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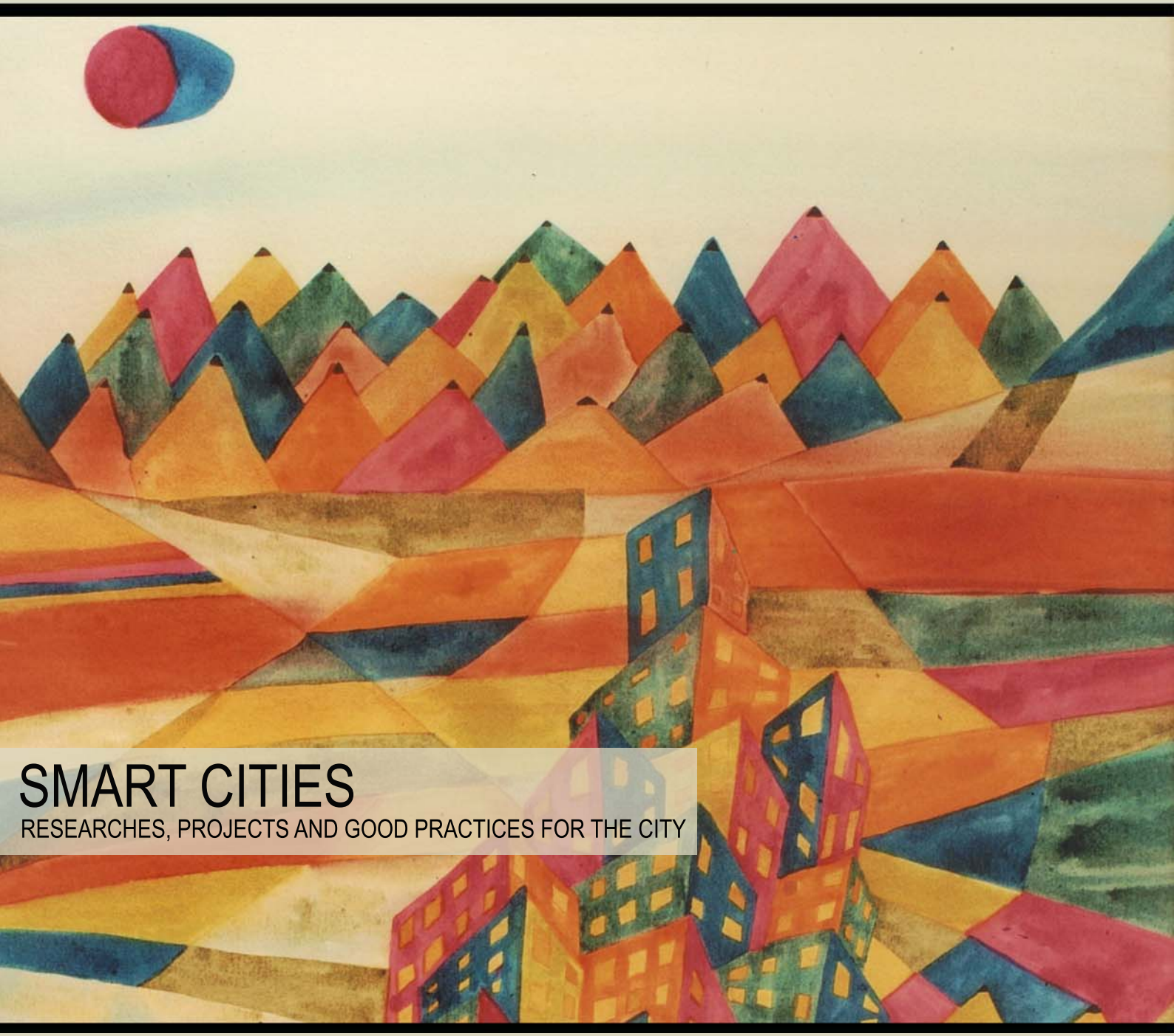

