Urban development towards smart city – a case study

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Abstract: *This paper contains an analysis concentrated on 7 poles from Romania: Braşov, Cluj-Napoca, Constanţa, Craiova, Iaşi, Ploieşti and Timişoara which are declared growth poles in which priority investments are made from domestic and European funding. We analysed information presented in official documents, including strategies, integrated urban development plans (IUDP) for the programming period 2007-2013, project presentations and other documents. We set to focus our analysis on endeavours of the local public authorities to apply the human and digital intelligence in planning development of the respective cities. The research interest focused on identifying whether becoming smart city is part of strategic planning, either as strategic objective or as specific project as part of another objective meant to contribute to overall urban development. The analysis on the availability of local authorities from Romanian growth poles to take up in their planning endeavours aspects related to human and digital intelligence that Romanian growth poles do not seem to explicitly envision themselves as smart cities, with no explicit reference being made to "smart city" in their visions. One could nevertheless notice that the dimension related to human intelligence is present in the visions, with some growth poles - Timişoara and Cluj-Napoca - making reference also to technological intelligence that is to be taken into account for economic development of the respective growth poles. These two growth poles are the two most advanced economically of the seven growth poles. Of theses seven, we argued that Brasov stands out as the one that showed more awareness and interest in becoming a smart city, as its IUDP included a policy towards development of information society, reflected in two programs and several projects that converged towards development of integrated data management systems in the local authority, in order to improve access to public information and to management of several public services provided by the local authorities. Thus, it is more advanced in its endeavours towards becoming a smart city, as their coherent actions that followed the initial planning proved. The other growth poles took into account specific interventions, through projects, which involved mostly technological intelligence.*

Keywords: *urban development, smart city, Romania, planning, growth poles.*

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Introduction

As more than two thirds of Europeans live in urban areas, it was only natural that recent approaches in European policies place urban development in the centre of cohesion policies. Planning for urban development has also started to take integrated approaches. And as technological developments have become increasingly omnipresent, the concept of smart city became more and more attractive.

In this framework, the approaches used in urban development for putting this concept into practice may be of interest to analyse, taking into account the usage of digital technologies in such endeavours. We focus our analysis on approaches used in putting into practice such a concept in cities declared as growth poles from Romania.

1. What makes a city"smart"?

Recent literature on smart cities shows a diverse image on approaches of smart cities. Some authors consider difficult to define the concept of "smart city". Yet, if defining it may be difficult, so shall be the mission to design and build it, with the risk of implementing chaotic, useless or isolated initiatives, especially in areas that do not communicate directly (Rizzini, 2014).

Other authors define the concept of smart city quite easily. For example, Turchi (n.d), analyses the phenomena of "smart city" following the rule of the 5W, as follows:

a. What – What is a smart city?

It is that city that can be both sustainable and efficient, and also innovative. Certainly such a city will ensure high standards of life for its citizens, giving them everything they need to improve, beautify and simplify their lives: urban regeneration, improving energy efficiency of buildings, reducing polluting emissions, ensuring mobility by use of non-polluting electric sources, free Wi-Fi networks, the possibility to pay by using the smart phone etc.

b. Who – Who are the key actors in a smart city?

Actors involved in smart cities include several categories:

❖ **The city** and other Government structures – in terms of problem analysis, project proposals, support implementation of solutions, in view of accessing European funding, which is represents the sustainable solutions for such purposes (Androniceanu, 2014);
❖ SMEs – with support from government;
❖ Universities – researchers;
❖ Citizens – as end-users, consumers.

While aware that different stakeholders can contribute to the development and functioning of smart cities and projects for smart cities (cities, administration, universities, companies, citizens) (Perboli et al, 2014), in our paper we choose to focus on endeavours made by local authorities towards becoming smart cities.

c. When – When can a smart city be created?

The quick and simple answer to this question is that smart cities are cities of the future (Turchi, nd). They become rapidly a possibility in the real world (Höller et al, 2014), ensuring those elements that currently lacking in cities: quality of life and social-economic development, with capabilities to monitor and include all critical infrastructures: highways, tunnels, air and water networks, energy networks, as well as control and maintenance activities that contribute to optimizing resource consumption, while also satisfying needs related to security. (Joshi et al, 2016).

d. Where – Where can such cities be created?

