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FROM SMART CITIES TO SMART REGIONS AS A SOLUTION TO IMPROVE THE SUSTAINABILITY OF URBAN COMMUNITIES

Summary: In recent years, cities are facing the rapid urbanization phenomenon, the urban population growth and the immigration. This has resulted in a lot of problems such as difficulty in waste management, urban congestion, excessive energy use, shortage of supplies, traffic congestion and air pollution. All above force government to use ICT technology and introduce the concept of 'smart city' to promote the sustainable development of a city. As regions face similar problems, the goal of this study is to examine whether or not the concept of 'smart city' could be expanded and used to region and we present the case study of a Greek Smart/Digital Region.

Keywords: smart city; urbanization; urban innovation, smart region, ICT's.

JEL Classification: R0, R1, R12.

Introduction

The rapid urbanization phenomenon has been strongly observed in recent years, especially in big European cities. This, combined with the large waves of migrants entering in Europe, has created unfavorable living conditions for the citizens of large urban centers. Difficulties concerning urban congestion have to do with: 1) waste management, 2) excessive energy use, 3) shortage of supplies, 4) traffic congestion and 5) air pollution. As urban areas are now facing the complexity of the social ecosystem, sustainability becomes an important factor. The above difficulties are complex, and their response requires an organized and hierarchical policy strategy for development that will improve the quality of life of its residents.

In this direction, the concept of smart city which has been developed in recent years, to solve tangled and wicked problems inherited in the rapid urbanization. Smart/Intelligent city is defined as “a city with high capacity for learning and innovation, which is built-in the creativity of their population, their institutions of knowledge creation, and their digital infrastructure for communication and knowledge management” (Komninos, 2006, pp. 13). The concept of a smart city is based on the rapid development of Information and Communication Technology (ICT). It is an essential tool for transparent and effective governance and for the provision of improved services to the citizen. Furthermore, ICT creates a new knowledge-based economy, and upgrades the role of human resources. Based on academic literature from various disciplinary fields (not only from the technological point of view), we will describe the various definitions of the concept of smart city and we identify six significant pillars for developing the framework as: Governance, Economic, People, Technology, Infrastructure and Environment.

As regions face similar problems, the goal of this paper is to examine whether the concept of ‘smart city’ could be expanded to ‘smart region’. Regions in contrast to a city are an association of more areas or cities with different growth rates, with different spatial development and physical – technological infrastructure and with different needs of citizens. However, they could take advantage of the development of new technologies and exploit the opportunities offered by the concept of ‘smart city’ in the fields of e-economy, e-government and e-citizens.

The goal of this study is to introduce the concept of ‘smart region’ and to develop a framework for identifying the elements of ‘smart region’. Applying the concept of smart city to smart region we try to incorporate innovative tools of managing diverse and complex technical or political issues. Finally, we present the case study of a Greek Smart/Digital Region, describing the benefits of using the proposed framework.

The paper is organized as follows: First, we present the main definitions of “smart city”, highlighting the different concepts given and showing the different fields based on each author. Then, we examine whether the concept of ‘smart city’ could be expanded to ‘smart region’ and we propose a definition of smart region. In section 3 we try to measure the smartness of a region, identifying the pillars and the indicators of smartness. Section 4 presents the case study of a Greek Smart Region, the region of Central Greece describing the benefits of using the proposed framework. Finally, section 5 summarizes the conclusions of our work and suggests areas for further research.

1. Literature review

The concept of smart city is strongly discussed in an academic literature in recent years, to solve tangled and wicked problems inherited in the rapid urbanization. Its main objective appears to be the role of the ICT infrastructure, although many researches has also been carried out on the role of human capital / education, social and relational capital and environmental interest as important drivers of urban development.

The European Commission presented a new policy strategy entitled “Europe 2020” to promote employment, improve productivity and strengthen social cohesion in Europe. Nowadays, the European Union (EU) is being transformed, which is mainly due to globalization, climate change and demographic aging. Moreover, the 2008 financial crisis has affected the social and economic progress of EU countries. Therefore, the economic recovery launched in 2010 must be coupled with some reforms aimed at ensuring the sustainable development of the EU over the next decade. In this context, the European Union (EU) has incorporated into the urban development strategy the concept of a ‘smart’ city for its metropolitan areas [Angelidou, 2014].