SMART CITIES

RESEARCHES, PROJECTS AND GOOD PRACTICES FOR THE CITY

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TOWARDS AN URBAN PLANNERS' PERSPECTIVE ON SMART CITY[1]

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ABSTRACT

The concept of "Smart City", providing a solution for making cities more efficient and sustainable, has been quite popular in recent years, encouraging reflections, ideas, researches and projects for a "smart" urban development.
A smart city is generally meant as a city capable of joining "competitiveness" and "sustainability", by integrating different dimensions of development and addressing infrastructural investments able to support economic growth as well as the quality of life of communities, a more careful management of natural resources, a greater transparency and participation to decision-making processes.
Based on those assumptions, this contribution tackle the controversial subject of Smart City, starting from the review of the scientific Italian and international literature that, from the Eighties to the Nineties, has been largely focused on ICTs and their impacts on urban development. Then, the focus shifts on the large debate on smart cities that has been developing from the beginning of 2000s and on the numerous institutional initiatives up to now implemented by the European Union for building up the Smart City. Finally, the article highlights how, despite these efforts, a shared definition of the term is still missing and current approaches to the issue are still very heterogeneous; it emphasizes, on the opposite, the key-role that urban planning, grounding on a holistic approach to cities' development, should play in coordinating and integrating urban policies addressed to building up a Smart City.
KEYWORDS:
Smart City, Information and Communication Technologies, Urban Planning

1. TOWARDS SMART CITY

The concept of "Smart City", providing a solution for making cities more efficient and sustainable has been quite popular in the policy field in recent years. Although, since the Eighties and Nineties the scientific literature has dedicated a lot of attention to the topic of the smart city, with a particular attention to the role of ICTs and their impacts on urban planning and on the structure of urban systems. For many visionaries in this field, new technologies and the overall information society contributed to the birth of a new economic era in the history of mankind and the concept of the information society has been successfully developed over the last 30 years by a number of distinguished proponents (Bell, 1974; Castells, 1996; Martins, 1978). In those years academia, international institutions and think tanks believed in a wired, ICT-driven form of city development. In those years the focus was mainly oriented to the availability and quality of ICTs infrastructure within the urban system.

In the contemporary debate, the concept of smart cities is much more related to the role of human capital, social and relational capital using ICTs. In other words, we observe a growing attention to the role of the users and how they utilize communication infrastructures. One most cited definition of characteristic of smart city regards in fact the "utilization of networked infrastructure to improve economic and political efficiency and enable social, cultural and urban development" (Hollands, 2008). What is central to the concept of the Smart City and what makes it differ from 'sustainable cities' or 'ECO cities' is the use of Information and Communication Technologies (ICTs) in the process of creating a more sustainable city, but also the availability and quality of knowledge communication and social infrastructure.

According to the literature, it is possible to define a set of fundamental factors which make a city smart: technology (infrastructures of hardware and software), people (creativity, diversity, and education), and institution (governance and policy). Given the connection between the factors, a city is smart when investments in human/social capital and IT infrastructure fuel sustainable growth and enhance a quality of life, through participatory governance (Nam and Pardo, 2009).

With respect to this general definition, millions of euros are being invested in research, development and pioneer projects which tried to contribute to the construction of more intelligent urban areas. The European Union (EU), in particular, has devoted constant efforts to devising a strategy for achieving urban growth in a smart sense for its metropolitan city-regions.

However, after an enthusiastic first phase in which information technology and digital data were considered the solution for making cities far more efficient, some disappointments have grown around this theory. An article by Ludwig Siegele, published in the Economist in 2012, analyses this phenomenon and describes the passage from top-down and bottom-up Smart Cities projects. He explains the main difference from the first Smart City ambitious projects that built shiny new metropolis on green fields or in the desert as the famous Masdar, in Abu Dhabi, and the more democratic bottom up Smart City project developed for example in Amsterdam: a "smart-city platform" of institutions and infrastructure that helps businesses and citizens develop and test green projects. In the first top-down case the whole new cities are built from scratch and were thought holistically from the very beginning, the second case regards most European cities where the development towards a Smart City happens within several bottom up stages. Some failures of the first and the achievements of the second suggest that the smart cities of the future will not be those created from the top down, but those that have grown organically more intelligent. In other words, the essence of future smart city is based on the idea of coordinating and integrating technologies that have been still developed separately from each other but have clear synergies in their operation and need to be coupled with a bottom up approach. An essential element on more recent attitudes is to use ICT to engage the community through