The answer to the question whether a city can become smart can be guessed as affirmative. In a ranking done in 2016, with 70 European cities that expressed their interest to get the status of smart cities, included 3 Romanian cities, as follows: Timisoara on position 55, Sibiu on position 63 and Craiova on 68 (Vienna University of Technology, 2016). Of these, two are growth poles.

e. Why – Why create a smart city?

Because of recent challenges, related to climate change, rapid growth of world population, deficit of energy resources, and decrease of water supply of the planet. Smart cities address these issues, and attempt to create new projects and services to improve the life of citizens, with respect for the environment, in support of present and future generations (Turchi, n.d).

Moreover, while some consider that in time cities that become smart cities will become richer, cleaner and more efficient, other argue that there is the danger that cities turn into automated places, where there will no longer be any creativity (Van Zoonen, 2016).

When looking over the recent 5-year literature, we notice that the body of literature related to smart cities is growing significantly by the year, as shown in different international databases, such as science direct – where searches with key words "smart city" turned 1352 articles for year 2010, increasing at a slower pace during 2011-2013 (1547 articles for year 2011, 1906 for year 2012, 2179 articles in 2013), while turning more than double results for the year 2014 as compared to the year 2010 (2748 articles) and almost triple results for the year 2015 (3575 articles).

While all research make reference to a technological dimension, implying use of ICT in cities, there is no generally agreed upon definition of what actually makes a city smart. While the purpose of this article is not on providing a thorough literature review on the definition of smart cities, which can be read in other articles (e.g. Caragliu et al, 2015), we feel compelled to provide brief references related to smart cities that enable us to conduct our research (Kola-Bezka, Czupich, Ignasiak-Szulc,2016).

When looking into the areas of interest for research on smart cities, we notice that research focuses on various areas, from economic development, energy, building, e-governance, transport and mobility, environment, water, waste water

and waste management, public safety and security, city management, education, health services, payments etc., which can be observed both from looking into the titles of the articles and is also confirmed in different articles (e.g. Caragliu et al, 2015, Perboli et al, 2014). Moreover, projects that target smart cities are important for urban policies, enabling them to reinvent spaces. Many aspects of the territorial policies can improve the competitiveness of territories, aspects such as social cohesion, creativity, freedom of movement, efficient use of environment, landscape quality, welfare of citizens etc. (Rosati, Conti, 2016).

Moreover, the body of literature related to smart cities includes a strong technological component, in terms of computer science research, focusing on different technological tools, such as databases, cloud computing, smart grid systems, going towards portable devices.

We agree with the two dimensions of smart cities identified by Angelidou (2015), namely one related to digital intelligence, based on technology ("urban futures"), and one related to human intelligence, based on knowledge and innovation. Moreover, the same author (Angelidou, 2015) argues that while technologies develop at fast pace and put pressure towards their usage ("technological push"), the demand for implementation of smart cities is also important (application pull) (fig. 1).
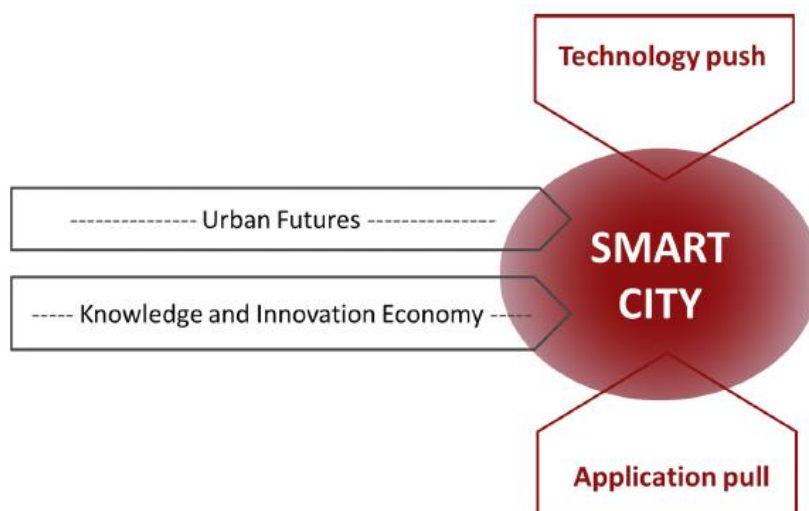
Figure 1. Smart cities
(*Source:* Angelidou, 2015)

The dimension related to urban futures imply the creation of knowledge infrastructure, applied technology, making reference to smart grids, smart meters, and other infrastructure. In this sense, smart city proposes a holistic vision of future

communities where new intelligent technological tools, services and applications are integrated, with interoperable systems.