The OECD [Gault, 2016] also mentioned that “Innovation drives growth and helps address social challenges” and in Oslo Manual [OECD-EUROSTAT, 2005] with EUROSTAT they stresses instead the role of innovation in ICT sectors and provides a framework to identify innovative indicators to measure the urban development.

Although the concept of smart city is increasingly used, however, it is rather an abstract concept and its definition is in progress. Many definitions have been given by replacing the word smart with the word digital, intelligent, virtual, etc. In an academic bibliography the smart city definitions are heterogeneous depending on which factor they consider decisive. Some researchers emphasize the role of ICT infrastructures in developing the concept of smart city [for example, Mitchell, 2013]. Others emphasize the role of governance that through an ‘smart’ strategy will improve the services provided by its citizens by improving the quality of life of its inhabitants and achieving sustainable development and economic growth. Hall [2000, pp. 633-649] stressed that “[...] a city that monitors and integrates conditions of all of its critical infrastructures, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens, can be called a smart city”.

Additionally, some other definitions of smart city empathize the role of human capital in urban development. Berry and Glaeser [2005, pp. 407-444] show, for example, “[...] that the most rapid urban growth rates have been achieved in cities where a high share of educated labor force is available by assuming that innovation is driven by entrepreneurs who innovate in industries and products which require an increasingly more skilled labor force”.

However, the first commonly accepted definition of smart city has been given by Giffinger et al. [2007, pp.10-11]: “[...] a smart city is a city well performing in six characteristics, built on the ‘smart’ combination of endowments and activities of self-decisive, independent and aware citizens”.

This definition defines in an interesting project conducted by the Centre of Regional Science at the Vienna University of Technology, six main ‘axes’ (dimensions) along which a ranking of 70 European middle size cities can be made. These axes are: a smart economy; smart mobility; a smart environment; smart people; smart living; and, finally, smart governance, which in turn are analyzed into 31 major factors and 74 indicators in total. This project was the first attempt to classify cities based on their level of smartness.

Following this approach, other studies [Caragliu, Del Bo, and Nijkamp, 2011] “[...] focus on the interrelationships among the components of smart cities” (as defined by Giffinger et al. [2007, pp. 10-11]), including human and social relations that link the intellectual capital, health and governance through an approach based on the triple helix model. In this framework, the city is called ‘smart’ when: “[...] investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance” [Caragliu, Del Bo, and Nijkamp, 2011 pp. 44-60]. “Furthermore, cities can become ‘smart’ if universities and industry support government’s investment in the development of such infrastructures” [Nijkamp et al., 2011, p. 3].

Based on the above definitions, we try to proceed to a taxonomy about factors which play crucial role in the definition of the concept of smart city.

Table 1. Factors of smartness

No.	Factors of smartness	Authors
1	Information and communications technology (ICT) (a network and a linked system that develop an artificial nervous system)	Mitchell [2013], Giffinger et al. [2007], Caragliu, Del Bo, and Nijkamp [2009], Harrison and Donnelly [2011], Washburn et al. [2010], Nam and Pardo [2011], Lazaroiu and Roscia [2012], Lombardi et al. [2012], Caragliu, Del Bo, and Nijkamp [2011], Zygiaris [2012]
2	Physical infrastructures (roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings)	Hall [2000], Giffinger et al. [2007], Caragliu, Del Bo, and Nijkamp [2009]
3	Human capital (creativity, diversity and educated labor force)	Berry and Glaeser [2005], Hollands [2008], Giffinger et al. [2007], Caragliu, Del Bo, and Nijkamp [2009], Washburn et al. [2010], Nam and Pardo [2011], Lombardi et al. [2012], Caragliu, Del Bo, and Nijkamp [2011], Zygiaris [2012]
4	Social capital (healthcare, public safety, real estate and utilities more intelligent)	Caragliu, Del Bo, and Nijkamp [2009], Washburn et al. [2010], Lazaroiu and Roscia [2012], Caragliu, Del Bo, and Nijkamp [2011]
5	Urban development (transportation systems and land use to improve the structure of a town or city)	Berry and Glaeser [2005], Barrionuevo et al. [2012], Zygiaris [2012]
6	High capacity for learning and innovation	Komminos [2006], Zygiaris [2012]
7	Economic and political efficiency	Giffinger et al. [2007], Hollands [2008], Caragliu et al. [2011]
8	Environmental protection (reduction of CO2 emission)	Caragliu et al. [2009], Lazaroiu and Roscia [2012], Lombardi et al. [2012], Caragliu et al. [2011], Zygiaris [2012]
9	Governance and policy (administration, institutions)	Caragliu, Del Bo, and Nijkamp [2009], Washburn et al. [2010], Nam and Pardo [2011], Caragliu, Del Bo, and Nijkamp [2011]
10	Maximizing services to citizens (self-decisive, independent and aware citizens)	Giffinger et al. [2007], Caragliu et al. [2009]
11	Industry (innovate products, entrepreneurship and more skilled labor force)	Berry and Glaeser [2005], Caragliu, Del Bo, and Nijkamp [2011]

