: Portland International Center for Management of Engineering and Technology, Proceedings
- 146.Rebolledo, J.L.S., Martínez, M.B.G., Ibarra, R.C., Salvador, L.E.M., 2020. Smart specialization for building up a regional innovation agenda: The case of san luis Potosí, Mexico. *Journal of Evolutionary Studies in Business* 5, 81–115.
- 147.Rocha, C., Quandt, C., Deschamps, F., Philbin, S., Cruzara, G., 2021. Collaborations for Digital Transformation: Case Studies of Industry 4.0 in Brazil. *IEEE Transactions on Engineering Management*
- 148.Rocha, C.F., da Silva, M.V.G., Pagnoncelli, V., de Lima, L.A.A., 2018. Ecosystem of Innovation in Industry 4.0: the case of collaborations in Startups in Brazil. *International Journal for Innovation Education and Research* 6(12), pp. 26-38.
- 149.Rocha, C.F., Mamédio, D.F., Quandt, C.O., 2019. Startups and the innovation ecosystem in Industry 4.0. *Technology Analysis & Strategic Management* 31, pp. 1474–1487.
- 150.Rochdane, H., Hamdani, S., 2018. Economic intelligence a global approach to business competitiveness and the emergence of smart cities, in: *3rd Renewable Energies, Power Systems and Green Inclusive Economy, REPS and GIE 2018*.
- 151.Rosado-García, M.-J., 2022. Smart territory, infrastructure maintenance, and sustainability: the necessary evolution of “smart” after COVID-19. *Dyna (Spain)* 97, 258–262.
- 152.Rosado-García, M.J., Kubus, R., Argüelles-Bustillo, R., García-García, M.J., 2021. A new European Bauhaus for a culture of transversality and sustainability. *Sustainability (Switzerland)* 13.
- 153.Ruohomaa, H., Salminen, V., Lähteenmäki, N., 2020. 5G as a Driver for Transition of Digitalization in Ecosystem-Based Development. *Advances in Intelligent Systems and Computing* 1209 AISC, pp. 35–43
- 154.Sabău-Popa, C.D., Bele, A.M., Dodescu, A.O., Boloş, M.I., 2022. How Does the Circular Economy Applied in the European Union Support Sustainable Economic Development? *Sustainability (Switzerland)* 14.
- 155.Sadollah, A., Nasir, M., Geem, Z.W., 2020. Sustainability and optimization: From conceptual fundamentals to applications. *Sustainability (Switzerland)* 12.
- 156.Saleh, H., Surya, B., Ahmad, D.N.A., Manda, D., 2020. The role of natural and human resources on economic growth and regional development: With discussion of open innovation dynamics. *Journal of Open Innovation: Technology, Market, and Complexity* 6, 1–23.
- 157.Salkuti, S. R., 2021. Smart Cities: Understanding Policies, Standards, Applications and Case Studies. *International Journal of Electrical and Computer Engineering*, 11: 3137–44.

- 158.Samara, E., Andronikidis, A., Komninos, N., Bakouros, Y., Katsoras, E., 2022. The Role of Digital Technologies for Regional Development: a System Dynamics Analysis. *Journal of the Knowledge Economy*.
- 159.Sánchez-Carreira, M.D.C., Peñate-Valentín, M.C., Varela-Vázquez, P., 2019. Public procurement of innovation and regional development in peripheral areas. *Innovation: The European Journal of Social Science Research* 32, 119–147.
- 160.Santos, D., 2022. Building entrepreneurial ecosystems: the case of Coimbra. *Journal of Science and Technology Policy Management* 13, 73–89.
- 161.Savastano, M., Amendola, C., Bellini, F., D’Ascenzo, F., 2019. Contextual Impacts on Industrial Processes Brought by the Digital Transformation of Manufacturing: A Systematic Review. *Sustainability*, 11, 891.
- 162.Savastano, M., Gorelova, I., Belcastro, M., Stori, P., 2020a. The participation of local communities in the co-creation process of cultural initiatives. The case of Matera 2019. *ItAIS 2020 - XVII Conference of the Italian Chapter of AIS Organizing in a digitized world: Diversity, Equality and Inclusion*. ISBN: 978-88-6685-021-2.
- 163.Savastano, M., Suci, M.-C., Gorelova, I., Stativă, G.-A., 2020b. Smart grids, prosumers and energy management within a smart city integrated system. *Proceedings of the International Conference on Business Excellence*, vol.14, no.1, pp.1121-1134.