The "smartness of these cities" is a distributive, horizontal, common intelligence that encourage involvement of citizens for sustainable organization of cities, with optimizing consumption of natural, energy, economic and human resources (Lodi Rozzi, 2014).

On the other hand, Ahvenniemi et al. (2016) recommend the use of the term "smart sustainable cities" instead of that of sustainable cities or "smart" cities, suggesting that the performance of smart cities should be measured not only in the sense of efficiency of implementing smart solutions, but also through its ecological, economic and social sustainability, that contribute to smart urban growth and development (Demetri, 2015).

Moreover, a city may be considered smart when investments both in traditional and in modern elements lead to sustainable economic growth and to increase in the quality of life. In addition, natural resources should be managed as efficiently as possible with involvement of public authorities (Demetri, 2015).

In this context, in the present research we focused more on the possible „application pull" in the development of smart cities rather than on the technology push, looking into endeavours made by cities, as actors involved in development of smart cities. Thus, we focused on planning endeavours made by local authorities from seven growth poles from Romania towards becoming smart cities, in relation to digital intelligence, based on technology, and to human intelligence, based on knowledge and innovation, as part of their planning endeavours towards integrated urban development of the respective growth poles. The focus on planning was determined by the strong belief that failure to achieve one's objectives may be due also to the fact that one has no set objectives, thus for a city to become smart city, there should also be plans in this respect.

2. Methodology

As cities undertake strategic planning endeavours, that encapsulate their vision and objectives for development, the research interest focused on identifying whether becoming smart city is part of such strategic planning, either as strategic objective or as specific project as part of another objective meant to contribute to overall urban development.

The analysis is conducted on 7 poles from Romania, namely Braşov, Cluj-Napoca, Constanţa, Craiova, Iaşi, Ploieşti and Timişoara, which are considered growth poles (see Fig.2). We selected the growth poles taking into account existing normative framework in this respect - the Romanian Government Decision no. 998 / 2008, with subsequent changes, which stipulates that 7 cities from Romania, with the exception of the capital city, are declared growth poles in which priority investments are made from domestic and European funding.

These growth poles are urban and peri-urban areas - formed of the city and its area of influence (surrounding area) (MRDPA, n.d.), their delimitation being in this case confirmed by formal legal structure (intercommunity association). These growth poles, through their local authorities, received European funding, especially from Regional Operational Program, in order to "increase the quality of life and to create jobs in towns by rehabilitating urban infrastructure, by improving services, including social services, as well as by developing business and entrepreneurial support structures" (MDRAP, nd.).

Analysis of the growth pole policy, the context of its development have been provided in other research studies (Hintea & Neamțu, 2015) (Ionescu-Heroiu et al., 2013). One of the requirements for accessing funds for the development of the growth poles was related to present integrated urban development plans (IUDPs), with comprehensive planning strategic conducted at the level of the growth pole, and action plans with project due to be done in the short run, as investment plans for the development of the growth poles.
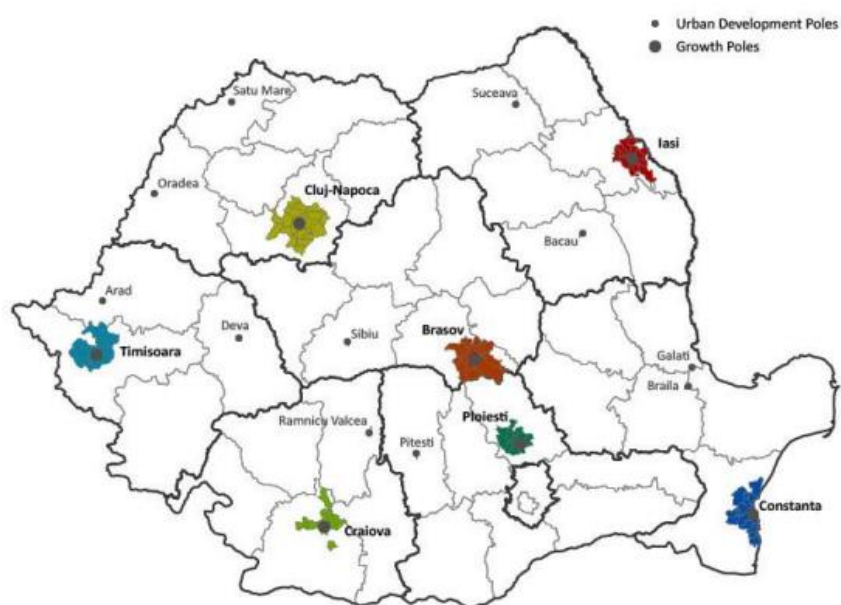
Figure 2 Growth poles from Romania
(*Source*: Ionescu-Heroiu et al., 2013)