Source: Based on literature review.

The European Parliament [2014] synthetizes international debate and introduces a formal definition that, while providing a milestone in the search of definitions, could also shape the debate and the smart city evolution: “[...] a smart city consists of not only components but also people. Securing the participation of citizens and relevant stakeholders in the smart city is therefore another suc-

cess factor”. This definition tends to coincide with the previous system of systems, but explicitly introduces people component, just implicitly included in the system concept (Russo, Rindone, and Panuccio, 2016).

2. From smart city to smart region

2.1. The definition of ‘physical region’ and the EU Regions

The concept of ‘smart city’ has emerged as an attractive topic in the academic literature concerning the continuing significant concentration of population and economic activity in urban centers. The creation of a ‘smart’ city emerges as a strategy to mitigate the problems created by urban population growth and rapid urbanization. Smart cities ensure a viable environment with the help of Information & Communication Technologies. The main question of this research is whether the concept of smart city can be used to a regional level, and if, to define the smart region’s concept and to determine the components it compiles.

First of all, in order to define the concept of smart region we must define the concept of the **physical region**. The concept of the region is generally very difficult to define without the prior reference to the purpose it intends to serve and the criterion to be used. It is impossible for a division into regions to be suitable for analysis and policy purposes at the same time. Any discipline, such as geography, urban planning, sociology, economics, etc., in theoretical and applied research and studies gives similar meaning to the concept of ‘region’ to better facilitate the purpose of the study and the needs of the hierarchy system and ranking. A common feature, however, of all definitions is the idea of the ‘geographical area’, which can be researched as a ‘single area’ [Konsolas, 1997, p. 98].

Many definitions of the concept of the physical region have been given with their most important ones being presented below. Perrin [1976, pp. 29-31] considers that the economic region is an “open system with borders that change from the evolution of the urban network and the structure of production factors”. Isard [1956, pp. 19, 21], considers that regions are simply generalizations of the human mind. “The choice of a particular set of regions, their cores and boundaries, their internal structures and hierarchical arrangement, etc., depends on the particular problems to be examined...” [Isard, 1956, pp. 6-16] The concept of a region is a very generalized and flexible one.

In accordance with the contemporary needs of regional analysis, Konsolas [1997, p. 98] considers the ‘economic region’ as “[...] a dynamic geographical unit whose boundaries are affected by the temporal changes of the common or complementary characteristics of the spatial units from which it is composed”.

In conclusion we can describe the ‘physical region’ as “[...] an area of geographical land that has common features. These features can be natural, such as climate or landscape. It is a territorial entity with its own geographic structure which is framed in space and time, and that is difference from other units” [Radulović et al., 2015, pp. 2-5].

The European Union in order to compare the development process and the inequalities of its regions proceeded with the NUTS classification, a classification of territorial units for statistics. NUTS is a geographical nomenclature subdividing the territory of the European Union (EU) into regions at three different levels (NUTS 1, 2 and 3, respectively, moving from larger to smaller territorial units). Above NUTS 1 is the national level of the member state. NUTS areas aim to provide a single and coherent territorial breakdown for the compilation of EU regional statistics.