diverse instruments and initiatives (Batty et al., 2012). This reinforce the concept according to which being a smart city, is not just about using less energy or being made of smart and reusable materials. It is about being able to function as an integral part of a larger system, that also regards participation, human capital, education and learning in urban development.

Starting from these considerations, this contribution tackle the subject of Smart City, starting from the review of the scientific Italian and international literature that, from the Eighties to the Nineties, has been largely focused on the ICTs and on their impacts on urban development. Then, the article focuses on the large debate on smart cities that has been developing from the beginning of 2000s and on the numerous institutional initiatives up to now implemented by the European Union for building up the Smart City. Finally, it highlights how, despite this efforts, a shared definition of the term is still missing and current approaches to the issue are still very heterogeneous, emphasizing, on the opposite, the key-role that urban planning, grounding on a holistic approach to cities' development, should play in coordinating and integrating urban policies addressed to building up a Smart City.

2. THE ROOTS OF SMART CITY

In the 1970s the informational revolution and the spread of new information technologies had so much affected the expectations of city and society evolution that the various Cassandras predicted the death of city. Starting from the 1980s and during the 1990s the full development of information technologies made many people think that the centralizing role of the city was finished and that new technologies could produce new forms of production, markets and society organization, by overcoming the limits of spatial proximity and placing industries, business districts, work places, residential districts, and so on, indiscriminately all over the world, thanks to the possibility of cancelling the distance by a simple click.

Most people stated that new technologies of communication and cyber space would have been able to replace social relationships and physical space and to build a computerized world parallel to the physical space. It was not understood that the effects of new technologies on the city would not have been real substitutes but complementary to the evolution of physical, economical and social systems; the effects of new technologies on the cities "shared one thing: they were based on the generalized and uncritical use of the metaphor according which the cities would have simply undergone the impact of new communication technologies in the same way as planets are hit by asteroids (...) the information and communication technologies were described as something issuing from the deep space, like a transforming force or a shock that would have hit the structure of urban society" (Graham 2004).

"We had been assured that Internet would have changed everything – distance would have died, economy would have lost its weight. (…) But a complementary transformation was nimbly taking place on a more structural level; the physical space was acquiring many of the crucial features of cyberspace" (Mitchell 2004).

Nowadays, those who study the relationships between cities and information technologies believe that the triggered changes have a more complex nature than a simple cause-effect relationship; electronic spaces and physical spaces, time structure and social relationships develop together through a process of "recurring interaction" (Graham 2004).

As Graham states (2004) people believed that, thanks to new information technologies, it would have been possible to get rid of the "deadweight of materiality" transferring everyday activities into the cyberspace: from social relationships to every kind of business, from decision-making processes to work meetings. Moreover, they thought that it would have been possible to abolish the distances enabling all citizens to be wherever and whenever they wanted.

At the same time, in the 1980s there were some scientists, such as Manuel Castells, Peter Hall and Philippe Aydalot, who expressed formally the theory of "milieu of innovation" meant as a specific set of relationships of production and management, based on a social organization that greatly share a culture of work and instrumental goals targeted to produce new knowledge, new processes and new products". So these scientists had already understood that the condition required for reaching this milieu was undoubtedly the spatial proximity, because of the nature of interaction in the innovative process as well as of the need for huge resources.

Indeed, information technologies require, for their correct operation, so many tools, infrastructure and resources that only on theory they can be disseminated in any place of the world. Actually they are assembled in the world capital cities of the global economy (Gargiulo, Galderisi, 1995). The big metropolitan areas, in fact, contain a great number and variety of services that cannot be found in other parts of the world. The management bodies of international corporations and research centers require broadband connections, linked directly to the faster intercontinental backbones in order to exchange a great amount of data. The direct access to those backbones is assured only in the most advanced metropolitan areas of the world such as London, New York or Tokyo.