We analysed integrated urban development plans (IUDP) of the growth poles for the programming period 2007-2013, while also taking into account projects included in the action plans of these IUDPs. Thus, we analysed information presented in official documents, including strategies, project presentations. Information was accessed from the websites of the municipality declared as growth pole / website developed for the respective growth pole.

Thus, when looking into the strategic endeavours of the growth poles, we focused on areas that are most likely to be influenced in the endeavours for development of smart cities, while taking into account the two dimensions, related to usage of technology and to knowledge and innovation. We looked into the way visions for development are formulated, looking for key words that make reference to innovation, to intelligent / smart growth in relation to sustainable development.

When reviewing the list of projects from the action plans, the interest was to identify areas that presented interest to develop projects that would enable the city to include elements of "smartness", while aware also of certain limitations in this approach, related for example to potential technological aspects that are not included in the project title or brief project description from the IUDPs, but which may be included in the respective projects, and may have been detailed for example in the procurement specifications.

3. Research results and discussions

If we are to take into consideration Demetri's argument (2015) that cities may be considered smart when investments lead to sustainable development, as reflected in sustainable economic growth, increased quality of life and management of natural resources, the approach in all these IUDPs seem to point towards smart cities in the growth poles.

As the approach in the analysis is based on Angelidou's approach (2015), we focused on the application by local authorities of the human and digital intelligence in planning development of the respective cities.

When looking into the IUDPs, we notice that none of the seven growth poles explicitly aimed in their vision to become smart city. Although the words of smart city are not explicitly mentioned, we could however see other words that could be associated with fostering smart cities – e.g. "industries that use high technologies, informatics, telecommunication and creative services" (Timişoara), "services of research, development innovation and information technologies" (Cluj-Napoca), "regional pole of knowledge" (Iaşi). Nevertheless, we could notice that both dimensions of smart cities could be identified in all of the IUDPs.

3.1 Human intelligence – knowledge and innovation

When looking into the dimension related to knowledge and innovation economy, that is, in terms of development of human capital, given the general competences established by law for local authorities, we could not expect much involvement in development of knowledge and innovation economy, with this dimension being treated more as being in the responsibility of the private sector and of the universities. Nevertheless, we could observe that innovation is of interest, with possible support for SMEs, either in economic support infrastructures or in structures that support innovation.

Thus, many of the growth poles included in their IUDPs projects for development of competitiveness poles (see Table 1 - Ionescu-Heroiu, 2013). The information available with respect to the applicants for projects meant for development of competitiveness poles did not indicate whether public authorities were involved, possibly as partners or as members of private enterprises, for such projects, in a triple helix approach (partnership among private enterprises, universities / research centres and government structures). Such planning approach may reflect an integrated approach in dealing with planning of the growth pole, even if possibly included due to external requirements.

Table 1 List of competitiveness poles proposed for funding in IUDPs

Growth pole	Economic profile, as defined in the IUDP	Name of competitiveness pole (project application submitted)	Economic profile of the competitiveness pole
1 Braşov	technologies for sustainable development, tourism	no project submitted	Not the case
2 Cluj-Napoca	energy industry, ITC, business support services, specialized medical services, biotechnologies	TREC - Transnational Renewable Energies Cluster*	Renewable energies
		Transylvanian Furniture Cluster	Furniture
		POLARIS	ICT
		EXCELSIOR – EXCELency in Information Systems Oriented Towards Results	ICT
3 Craiova	IT and high technologies	ICT – Regional Competitiveness Pole	ICT
		Automotive Sud Vest Oltenia Pole	Automotive industry
		INOVTRANS	Rolling stock manufacturing
		TurOlt InTT – Innovation and traditions in Oltenia	Tourism
4 Constanţa	maritime industry, tourism, energy industry, agro-food	no project submitted	Not the case
5 Iaşi	ITC, new/creative industries	no project submitted	Not the case