Inequalities that exist between different regions of the EU can be attributed to a wide range of factors, including: changes brought about by globalization (such as the relocation and outsourcing of manufacturing and service activities), the legacy of former economic systems, socioeconomic developments, geographic remoteness, and the availability of resources, including human resources. These manifest themselves, among others, in the form of social deprivation, poor-quality housing, healthcare or education, higher levels of unemployment, or inadequate infrastructure. For the above reasons the European Union (EU’s) regional policy aims to support the broader Europe 2020 agenda. It is designed to foster solidarity, such that each region may achieve its full potential by alleviating economic, social and territorial disparities. During the period 2014-2020, almost one third of the EU’s total budget is devoted to cohesion policy: national accounts and regional accounts are important in this context, insofar as they were used to determine the extent to which EU member states should contribute to the EU’s budget and they also serve as the basis for the allocation of cohesion policy expenditure [Eurostat Regional Yearbook, 2018].

From the regional yearbook of 2018, what is worth noting is that the highest positions in wealthy regions, hold northern and central European countries (Austria, Germany several regions in the Benelux countries, southern England, southern Ireland, and Nordic member states) and at the bottom the ‘poorest’ regions in the EU were primarily located in eastern parts of the EU (Latvia, Greece, Italy,

Spain and Portugal). Finally, it is worth mentioning that the highest levels of GDP per capita were generally recorded in capital city regions of member states and that Bulgaria, Croatia, Greece and Slovenia were the only multi-regional EU member states where economic activity was below the EU-28 average in each and every region.

2.2. The smart region concept

The European Union, in the context of its social and territorial cohesion policy, promotes investment at regional level, supporting the development of local economies in a rapidly evolving digital world. Investments at regional level, lead to the improvement of the development process of all the cities and municipalities which are included in the region because with regional governance coordination and prioritization of the necessary infrastructure investments, the gaps, that would emerge if each city made its own investments infrastructure, are reduced. Moreover, the planning of investments at regional level improves the development process in the whole region and its constituent cities, and this is achieved by city-scale economies within the region.

Additionally, investment in research and innovation at regional level will support the innovation in cities and regions near the region under transformation because they will benefit from the increased innovation and the concentration of high-level services. Given that spatial proximity is vital for growth, the promotion of development nodes beyond the regional capitals will support national development and will support cohesion by reducing regional disparities.

Moreover, it is important to emphasize that fund raising and infrastructure investment are primarily at the regional level as it is a political and economic option for public investment to be gathered, favoring greater capital accumulation.

Regional investment improves their attractiveness, resulting in decentralization from the capital and major urban areas in the regions, facilitating the decongestion of large urban centers, such as traffic congestion and environmental pollution, as well as reducing real estate prices in major cities. The regions and their cities can achieve investment in technological and innovative sectors if they are given the right infrastructure, capacity and facilities.

An additional factor promoting public investment at regional level is the effort to preserve the local population in their regions, as the forecast of the European Investment Bank study [EIB Investment Report, 2018/2019] is that there is a significant decrease in their population due to lower fertility, aging and immigration.

If a region has the same quality and availability of services and quality of life for its employees, a business does not have to be in the capital and will enjoy less congestion and lower costs. Businesses and people do not have to move to capitals to access technology, healthcare or a vibrant cultural life. Such structure is not detrimental to growth, as it also reduces the cost of aggregation of capital and increases the diversification of the economy. This is an incentive for regional governance to keep its local population.

Another important factor for promoting regional investment is the fact that, at the time of the economic crisis and the fiscal consolidation phase, national financial regulations limit the ability of cities to incur additional debt to finance new investment projects and large-scale projects, resulting in disproportionate costs for public investment, which particularly affect municipalities.

Finally, analyzing and examining the concept of smart region is preferred because regional data is significantly richer and more readily available than data at a city level.

