# TeMA

Journal of
Land Use, Mobility and Environment

The concept of "Smart City", as a solution to make cities more efficient and sustainable, has been quite popular in the policy field in recent years. In the contemporary debate, the concept of smart city is related to the utilization of networked infrastructure to improve economic and political efficiency and enable social, cultural and urban development.

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## SMART CITIES

### RESEARCHES, PROJECTS AND GOOD PRACTICES

**Vol. 6 nn. 1 - 2 - 3 aprile-dicembre 2013**

**ISSN 1970-9889**
**University of Naples Federico II**

**This book has been realized with the economic contribution of ONP Research and Competitiveness 2007-2013**

# SMART CITIES

RESEARCHES, PROJECTS AND GOOD PRACTICES

UNIONE EUROPEA
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PON Ricerca e Competitività 2007-2013

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Questo volume è stato realizzato con il contributo del PON Ricerca e Competitività 2007 – 2013. Gli autori sono i soli responsabili delle informazioni contenute nella pubblicazione.

This book has been realized with the contribution of ONP Research and Competitiveness 2007-2013. It reflects the views of the authors who are responsible for the information contained therein.

The *Project Smart Energy Master (SEM) for energy management of territory* has been co-financed by the National Operating Programme Research and Competitiveness 2007- 2013 *Smart Cities and Communities* "Integrated Action for the sustainable development - Energy Efficiency and Low Carbon Technologies". According to the latest trends of the European and National research (Horizon 2020, Hit 2020), targeted to improve the research-innovation and production cycle and to increase the Italian and European competitiveness worldwide, this Project is supported by a big partnership which includes universities, firms, research institutions and public administrations. The SEM Project, started in November 2012 and expected to be concluded in May 2015, is divided into Research and Experimental Development and Training activities. The Research and Experimental Development activities aim at working out a model of *governance* for the territorial energy efficiency, with particular reference to the management of urban areas as well as of high "humanized" buildings (schools, offices, hospitals, museums, theatres, stations). The Post-Graduate High Training Course is addressed to train expert researchers, with competences in the field of the management of urban systems and mobility, energy control and efficiency, innovative technologies. The driving force of the project SEM is the overcoming of the sector-based and low-effective approach mainly referred to the building scale in order to propose a system approach addressed to integrated policies for the management of land, mobility and energy consumption control. Within the SEM project, the TeMA*Lab* team of the University of Naples Federico II plays a twofold role, since it is engaged in the research and experimentation activities as well as in the training ones. Among those activities, the dissemination and divulgation of approaches and project's developments play a major role. The publication of this volume can be framed into these activities and represents an integration to the deliverables of the project.

Il Progetto di ricerca *Smart Energy Master (SEM) per il governo energetico del territorio* è co-finanziato dal Programma Operativo Nazionale Ricerca e Competitività 2007-2013 Smart Cities and Communities, "Azione integrata per lo Sviluppo Sostenibile - Energy Efficiency and Low Carbon Technologies". In linea con i più recenti orientamenti della ricerca europea e nazionale (Horizon 2020, Hit 2020), questo progetto si avvale di un ampio partenariato che integra università, imprese, enti di ricerca e pubbliche amministrazioni. *SEM* si concluderà nel maggio 2015 e si articola in attività di Ricerca e Sviluppo Sperimentale ed attività di Formazione. Finalità del Progetto di Ricerca e Sviluppo Sperimentale è la messa a punto di un modello di *governance* dell'efficienza energetica del territorio, con riferimento alla gestione delle aree urbane e di edifici ad elevata "umanizzazione" (scuole, uffici amministrativi, ospedali, musei, teatri, stazioni). Obiettivo del Progetto di Alta Formazione post-universitaria è la Formazione di ricercatori esperti con specifiche competenze nel campo dei processi di governo dei sistemi urbani e della mobilità, del risparmio e dell'efficienza energetica, delle tecnologie innovative per il governo dei sistemi urbani. L'idea guida del progetto SEM è il superamento dell'approccio settoriale, che caratterizza gran parte delle ricerche in campo energetico, a favore dell'adozione di un approccio di sistema indirizzato verso politiche integrate di governo del territorio, della mobilità e di riduzione dei consumi energetici. Il gruppo TeMa*Lab* dell'Università degli Studi di Napoli Federico II è partner del progetto e riveste un duplice ruolo essendo impegnato sia nelle attività di ricerca e sperimentazione che nelle attività di formazione. All'interno di tali attività grande rilevanza viene data alla disseminazione e divulgazione degli approcci e degli avanzamenti del progetto. La pubblicazione del presente volume può essere inquadrata nel contesto di tali attività.