Growth pole	Economic profile, as defined in the IUDP	Name of competitiveness pole (project application submitted)	Economic profile of the competitiveness pole
6 Timişoara	automotive industry and ICT	AUTOMOTIVEST Association	Automotive industry
		ICT Regional Cluster	ICT
		Romanian Sustainable Energy Cluster*	Green energy (manufacturing of equipment)
		El Camino	Constructions
7 Ploieşti	oil industry, energy industry	CREVIS	ICT
		Pole of competitiveness in the field of automatic systems and robotics	Aircraft production

(Source: Ionescu-Heroiu et al., 2013 processed data from AM SOP IEC and IUDP from each growth pole. Note: TREC and ROSENC have joined MEDGREEN to submit a common application for MA SOP IEC. For this reason, they do not show up as standalone applicants on the MA SOP IEC list)

As the list developed by Ionescu-Heroiu et al. (2013) was before contracting the respective projects for the competitiveness poles, data was identified to confirm already existing information. When reviewing the lists of the competitiveness pole applicants (from www.fonduri-ue.ro – applicants for development of business support structures of national and international interest – competitiveness poles), we could identify several projects submitted by private structures from the growth pole, ranging from 3 projects from Timişoara competitiveness pole to 7 projects in the case of Cluj-Napoca competitiveness poles, with names of the project proposals making reference to previously mentioned competitiveness poles.

As government decision in the national policies was to support business support structures that involved companies and institutions involved in R&D, under measures funded with European funding (Sectoral Operational Program Increased Economic Competitiveness, namely "Development of national and international business support structures – Poles of Competitiveness" - Operation no. 131) meant for development of competitiveness poles, and local government structures were not directly involved, we shall no focus further on documenting such endeavours, as we set to focus our analysis on endeavours of the local public authorities. We shall, however highlight the results of analysis conducted in relation to this aspects (Ionescu-Heroiu et al., 2013, p. 39), which identified the best correlations between growth pole profiles and competitiveness growth poles in the case of three growth poles, Cluj-Napoca, Craiova and Timisoara, where the Regional development agencies were involved in the development of the projects.

3.2 Digital intelligence – urban futures

When reviewing the objectives, policies and programs of the growth poles, and also the list of possible projects from the action plans, in some cases we could see reference made to technology development and usage (e.g. "development of information society") is mentioned as policy in Brasov IUDP, which includes two programs and several projects; one of the objectives in the IUDP of Timişoara mentioned "development of integrated, complex and flexible technical infrastructure", with projects included in the action plan in relation to achieving this objective; "promotion of information technologies" as sub-objective for development of knowledge-based economy in view of increasing economic competitiveness of the Cluj metropolitan area – in the case of Cluj-Napoca growth pole).

When looking into the policies taken into consideration in the UIDPs for achieving sustainable development of the respective growth pole, a policy related to development of information society could be identified in the case of Brasov, this policy included 2 programs, one for ensuring interoperability between public administration and business and citizens and one for creating infrastructure for access to ICT.

Given the interest and willingness of public authorities to take into account technological progress, the areas in which projects were proposed in relation to the development of smart cities were identified (table 2).

Table 2 ICT Projects proposed by public authorities from growth poles in relation to development of smart cities

Growth pole	Areas in which projects are proposed in relation to development of smart city	Observations on usage of ICT
Braşov	Transport urban mobility – traffic safety, public transport management systems, traffic monitoring and management systems; E-government services, interoperability platforms between local public administration and citizens, and between local public administration and business Management of utilities GIS for managing geospatial data E-learning - city staff	Management system – Traffic and public transport Online services (e-services) – web-based Integrated technical call center and GIS system – data management *Integrated approach* - Video-monitoring, public lighting, traffic management, GIS, document management
Cluj-Napoca	E-government Transport – related to public transport management system	Services online – web-based Centralized system for issuing tickets / subscriptions for public transport

Growth pole	Areas in which projects are proposed in relation to development of smart city	Observations on usage of ICT
Constanţa	Transport E-government	Integrated management system – traffic and public transport Online services – web-based Services online
Craiova	Safety e-government	Monitoring system for public safety Online services
Iaşi	Transport E-government	Traffic management system Integrated information and communication system in Iasi metropolitan area
Ploieşti	e-government	Integrated system for urban planning for managing the relations with citizens Integrated system for the county network of public libraries – interoperability
Timişoara	e-government transport public safety	Platform for interinstitutional communication for public administration Traffic management and video surveillance Video surveillance for increasing safety and preventing crime