Although, in a first phase, the concept of "milieu of innovation" had been meant for restricted territorial areas, it describes the phenomena of spatial development as outcome of innovative processes and synergies that take place in those areas. It is defined as a set of relationships that unite a local system of production, a set of actors and representations and an industrial culture and which produces a dynamic localized process of collective learning (Camagni).

As consequence of the evolution of information technologies, a new concept of city and territory has been establishing so that, if some researchers think that it has replaced the old one, other people think that it goes to overlap the previous concept enriching it with new meanings.

Castells is almost the first to state that space of places and space of flows are two forms of spatial organization. The space of places represents the physical space, where people carry out their everyday life (shopping, work, free time, study, and so on), "the material support of time-sharing social practices" (Castells 1996). The space of flows represents "the material organization of time-sharing social practices that work through flows", business transactions, information exchange, coordination activities between an international company and all the production industries linked to it, high speed travels, communications through computer. In particular, Castells considers as flows the "purposeful, repetitive, programmable sequences of exchange and interaction between physically disjointed positions held by social actors in the economic, political and symbolic structures of society".

According to Castells (1996) the space of flows consists of at least three dimensions. The first dimension is made up of the technological infrastructure that allow it to exist, such as the television and radio transmission systems and high speed transportation links that give rise to different networks, each of which is linked to the others and shape a different space of flows. Therefore, particular networks are capital markets, science and technology, art, sport.

All those networks are linked to each other by a network of relationships that requires nodes for being operative, which represent the second dimension of the space of flows. Nodes and hubs make the single elements of the network interact, addressing the transmitted information and connecting the whole system to the global economy. Rome, Florence, Venice are, thus, nodes of the global tourism network. Nodes are also the big intermodal exchangers such as airports, railway stations, harbors.

The geographic location in a defined place of the world, the quantity and quality of the connections to global networks are crucial for the survival and efficiency of the hubs.
Finally, the third dimension consists of the spatial organization of the leading élites: the way in which they live, travel and interact with each other. This spatial organization can be found , for example, in the gated communities or in the protected and isolated consumer spaces; exclusive spaces intended for that little part of world population that holds the power and is able to decide the fate of the global economy (Amendola 1997). Therefore, apart from the abatement of the "interface" relationships in the urban space, expected by some people because of the consequences of new information technologies, the definition of the space of flows denotes, instead, a new possibility of interpersonal interaction.
During an interview (Pflieger 2006) Manuel Castells stated: "I have tried to work out a theory based on the observation by integrating the forms of space organization. So I have observed that the prevailing logic, rooted in the social and economic structure, was the space of flows. But, contextually, I have observed also a cultural logic based on the supremacy of experience that endorsed, on the contrary, the relationships with the surrounding space, with the localized space. And that is what I have defined the space of places. Therefore, the space of places is not a specific place, a place in the geographical or material meaning of the word, because in the space of flows there are also places, but a space whose primordial sense is centered on the enhancement of the place".
In the same period also in Italy some researchers investigated the integration between technological innovation and urban systems, and expressed an idea that, after many years, can be still considered innovative and anticipatory thanks to the insights of Corrado Beguinot and of a large group of researchers, who jointly reasoned about wired city.
The main meaning of the research, carried out in the decade from 1985 to 1995, intended "to condemn the use, or better the over-use, of the word "intelligent". Indeed, it was chosen to replace the Intelligent City with the intelligence of the city, by referring to the expression coined in "Wired city and new architecture" (Beguinot, 1992).
The research outcomes of the these scientists have followed a route similar to that of European and U.S. scientists, who have often reached the same conclusions with more favorable feedbacks.
The word "wired city" was used in a provocative way to refer to a city that by using new technologies in the right and regular way could succeed in regaining its values, history and culture of places. The foundations of the wired city issued from a deep investigation on the complexity and dynamism of urban systems, on the dyscrasia among the physical subsystems, places subsystem and functional subsystem - namely the relationships one - and between the above-said ones and the subsystem of the real life - namely the social one (Papa 1989a). Therefore, the research aimed at founding non-consumer and no-profit solutions of new information technologies, which could have help reorganize urban activities and functions as well reshape and reuse urban spaces in the right way (Papa 1898b; Gargiulo 1989). The wired city arose from the belief that through a correct use of the outcomes of new information technologies, it was possible to improve territory organization and management and thus make urban systems management more effective (Beguinot 1987; Galderisi 1995; Gargiulo, Galderisi 1998).
In the same years David V. Gibson, George Kometsky, Raymond W. Smilor published the Technopolis Phenomenon (1992), in which the word Smart City appeared for the first time. They showed an innovative approach to economic development, which connected technology marketing to the initiatives of public and private sectors in order to realize new infrastructure for economic growth, diversification and global competitiveness. The authors pointed out that the phenomenon of Technopolis helped improve the quality of life as well as increase the range of opportunities in the global market.
Twenty years after the Information Revolution, it can be useful to make a short survey on the "magnifiche sorti e progressive" (Leopardi 1845) expected by many people. It should be said that from many points of view the result has outstripped the expectations.