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# TeMA

Journal of
Land Use, Mobility and Environment

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RESEARCHES, PROJECTS AND GOOD PRACTICES

Vol. 6 nn. 1 - 2 - 3 aprile-dicembre 2013

ISSN 1970-9889
University of Naples Federico II

TeMA. Journal of Land Use Mobility and Environment
Vol. 6 nn. 1 - 2 - 3 aprile-dicembre 2013

*SMART CITIES:*
RESEARCHES, PROJECTS, AND GOOD PRACTICES FOR THE CITY 1 (2013)

*SMART CITIES:*
RESEARCHES, PROJECTS, AND GOOD PRACTICES FOR BUILDINGS 2 (2013)

*SMART CITIES:*
RESEARCHES, PROJECTS, AND GOOD PRACTICES FOR INFRASTRUCTURES 3 (2013)



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**PUBLISHED BY:** University of Naples Federico II
print ISSN 1970-9889

Lycence: Cancelleria del Tribunale di Napoli, n° 6 of 29/01/2008

TeMA. Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of transport, land use and environment. Domains include engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science, and complex systems.

The Italian *National Agency for the Evaluation of Universities and Research Institutes* (ANVUR) classified TeMA as scientific journals in the Areas 08. TeMA has also received the *Sparc Europe Seal* for Open Access Journals released by *Scholarly Publishing and Academic Resources Coalition* (SPARC Europe) and the *Directory of Open Access Journals* (DOAJ).

 TeMA has been published since 2007 and is indexed in the main bibliographical databases and it is present in the catalogues of hundreds of academic and research libraries worldwide.

Printed in Naples, Officine Grafiche Francesco Giannini & Figli SpA, April 2014

Cover image by Michael Mellinger "Night Shot of Expo Bridge in Daejeon, South Korea".

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Journal of
Land Use, Mobility and Environment

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Roberto Matarazzo “Il territorio della città”, 100x70 inks, water based colours, courtesy of the author.

TeMA

Journal of
Land Use, Mobility and Environment

TeMA 1 (2013) 3-4
print ISSN 1970-9889, e-ISSN 1970-9870
DOI: 10.6092/1970-9870/1544



EDITORIAL PREFACE:

# SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR THE CITY

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The concept of the smart city has been quite fashionable in the policy arena in recent years and the question of how we can live "smartly" in a city has become the focus of policymakers and private industry. The label smart city is still quite a fuzzy concept and is used in ways that are not always consistent. However, starting from a general definition, 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. Smart cities can be identified along six main axes or dimensions: a smart economy, smart mobility, a smart environment, smart people, smart living, smart governance.

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 disappointing are growing around this theory. An article by Ludwig Siegele published in the Economist in 2012 analyses this phenomenon and describe the passage from top-down and bottom-up Smart Cities projects. He explain 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 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 becoming a Smart City happen 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. 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.