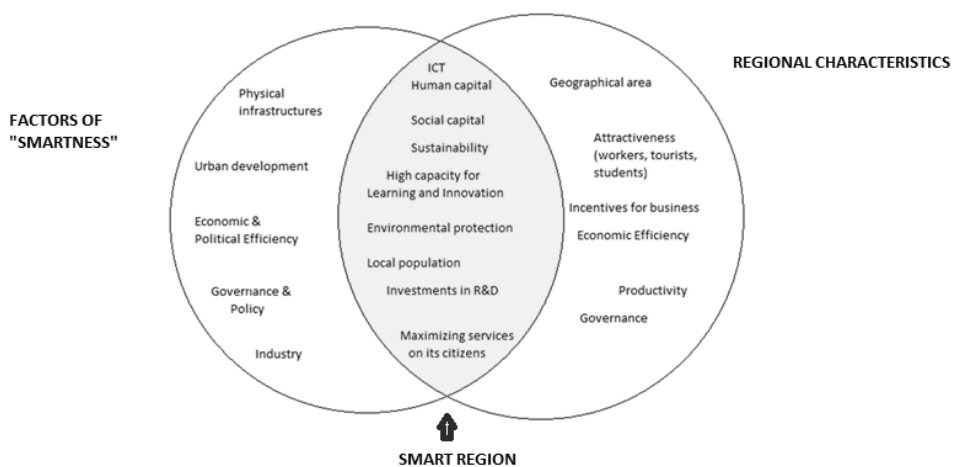
Based on the above, we believe that the concept of a smart city can also be used at regional level as the investments made in this direction will improve the basic infrastructure needs, making the cities of a region more favorable to innovation and development. Therefore, the wider urban development strategy, which responds to the challenges and opportunities faced by cities, and given the projected acceleration of urbanization, smart solutions will be needed at the regional level to reduce pressures from the increasing size of urban areas, while preserving the main objective which is to improve the quality of life of its residents. Smart solutions in the regions will create opportunities, unlock growth potential and allow businesses to thrive and employ younger generations and more skilled workforce and will be able to keep young people with talent in the wider region without the need to move to urban centers.

In addition, if a region can accommodate and support the development of some particularly innovative businesses, this can support further business production in the wider region. Moreover, investment in smart mobility, such as local and interurban accessibility, has a positive impact on the development process of a region. Better capacity for work, school and leisure is in line with the concept of 'new economic geography' and favors economic growth and urban wealth.

Finally, the protection of the environment and the health and social protection benefits provided by a region are related to its development process and are related to the objectives set by the EU for Social Cohesion. Investing in smart social infrastructures (such healthcare), environmental services, and energy effi-

ciency, as well as all the above investments which are mainly done at regional level rather than at municipal level help to turn a region into a smart region. The figure below illustrates the common characteristics of a region that can turn it into a smart region.

Figure 1. The concept of smart region



After the above we proceed to the definition of smart region as: a dynamic geographical unit with common or complementary characteristics of the spatial units from which it is composed, that invests in human and social capital and physical and technological (ICT) infrastructure and seeks for sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.

3. Measuring the smartness of a region

Defining the concept of smart region is not easy and is a complicated issue, as you have seen in the above analysis because there is no commonly accepted definition that includes all its elements. Even more difficult is to try to measure the concept of smart region. In this section we will present the pillars that are used to measure the smart city concept because we think that they can be applied to the smart region concept as well.

The **University of Vienna** [Giffinder et al., 2007], developed an assessment metric to rank European medium-sized cities. This metric uses specific indicators for each of the six identified dimensions of a smart city: smart economy,

smart people, smart governance, smart mobility, smart environment, and smart living. Another system is that used by the **Intelligent Community Forum (ICF)** which annually announces cities awarded as Smart21 Communities. This metric is based on five factors which must be fulfilled to be an intelligent community (i.e., broadband connectivity, knowledge workforce, digital inclusion, innovation, and marketing and advocacy) [Albino, Berardi, Dangelico, 2015].

A methodology to assess and compare smart city models has been recently proposed by Lazaroiu and Roscia [2012]. They selected a high set of indicators for computing the ‘smart city’ index. The index is proposed to help the distribution of funding by the European Commission in its strategic energy plan for the 2020 European strategy [Albino, Berardi, Dangelico, 2015].

Lombardi et al. [2012], have further explored the six pillars set by Giffinder and linked them to aspects of urban life, such as industry, education, e-democracy, logistics & infrastructures, efficiency & sustainability, security & quality [Albino, Berardi, Dangelico, 2015].

Based on extensive and deep research of literature, we have identified six significant pillars for developing the framework as: governance, economic, people, technology, infrastructure and environment. The paper throws light upon how these factors can make the smart region initiative a successful project.

3.1. Governance

e-Government is one of the most important determinants of a region’s transition from its physical form to the form of a smart region. Moving from this type of government to digital or e-government is a challenge for a region and is indispensable for the efficient and effective management of smart regions. Enables many traders (citizens, policy-makers, business, etc.) to interact with appropriate technological support, to improve the offered services and the quality of life of its residents.