It is the case of the "places" of the city that have not be replaced with virtual spaces. It is also the case of the interfacial relationships, of the social relationships that have kept their importance and have not been superseded by the computer ones. Remote work, from home or places of never-ending holiday, is a luxury that only few people can afford, for short periods and fortunately it is still necessary to meet colleagues and employees. We still enjoy travelling for thousand kilometers to appreciate a work of art or to dive in the Mediterranean sea or Indian Ocean.

Even the places intended for information technologies are tightly settled in geographic places. The dematerialization of the city, and consequently of the society, has not taken place.

On the other hand, new information technologies - maybe because they have not been used in the right way yet - have been not able to solve the organization and management problems of urban functions and activities, which often cause congestion and chaos in big cities. The ICT, still underused in the management of urban transformations, has crucially help introduce the paradigm of complexity in space and city interpretation, which has become the reference point of the most important theories on the evolution of city transformations.

From the urban planning point of view, the shape of city still persists in referring to criteria based on centrality. This fact has been caused by the failure of the possibilities of localization diffusion which, in the Eighties, some people considered feasible thanks to the massive use of communication networks.

There have been great changes in the communication and in the improvement of communication forms, since 1961 when the MIT purchased the PDP1, the computer supplied with screen and keyboard, which was secretly connected by some students to the railroad switches of their miniature trains they were keen on (the first hacking). And then in 1962 the first videogame Space war was invented, which had issued from the activity of a whole generation of software engineers.

3. SMART CITIES: CONTEMPORARY DEBATE AND EUROPEAN INITIATIVES

As largely emphasized in the previous paragraph, the main roots of the concept of Smart City have to be traced in some of the phenomena that characterized the Eighties and the Nineties, namely, in the evolution and diffusion of ICT and in their outcomes in terms of globalization of economy and markets.

The term Smart City was firstly coined at the beginning of the Nineties in order to point out an urban development more and more dependent on technology and on innovation and globalization phenomena, mainly by an economic perspective (Gibson, Kozmetsky and Smilor, 1992).

However, it is in the last decade that the term Smart City has become more and more widespread, especially in the field of urban planning. Nevertheless, definition and approaches are still very heterogeneous: during the last decade, the term has been used with so many different meanings, that the concept seems to be in danger of becoming a new (and a further) "urban label" (Hollands, 2008), a fuzzy concept, often improperly used (Nam and Pardo, 2011).