- 164.Savastano, M., Suci, M.-C., Stativă, G.-A., Gorelova, I., 2020c. Smart mobility: a comparison between the social media strategies for the public urban mobility services of Rome and Bucharest. *The smart cities international conference 8th Edition*, 2020.
- 165.Savithramma, R. M., Ashwini, B. P., Sumathi, R., 2022. Smart Mobility Implementation in Smart Cities: A Comprehensive Review on State-of-art Technologies. *2022 4th International Conference on Smart Systems and Inventive Technology (ICSSIT)*, pp. 10-17
- 166.Schiavone, F., Mancini, D., Leone, D., Lavorato, D., 2021. Digital Business Models and Ridesharing for Value Co-creation in Healthcare: A Multi-stakeholder Ecosystem Analysis, *Technological Forecasting and Social Change*, 166: 120647.
- 167.Schulz, T., Böhm, M., Gewald, H., Krcmar, H., 2021. Smart mobility–An analysis of potential customers’ preference structures. *Electron Markets* 31: 105–24.
- 168.Schwertner K., 2017. Digital Transformation of Business, *Trakia Journal of Sciences*, Vol. 15, Suppl. 1, pp 388-393.
- 169.Shami, M. R., Rad, V. B., M. Moinifar, M. 2022. The structural model of indicators for evaluating the quality of urban smart living. *Technological Forecasting and Social Change*, vol. 176.
- 170.Shepherd, J., 2004. What is the Digital Era? *Social and Economic Transformation in the Digital Era*, edited by Georgios Doukidis, et al., IGI Global, pp. 1-18.
- 171.Sidorova, J.P., Degtereva, V.A., Kichigin, O.E., 2019. Spatial diffusion of innovation from “circles of backwardness” and the “big push” to innovative development of territories, in: *Proceedings of the 33rd International Business*



- Information Management Association Conference, IBIMA 2019: Education Excellence and Innovation Management through Vision 2020. pp. 2848–2859.
172. Sikandar, H., Abdul Kohar, U.H., 2021. A systematic literature review of open innovation in small and medium enterprises in the past decade, *Foresight*, Vol. ahead-of-print No. ahead-of-print.
173. Singh, R.B., Kumar, A., 2022. Cultural Tourism-Based Regional Development in Rajasthan, India. *Advances in 21st Century Human Settlements* 453–466.
174. Smart City Indicators. 2019. Available online: <https://hub.beesmart.city/smart-city-indicators/>
175. Sturiale, L., Trovato, M.R., 2015. ICTs and smart territories. the knowledge and use of the UNESCO heritage by using the QR codes system, in: *CEUR Workshop Proceedings*. pp. 946–956.
176. Suseno, Y., Laurell, C., Sick, N., 2018. Assessing value creation in digital innovation ecosystems: A Social Media Analytics approach. *Journal of strategic information systems* 27, pp. 335–349.
177. Thapa, R.K., Iakovleva, T., Foss, L., 2019. Responsible research and innovation: a systematic review of the literature and its applications to regional studies. *European Planning Studies* 27, 2470–2490.
178. Tomor, Z., Przeybilovic, E., Leleux, C., 2021. Smart governance in institutional context: An in-depth analysis of Glasgow, Utrecht, and Curitiba. *Cities* 114: 103195.
179. Tranfield, D., Denyer, D., Smart, P., 2003. Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management*, 14, pp. 207-222.
180. Tronin, S.A., Rodermel, T.A., Uspaeva, M.G., Shashkova, A.V., Calesci, M., 2019. Formation of innovative strategies of regional economic development. *Space and Culture, India* 7, 65–75.
181. Trovato, M.R., Sturiale, L., 2016. The smart management and the e-cultural marketing of UNESCO heritage. *International Journal of Sustainable Agricultural Management and Informatics* 2, 155–173.
182. Turgel, I., Pobedin, A., Panzabekova, A., 2022. Digitalisation of the Economy and Regional Development, in: *Lecture Notes in Information Systems and Organisation*. pp. 133–147.
183. UN-Habitat, *The Economic Role of Cities*, 2011
184. United Nations Development Programme, 2022, <https://digitalstrategy.undp.org/> Last accessed: 10 June 2022
185. Van der Hoogen, A., Scholtz B., Calitz, A., 2019. A Smart City Stakeholder Classification Model. 2019. Paper presented at Conference on Information Communications Technology and Society (ICTAS), Durban, South Africa, March 6–8.