3.2. Economic

The economic factor is always an important factor in the development of a region. The indicators included in this pillar are all related to its economic activity, such as economic competitiveness, entrepreneurship, productivity, trademarks, innovation and labor market flexibility as well as the integration in the national and global market. The creation of a smart region with the adoption of ICT infrastructure enables the change of business and industry structures and the

economic outcomes of this initiatives are the creation of new businesses, the creation of new jobs, the development of the workforce and the improvement of productivity as well as the maintenance of the population in smart regions.

3.3. People

Projects of smart regions aim to foster more informed, educated, and participatory citizens, allowing them the opportunity to participate in the governance and management of the region and become active users. Smart regions create a new sense of ability in the idea that citizens can rely on smart communities and can play an active role in their design, through the ability to communicate with each other and with the organizations and the groups that represent them.

3.4. Technology

Information and Communication Technology (ICT) is the most essential driver of the smart region initiative. The transition from a physical region to a smart one is accomplished by infrastructure investments in ICT's. Smart regions depend on a new generation of integrated hardware, software, and network technologies that provide IT systems with real-time awareness of the real world and advanced analytics to facilitate citizens to make smarter decisions about alternatives and actions that will optimize their quality of life.

3.5. Infrastructure

The concept of a smart region includes all kinds of infrastructure for its development (both technological infrastructures – ICT elements, software and telecommunications, and physical infrastructure such as buildings, roads, bridges, railways, etc.). The availability and quality of a region's infrastructure is critical to the development of a smart region as it depends on what infrastructure it offers to better serve and facilitate the lives of its inhabitants. In addition, the infrastructure of a region is an important factor for the development of business and economic activities of its residents as well as for attracting new investors to it.

3.6. Environment

Smart region initiatives are consistent with the concept of sustainable development. Therefore, the environmental factor and especially the policies implemented to prevent and protect it are crucial for the development of a smart

region. Core to the concept of a smart region is the use of technology to increase sustainability and to better manage natural resources [*Our Common Future...*, 1997], without interfering with the growth of future generations and the conservation of natural resources.

Based on the above pillars of smart region, we try to proceed to a definition of Indicators that can describe each pillar of smartness.

Table 2. Indicators of smartness

No.	Pillars of smartness	Indicators of smartness
1	Governance	local institutions, participation and partnership, transparency, collaboration, leadership, service and application integration
2	Economic	entrepreneurship, trademarks, innovation, productivity and flexibility of the labor market, integration in the national and global market
3	People	human capital, lifelong learning education, creativity, labor market efficiency, health and personal safety, quality of life
4	Technology	ICT infrastructure, big data, open data platforms, fiber optic channels, Wi-Fi networks, wireless hotspots, kiosks
5	Infrastructure	local accessibility, long distance accessibility, connections (physical networks of interconnection), roads conditions public transport lanes, soft mobility paths
6	Environment	quality and efficiency of environment, energy-efficient buildings, emissions CO ₂ , water supply, protection of natural resources, waterways, green spaces, parks

4. From smart city to smart region: The case study of the region of Central Greece

As we have analyzed the concept of smart city can also be applied at regional level. Additionally, as a response to recent policy development in EU, there is a growing recognition of the potential role of innovation and ICT's solutions not only in local but also in the regional development in the context of smart specialization. Data does not have a natural habit of hitting the brakes when it reaches geographical city limits. Digital innovations can be held back from extending beyond city limits, however, confined by the ways they have been managed, procured, or deployed. But many digital innovations only make sense when scaled well beyond city limits.

Although the concept of smart region is a new concept and it does not exist in academic literature, we believe that, as the regions face similar problems from the rapid population growth and from rapid urbanization as well as cities and with the goal of sustainable development, they can apply the innovations offered

them by ICT's and pursue to turn their region into a smart region. In this context, we believe that the six pillars (governance, economic, people, technology, infrastructure and environment) we have presented in the previous section can be applied to the smart region concept. The above research is at an early stage and we still do not have a region that has applied the six-pillar framework, but we believe that the smart region concept will be soon a reality because it is a new initiative to drive economic growth and improve the quality of life of people by enabling regional development and harnessing technology as a means to create smart outcomes for citizens.