Some scholars have clearly outlined how, despite the wide literature and contributions on this topic, it is difficult to find out an appropriate and, above all, a shared definition of the term Smart City (Giffinger et al., 2007; Caragliu, Del Bo, Nijkamp, 2009). In detail, as highlighted by Giffinger et al. (2007), "the term is not used in a holistic way (…) but it is used for various aspects, which range from Smart City as an IT-district to a Smart City regarding the education (or smartness) of its inhabitants".

Since 2007, numerous scholars have tried to "bring order" among the heterogeneous definitions of the concept and to achieve a shared vision of "smart city".

Despite the difficulty to account for the multiple meanings attributed to the concept and the many different approaches that may be found in current scientific literature, the main approaches can be synthesized as follows:

- the techno-centered approach, characterized by a strong emphasis on the "hardware" and, namely, on the idea that ICT infrastructure represents the keystone for building up the Smart City (Cairney and Speaks, 2000; Washburn and Sindhu 2010);
- the human-centered approach, characterized by a strong emphasis on the human and social capital (Partridge, 2004; Berry and Glaeser, 2005);
- the integrated approach, characterized by the emphasis both on the quality of life that a Smart City have to to ensure through the integration between technological and social innovation (Kanter and Litow, 2009) and on the capacity of cities "to create the conditions of a continuous process of learning and innovation" (Campbell, 2012).

The techno-centered approach, largely widespread in the early 2000s and mainly focused on the technological aspects, provides a vision of the Smart City as a city capable of maximizing its efficiency thanks to a large and widespread use of ICT (Niger, 2012). Such a vision, which has been largely sustained by Multinational companies, leaders in the sector of ICT manufacturing, focuses on infrastructural innovation, looking at citizens as end-consumers. Even though the techno-centered approach to the Smart City is still largely widespread, the vice-president of CISCO has recently pointed out that, despite "we are crossing the threshold to put internet-based tools to work in cities (….) technological devices are merely tools that can make our life better only if they are put in the hands of users who understand and can make the most of them" (Elfrink, 2012). The human-centered approach has been largely widespread in the second half of the 2000s; according to such an approach, the social capital represents the crucial element for building up a Smart City: technologies, more and more widely available, are intended as "enabling tools", but insufficient to make "smart" an urban context, only by themselves.