(*Source*: Authors, based on information from the IUDP)

Similar areas of interest are related to e-governance. When reviewing the funding source for such endeavours, one could observe that mostly European funding was sought for such endeavours, either for e-government, or for interoperability of existing systems. Nevertheless, given the interest in this common area, projects related to e-governance were reviewed, based on information from the websites of the local authorities. The information available in relation to such projects revealed that most of them were web-based. The range of services varied from growth pole to growth pole, most of them taking into consideration services with uni-directional communication related to informing citizens in relation to different forms required in the communication with the local authority. The bi-directional character of some services provided was declared, yet could not be tested, due to registration requirements (that needed information about residency in the respective city, which could not be provided) – such was the case of tax payment services.

Nevertheless, the documentation conducted based on information on the websites of the public authorities revealed that most of the services were web-

based. In the case of tax servies, as in the case of other online services provided by the local authorities, it may be possible to have other approaches that do not require registration, with some of them developed using local resources / local budget, possibly building on existing initiatives, yet information was not accessible on the website of the local authority.

The interest in digital intelligence related to transport or public safety resides in the possibility to access funding for such initiatives (see MRDPA, n.d.). Some explanations for the choice of transport or public safety may reside in the fact that the European funding available through the Regional Development Program specifically funded such projects as part of project proposals from the IUDP and implementing such projects may have seemed easier for the local authorities.

Conclusions

The analysis on the availability of local authorities from Romanian growth poles to take up in their planning endeavours aspects related to human and digital intelligence that Romanian growth poles do not seem to explicitly envision themselves as smart cities, with no explicit reference being made to "smart city" in their visions. One could nevertheless notice that the dimension related to human intelligence is present in the visions, with some growth poles – Timişoara and Cluj-Napoca – making reference also to technological intelligence that is to be taken into account for economic development of the respective growth poles. These two growth poles are the two most advanced economically of the seven growth poles (Heroiu-Ionescu, 2013).

Given the fact that local authorities were not considered as eligible applicants for projects for development of competitiveness poles, which focused on the human intelligence, reflected in key words such as "innovation", "pole of knowledge", the current analysis presented limitations in analysing the dimension related to human intelligence and focused more in the digital intelligence.

Of the seven growth poles, we argued that Brasov stands out as the one that showed more awareness and interest in becoming a smart city, as its IUDP included a policy towards development of information society, reflected in two programs and several projects that converged towards development of integrated data management systems in the local authority, in order to improve access to public information and to management of several public services provided by the local authorities. Thus, it is more advanced in its endeavours towards becoming a smart city, as their coherent actions that followed the initial planning proved. The other growth poles took into account specific interventions, through projects, which involved mostly technological intelligence.

The growth poles included in the analysis took into account in their planning endeavours elements related to smart cities, in areas that are considered as core systems to smart cities: transport, e-government, education, health (Bătăgan,

2011), with Braşov including most of the core systems. These were reflected in various projects. Improvement of communication with citizens seemed to have been considered as key feature – with e-government projects found in all the IUDPs. These seem to be initial approaches, with focus mostly on development of infrastructures.

Based on the information available, one could argue that technological limitations may be due also to insufficient interoperability among systems, with Brasov being the only growth pole that took into account the possible integration of several systems - video-monitoring, public lighting, traffic management, GIS, document management.

Based on information available in the IUDPs, we could not find details related to usage of recent technologies, such as integration of mobile phone applications in various services in relation with citizens. Focus seemed to have been primarily placed on development of the system and its management by the local authorities, with interactions with citizens to be built on, including with development of further extensions of the system and / or interoperability with other systems that are used in providing local services. Thus, we argued that such possible extensions may be built with combination of funding sources – external (grants, EU funding) and own resources (either funding from local budget or reallocation of tasks for human resources).

Thus, while the growth poles include in their planning elements related to smart cities, both in terms of human and digital intelligence, their perception / interest in becoming smart may be a matter of opportunity, including funding opportunity, and could be reflected differently over time, under various influences, including pressures of the economic environment that supports innovation and knowledge.

Beyond all these, the development of human values of the 21st century in the urban environment should be the most important concern of smart cities (Paceşilă & Colesca, 2007).

The reality is that we are getting closer and closer to the moment when our cities become smart, meaning they will adopt that development plan through which they will be enabled to benefit all services in a rapid and intuitive manner by means of new technologies.

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