This first issue of TeMA, Journal of Land Use, Mobility and Environment, volume no.6 deals with the subject of Smart City with reference to the urban scale. Accordingly, the papers tackle the different aspects characterizing a smart urban development: ranging from the more specifically economic ones, targeted to the implementation of strategies expected to improve competitiveness of cities in the global scenario; to those more involved in environment questions aimed at identifying strategies for improving the city capability of facing the important challenges given by the ongoing climate change as well as by the ever-growing reduction of traditional energy resources, paying particular attention to the improvement of urban mobility and energy saving as well as of those connected with the quality of life of communities, with specific attention to the participation to decisions-making processes, equity in the access to resources, individual and collective safety, social cohesion. In the FOCUS section the paper by Rocco Papa, Adriana Galderisi and Carmela Gargiulo focuses on the urban planners' perspective on Smart City. The paper by Corinna Morandi, Andrea Rolando and Stefano Di Vita present the research called "The smart region between Turin and Milan. Mobile services as drivers of spatial innovation towards Expo 2015" by Politecnico of Milan and Telecom Italia. The paper by Francesca Moraci and Celestina Fazia proposes an idea of smart, secure and inclusive city. The work by Romano Fistola focus on the definition of Smart City bringing back the dynamics of development of the Smart Cities in their natural site of theoretical development. The work by Alessandra Barresi and Gabriella Pultrone present the most recent studies and trials about innovation and competitiveness. The paper by Luigi Minozzi focuses on the study case of Siracusa, presenting the "Smarter Cities Challenge program", sponsored by IBM. The LUME section includes papers on the general subject of the integration between land use, mobility and environment and in this issue proposes the study by Raffaele Pelorosso, Federica Gobattoni, Nicola Lopez, Antonio Leone with the title "Urban green and environmental processes: toward a multifunctional landscape design".

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TeMA
Journal of
Land Use, Mobility and Environment

TeMA 1 (2013) 5-17
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1536

review paper received 10 February 2013, accepted 29 March 2013

www.tema.unina.it

# 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

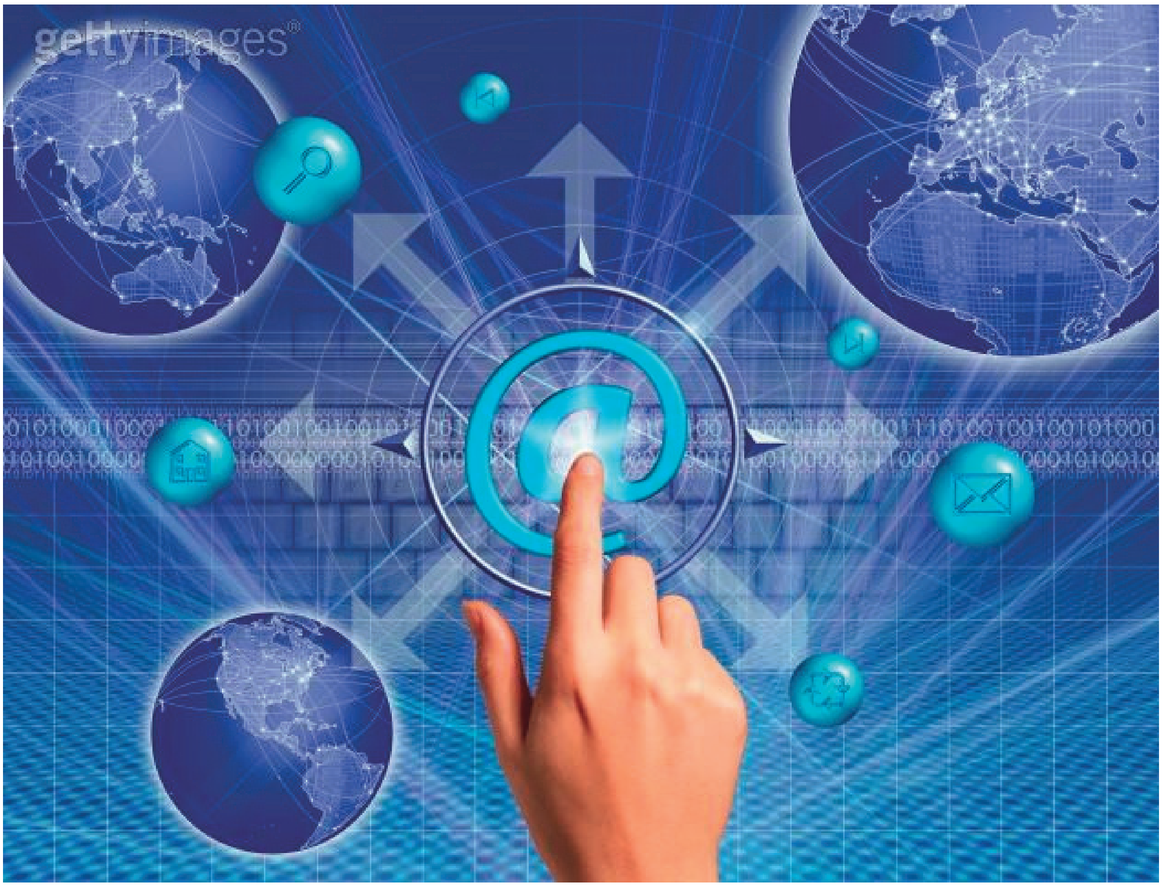
In the 1970s the informational revolution and the spread of new information technologies had so much affected the expectations of city and society evolution that the various Cassandras predicted the death of city. Starting from the 1980s and during the 1990s the full development of information technologies 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 INITIAVES

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" (Holland 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.