In this section we will present a case study of a region in Greece that makes the first steps of its transition to a smart region. The region of Central Greece is one of the leading regions in Greece that are trying to move from e-Government to the creation of a smart region with the aim of improving the quality of life of its citizens. The first action carried out in this context was on e-government.

E-government can provide high-quality and low-cost public services, while enhancing the relationship of self-government with citizens by providing access to information and online services. It is one of the most important features of a modern and efficient administration with positive effects on the economic development, competitiveness and well-being of the community.

There is therefore a pressing need to change management models that are characterized by intense bureaucracy, transparency and open access to information, efficiency, effectiveness and quality of information.

Within the framework of e-government, a series of services were created in the region of Central Greece, which are the following:

- new website,
- digital signature,
- electronic document handling,
- double-sided system,
- implementation of personnel management,
- open innovation center,
- national OGP action plan,
- smart region.

For a better understanding of the above services, applied in the region of Central Greece we will proceed to a brief description of them.

4.1. New website

Since March 2016, the region has acquired a new, modern website [www 2], which is more user-friendly and offers modern applications and innovative services to citizens and businesses. Already during its two years of operation, it has been visited by more than 150,000 unique users from nearly 110 countries around the world.

4.2. Digital signature

The region of Central Greece circulates daily hundreds of documents between its departments and other public bodies. These documents are signed by both officials and political agents. Today, all documents moving and compiled in the region are digitally signed, providing the following benefits:

- speed in signing documents and handling cases,
- possibility to sign a document remotely without requiring physical presence,
- increase the level of security in the communication of services,
- reduce operating costs and increase productivity.

4.3. Electronic document handling

Modern administration requires flexibility and speed in decision-making and in handling cases. Having implemented the full use of digital signatures the next step for the digital switchover is digital documents signed to move quickly and securely between the offices. This offers a number of advantages:

- speed of document handling and handling of cases,
- increase the security level using closed network and passwords,
- reduce operating costs without requiring printing and shipping by conventional means,
- reduce the space required to store documents (electronic file),
- ability to extract statistics for more efficient administration.

4.4. Double-sided system

The region of Central Greece is the first region in Greece to apply the double-entry system for financial management, to the standards of modern enterprises. Monitoring of financial management is carried out by external accountants and an annual balance sheet of profit and loss accounts is drawn up, which is audited by independent statutory auditors. The first comprehensive

balance sheet for the year 2015 has already been drafted and voted by the regional council. Implementation of the double-entry system provided many benefits for the region, for example:

- immediate, accurate and reliable information on the region’s economic data,
- securing property and fixed assets,
- better financial, administrative and administrative control,
- greater transparency with control by external controllers.

4.5. Implementation of personnel management

A staff management application has been created so that staff management can be done with modern tools. All data pertaining to each employee (service changes, salary scales, postgraduate courses, seminars, licenses) are now online and are readily available without having to browse any files. At the same time, a modern staff time system has been installed in all the regional units. With its full functionality, it will be possible, combined with the personnel management, to manage and control overtime, overtime and staffing more efficiently, with immediate results:

- immediate and reliable information,
- licensing electronically,
- automatic recording of presence-absence of employees,
- direct knowledge of the directors about the presence of the existing ones,
- watching staff requests,
- provision of statistics.

4.6. Open innovation center

The Center for Regional and Local Innovation has begun its activity to become the host and support center for smart, creative and innovative applications for all areas of public policy. It is a network of people with experience and enthusiasm for innovative actions that support the region’s efforts and will introduce new ideas and proposals in the future.

4.7. National OGP Action Plan

Openness, participation and accountability are fundamental principles that are the cornerstone for the design and implementation of modern policies. The region of Central Greece participates in the 3rd National Action Plan for Open Government (OGP) with 2 commitments.

1. Open-participation budget, with full disclosure of all its elements and the possibility for citizens to decide on what actions to allocate some of the region's money.
2. Impact and evaluation platform, projects where citizens will be able to evaluate projects and express their views through comments.