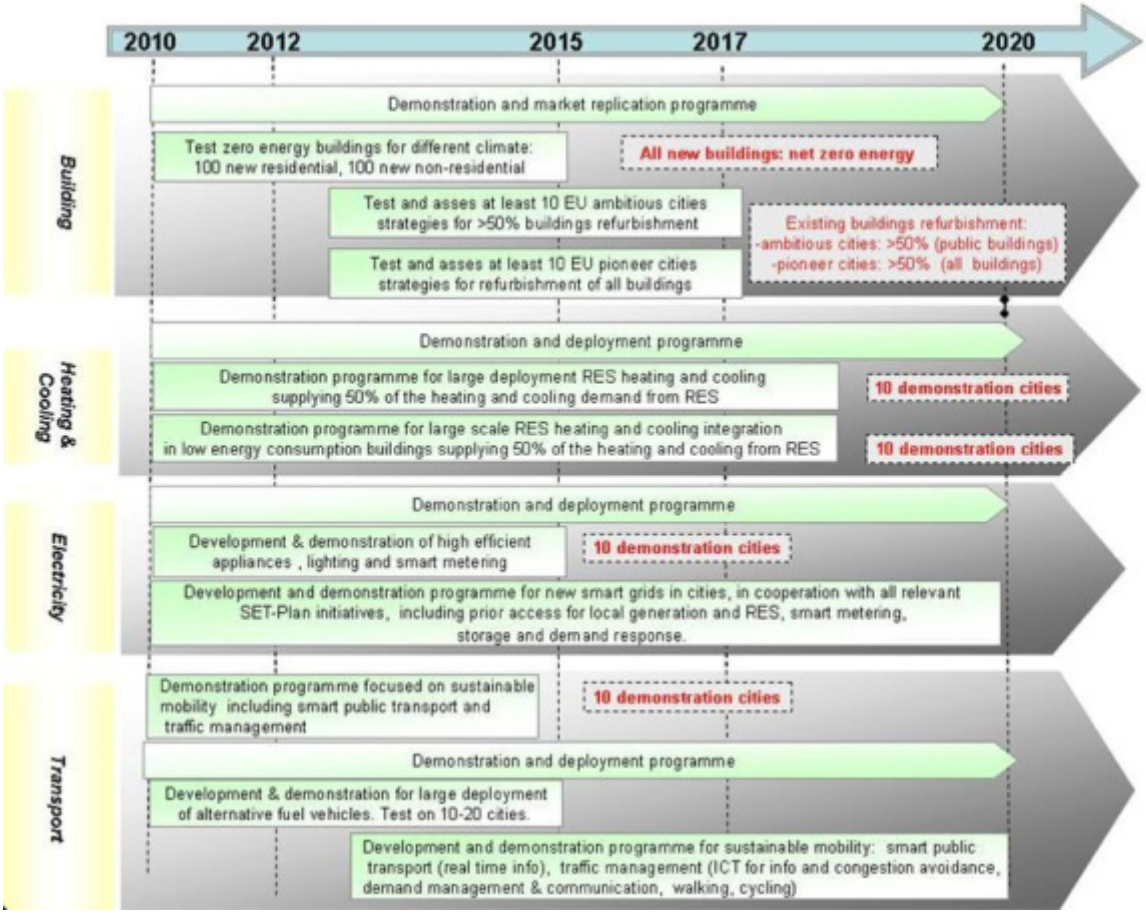

Fig. 1 - The Roadmap of the Smart Cities and Communities Initiative 2011.

The scholars who support such a vision focus, on the opposite, on human and social capital as a starting lever for a "smart" development, recognizing a direct relationship between human capital and urban development. In detail, some scholars emphasize the importance of a "creative class" (Florida, 2002; Nijkamp 2008), in terms of employees in "creative" sectors: from science to engineering, from education to research, from design to multimedia industry. Others highlight the close relationship between innovation and presence both of an entrepreneurial class capable of innovating products and processes and, in the meanwhile, of a highly skilled labor force (Berry and Glaeser, 2005; Glaeser and Berry, 2006).

The third approach - the integrated one - which is at present the most widely shared, combines the previous visions, looking at smart city as a city capable of use ICT in an extensive and intelligent way, in order to improve the overall urban performances and, above all, the quality of life of citizens.

Among the main elements that characterize the integrated approach to the Smart City, it is worth mentioning, first of all, the awareness that enhancing through ICT the performance of individual sectors (from transport to energy, from constructions to urban safety, etc..) does not necessarily result in the building up of a smart city: "a smart city should be viewed", indeed, "as an organic whole – as a network, as a linked system. In a smarter city, attention is paid to the connections and not just to the parts" (Kanter and Litow, 2009). Furthermore, the idea that a smart city represents the final goal of a virtuous path - along which investments are addressed to achieve a sustainable growth, in economic and environmental terms – aimed at improving the quality of life of citizens and based on the involvement of settled communities - is currently more and more widespread (Caragliu, Del Bo, Nijkamp, 2009).

Although the integrated approach is currently the most widespread in scientific literature, institutional initiatives aimed at building up Smart Cities at European level are still characterized by a sectorial approach.

The Europe 2020 Strategy is mainly addressed to enhance a "smart, sustainable and inclusive" growth (EC, 2010a): according to such Strategy, many initiatives have been launched by the European Commission in the last years.

Among the "flagship initiatives" of the Europe 2020 Strategy, it is worth mentioning the launch of the European Digital Agenda (EC, 2010b), aiming at favoring a more widespread and effective use of ICT as tool to enable Europe not only to stimulate employment and address the main challenges that it has to deal with but also to offer a better quality of life to its citizens. The "smart use of technology and exploitation of information will help us to address the challenges facing society like climate change and the ageing population", e to provide citizens with safer and more efficient transport solutions, cleaner environment, better health care, easier access to public services and cultural content (EC, 2010b).