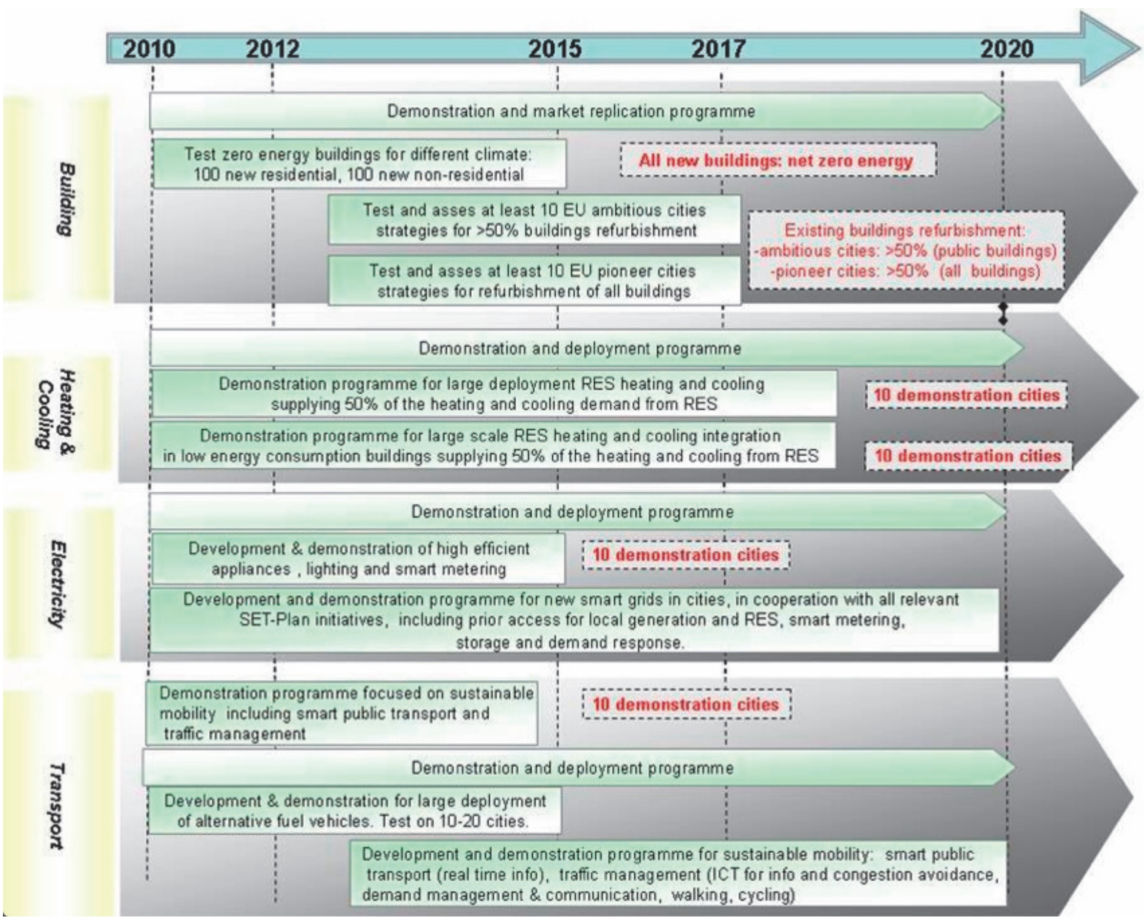



**Fig. 1: The Roadmap of the Smart Cities and Communities Initiative 2011**

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.