186. Vanhamaki, S., Medkova, K., Malamakis, A., Kontogianni, S., Marisova, E., Dellago, D., Huisman; Moussiopoulos, N., 2019. Bio-based circular economy in European national and regional strategies, *International Journal of Sustainable Development and Planning*, Volume 14, Issue 1, Pages 31 – 43.

187. Vasin, S., Gamidullaeva, L., Tolstykh, T., Rostovskaya, T., Skorobogatova, V., 2018. From innovation system through institutional transformation to digital innovation ecosystem, in: Proceedings of the 31st International Business Information Management Association Conference, IBIMA 2018: Innovation Management and Education Excellence through Vision 2020. pp. 4620–4633.
188. Verhoef P.C., Broekhuizen T., Bart Y., Bhattacharya A., Dong J.Q., Fabian N., Haenlein M., 2021. Digital transformation: A multidisciplinary reflection and research agenda, in Journal of Business Research 122, pp. 889-901.
189. Vinieratou–Bossinakis, M., Patargias, P.A., 2016. The functional territory of culture-led smart specialization: an EU model for the European local development and institutions. Sustainable development, culture, traditions, p. 35-46.
190. Vinod, K., 2020. Smart Environment for Smart Cities. In Smart Environment for Smart Cities. Edited by Kumar Vinod. Advances in 21st Century Human Settlements. Singapore: Springer.
191. Wang, J., Li, Y., Wang, Q., Cheong, K.C., 2019. Urban-rural construction land replacement for more sustainable land use and regional development in China: Policies and practices. Land 8.
192. Wang, P., 2018. Taking the “Eco” seriously: A multilevel model of digital innovation ecosystems, in: Proceedings of the 22nd Pacific Asia Conference on Information Systems - Opportunities and Challenges for the Digitized Society: Are We Ready?, PACIS 2018.
193. Wang, P., 2020. Theorizing digital innovation ecosystems: A multilevel ecological framework, in: 27th European Conference on Information Systems - Information Systems for a Sharing Society, ECIS 2019.
194. Wang, P., 2021. Connecting the parts with the whole: Toward an information ecology theory of digital innovation ecosystems. MIS Quarterly: Management Information Systems 45, 397–422.
195. Whyte, J., 2019. How Digital Information Transforms Project Delivery Models. PROJECT MANAGEMENT JOURNAL 50, 177–194.
196. Winarsih, Indriastuti, M., Fuad, K., 2021. Impact of covid-19 on digital transformation and sustainability in small and medium enterprises (smes): a conceptual framework. Advances in Intelligent Systems and Computing 1194 AISC, 471–476.
197. World Bank. 2019. Urban Population. <https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS>
198. Wu, M., Jin, M., Tian, Y., 2021. Technological innovation, industrial upgrading and regional economic development: Evidence from China’s Yangtze River Economic Belt, in: Journal of Physics: Conference Series.
199. Xu, Y., 2020. Digital Innovation Ecosystem: Research Context, Research Hotspot and Research Trends--Knowledge Mapping Analysis Using Citespace. Journal of Electronics and Information Science 5, 72–80.

200. Yigitcanlar, T., Han, H., Kamruzzaman, Md, Ioppolo, G., Sabatini-Marques, J., 2019. The Making of Smart Cities: Are Songdo, Masdar, Amsterdam, San Francisco and Brisbane the Best We Could Build?. *Land Use Policy*, 88: 104187.
201. Yin, D., Ming, X., Zhang, X., 2020. Sustainable and smart product innovation ecosystem: An integrative status review and future perspectives. *Journal of Cleaner Production* 274, 123005.
202. Yoo, Y., Henfridsson O., Lyytinen, K., 2010. Research commentary—the new organizing logic of digital innovation: an agenda for information systems research, *Inf. Syst. Res.*, 21(4), pp. 724-735.
203. Yudono, A., Dias, S., Angga, E., 2019. Toward Inclusive Development Through Smart Economy in Malang Regency. *IOP Conference Series: Earth and Environmental Science* 328: 012008.
204. Zavratnik, V., Podjed, D., Trilar, J., Hlebec, N., Kos, A., Stojmenova, D. E., 2020. Sustainable and Community-Centred Development of Smart Cities and Villages. *Sustainability* 12: 3961.