In 2011, the European Union launched "The Smart Cities and Communities Initiative", with an investment of approximately € 81 million aimed at supporting projects in two areas: energy and transport. The funded projects could be focused on an individual sector or on both sectors.

The initiative, framed in the SET-Plan Smart Cities and Communities, was addressed to support European cities in achieving, by 2020, the ambitious targets established at European level: in detail, it was addressed to support projects focused on buildings, local energy networks and mobility, aiming at reducing GHG emissions and improving energy efficiency.

More recently, in July 2012, the European Commission has launched a new initiative, "The Smart Cities and Communities European Innovation Partnership", with a budget of approximately € 365 million starting from the 2013 and aimed at supporting integrated projects in the sectors of energy, transport and ICT in urban areas. The new initiative is mainly addressed to encourage firms in the three sectors to cooperate with cities, combining expertise and technology in order to meet the needs of European cities.

Fig. 2 The six dimensions of Smart Cities

The most interesting aspect is that only the projects able to integrate the three areas of concern, in other terms able to create synergies between energy, transport and ICT sectors will be funded (EC, 2012).

Hence, even though the most recent initiatives seem to mirror a transition from a techno-centered approach towards a more integrated one, shifting the focus from the hardware to the needs of cities and promoting the integration among some sectors, particularly energy, transport and ICT, European initiatives are, however, still marked by a sectoral approach to the Smart City.

Up to now, no initiatives aimed at promoting, based on an integrated approach, the different dimensions of Smart City or, better, the various sectors in which a Smart City has to ensure high performances, according to a long-term perspective. These sectors - whose identification, despite the lack of a shared definition of Smart City, is well-established in scientific literature (Komminos, 2002; Giffinger et al., 2007; Shapiro, 2008; Van Soom, 2009) – can be identified as follows:

- smart economy;
- smart people;
- smart governance;
- smart mobility;
- smart environment;
- smart living.

The difficulty to translate the integrated approach to Smart City, widely shared in recent scientific literature, from the theoretical level into practice is clearly demonstrated not only by the sectoral approach that still characterizes European initiatives but also by the results up to now achieved by cities in the different sectors mentioned above. Based on a broad set of indicators able to measure urban performances in each sector, indeed, medium size European cities (Giffinger et al., 2007) and Italian cities (Dominici et. al, 2012) have been recently ranked in order to define the level of "smartness" achieved in each sector.

The most interesting aspect arising from such a classification is that none of the European and the Italian cities is at the top of the ranking in all sectors identified as crucial for a Smart City: most of them has high values in one or in two of the mentioned sectors.

In respect to the ranking of Italian cities, for example, it is worth noting that some cities, such as Pisa and Milan, reaching the highest values on the national level in the sector of Smart Economy, have unsatisfactory positions (twenty-sixth and fifty-second) in the sector of Smart Environment. Still, Turin, ranked as first in the sector of Smart Governance and as fifth in that of Smart Mobility is placed at the sixty-second position in the sector of Smart Living.

Summing up, according to the current European initiatives and to the actions up to now implemented in European cities, the topic of Smart Cities still requires significant insights both on a theoretical level - where definitions and approaches are still heterogeneous despite the efforts to move towards an integrated vision - and, above all, on the operational level, where initiatives and policies are still very fragmented and largely sectoral.

In this sense, on the theoretical and methodological level, urban planners could currently provide significant insights for shifting current debate on how cities can become smart into a discussion on how smart devices can lead us to rethink the basic concepts through which we define and consider urban development; on the

operational level, it is worth emphasizing that urban planning, grounding on a holistic approach to cities' development, might play a key role both in coordinating and integrating urban policies addressed to enhance the different sectors of a Smart City and in supporting citizens' participation in the decision-making processes, since a smart city is, above all, a city capable to effectively meet citizens' needs.

Notes

1 Although the paper grounds on a common research work, paragraph 1 has been written by R. Papa; paragraph 2 by C. Gargiulo and paragraph 3 by A. Galderisi.

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