4.8. Smart/digital region

Within the framework of the new website, the region of Central Greece launched the "Digital Region" project consisting of a grid of modern applications that improve the service of the citizen and the professional and increase the participation of citizens in governance and decision-making, we can see some of these applications below:

1. *Transparency in Central Greece.* All notices, competitions and invitations to tender, works and services are published on a single platform, with access to all.
2. *Central Greece for the Citizen.* All transaction procedures with the region (e.g., licenses, bonuses) gathered on a portal.
3. *And now... then will I get paid?* The application by which suppliers in the region, after registering, can see their tab and know when they will be paid. At the same time, they are given the opportunity to print tax certificates directly through the application.
4. *Learn where your money is going.* A platform with online budget details for the region. This platform presents specific spending categories (e.g., fuel, rent, overtime) in an understandable way so that the citizens of Central Greece know where their moneys are going.
5. *Know what you breathe.* The region of Central Greece has installed air quality measuring devices at the headquarters of each regional unit. The measurements automatically go up every hour to the portal to let people know about the air quality they breathe.
6. *Application for livestock breeders.* A simple-to-use app for servicing livestock farmers in relation to their debts arising from the lease of land for grazing.
7. *Our Projects on Map.* A new platform with a geographic representation of all the works performed by the region of Central Greece. Citizens through it will be able to search for the projects that are being carried out in their area and to be informed about their budget the geographical extent they cover and will be given the opportunity to evaluate them.

8. *Digital Council*. A new project is under design. Through a sophisticated platform, regional counselors will be able to vote electronically on the issues of the regional council. Citizens and organizations will have the opportunity to read online suggestions and questions on issues as well as to know how each regional councilor has voted on all issues.
9. *Gateway to open satellite data*. A new data access service for a global real-time satellite network.
10. *Open participatory budget*. Citizens of Central Greece vote by actively participating in the actions that the region wants to fund. Through a set of costly actions, and based on the budget available, citizens and stakeholders choose those that most importantly evaluate, and its region implements.

5. Discussion and conclusions

The concept of smart city has been developed in recent years, to solve the problems that are caused by the rapid urbanization phenomenon, the urban population growth and the immigration.

To manage these complex issues, local authorities must adopt strategic of urban development in a smart way by capitalizing on investment in innovative sectors and using ICT's technologies to support a higher quality of urban spaces and a better offering of public services. Smart cities ensure sustainable environment because the key elements identifying them are in line with the principles of sustainable development and because they aim at improving the quality of life of residents without restricting this possibility to future generations.

This paper is an attempt to go a step forward and try to explain and clarify the meaning of the concept of smart region. Drawing on the conceptual literature on smart cities and the factors outlined above we have developed an integrative framework to explain the relationships and influences between these factors and the concept of smart region. Additionally, we explained why we believe that these six pillars we presented can also characterize a region as a smart one.

Furthermore, we introduced and identify the concept of smart region and we present the case study of a Greek Digital Region, the region of Central Greece which makes slow but steady steps to move from e-government to the development and implementation of the digital region, was presented. All applications that facilitate and improve the quality of life of its citizens have been examined.

Further research can include further work on quantification of smart region' indicators and the examination of more cases studies of smart regions. The area

of further research may include further elaboration on the definition and quantification of smart regions characteristics and a framework for understanding the dimensions and to provide a methodology for enriching them.

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OD INTELIGENTNYCH MIAST DO INTELIGENTNYCH REGIONÓW JAKO ROZWIĄZAŃ SŁUŻĄCYCH TWORZENIU ZRÓWNOWAŻONYCH SPOŁECZNOŚCI MIEJSKICH

Streszczenie: W ostatnich latach miasta stają w obliczu takich zjawisk, jak szybko postępująca urbanizacja, wzrost liczby mieszkańców miast i imigracja. Powoduje to wiele problemów, takich jak: trudności w gospodarowaniu odpadami, zatłoczenie miast, nadmierne zużycie energii, niedobory w zaopatrzeniu, kongestia i zanieczyszczenie powietrza, zmuszając rząd do korzystania z technologii ICT i wprowadzenia koncepcji „inteligentnego miasta” w celu promowania zrównoważonego rozwoju miasta. W związku z tym, że regiony borykają się z podobnymi problemami, celem tego badania było sprawdzenie, czy pojęcie „smart city” może zostać rozszerzone i wykorzystane w regionie. Przedstawiono również studium przypadku greckiego Inteligentnego/Cyfrowego Regionu, opisujące korzyści wynikające z zastosowania proponowanych ram.

Słowa kluczowe: smart city, urbanizacja, innowacje miejskie, inteligentny region, ICT.