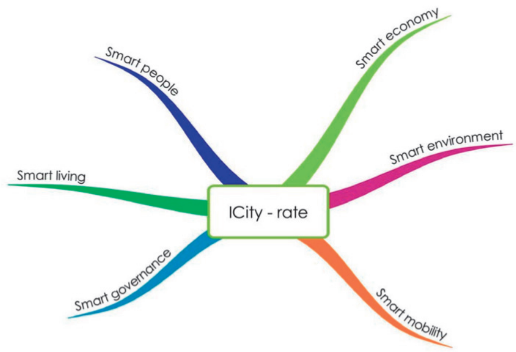



Fig. 2: The six dimensions of Smart Cities

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, the introduction has been written by R. Papa; paragraph 1 by C. Gargiulo and paragraph 2 by A. Galderisi.

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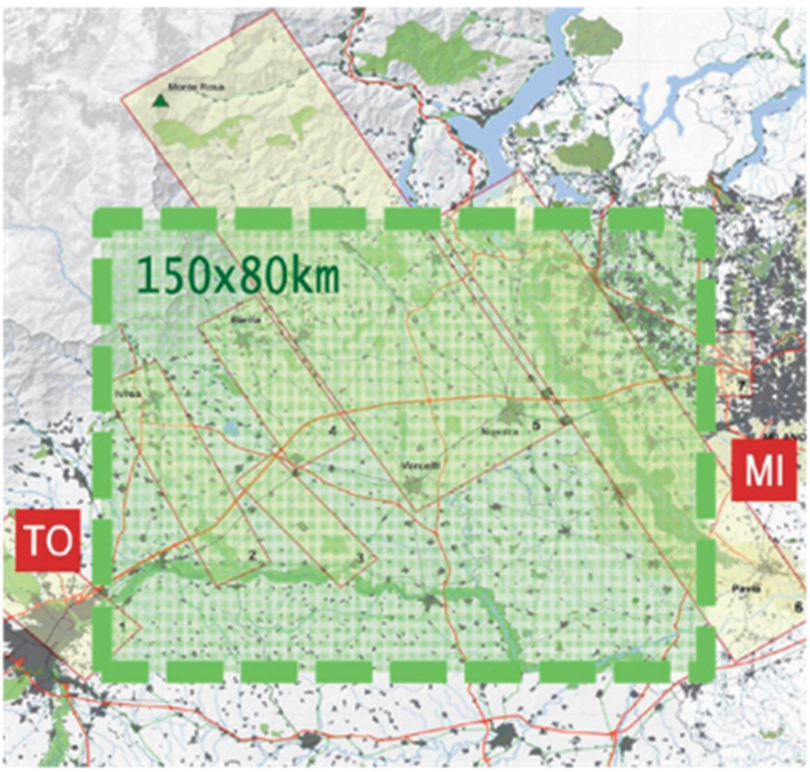
Journal of
Land Use, Mobility and Environment

TeMA 1 (2013) 19-33
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1456

review paper received 16 February 2013, accepted 08 April 2013

www.tema.unina.it




# ICT: INTERFACCE TRA PERSONE E LUOGHI

## SPERIMENTAZIONI IN CORSO PER UNA "SMART (CITY-) REGION" DEL NORD ITALIA: IL TERRITORIO TRA TORINO E MILANO VERSO L'EXPO 2015 E OLTRE

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ABSTRACT

Although the spread of the smart city paradigm has been exponential, with a consequent decrease of part of its meaning, the smart city concept still suggests a system of innovative theories and practices. In this sense, the research "The smart region between Turin and Milan. Mobile services as drivers of spatial innovation towards Expo 2015" (Politecnico di Milano-Telecom Italia) is proposed as an opportunity for exploring the use of Information and Communication Technologies (ICTs) to promote an integrated system of services at the regional scale, also in perspective of the 2015 Universal Exhibition. Considering the transformation of universities into one of the major players in the current processes of urban and regional development, the research (in progress) has chosen to focus on the physical and immaterial services provided by university campuses. The operational phase of the research was developed in the second half of 2012, with a first focus on the Città Studi area in Milan, where the Sustainable Campus project (promoted by Politecnico and Università degli Studi di Milano) is going on. The outcome of the first implementation phase of the research has been the preliminary set up of two smartphone applications and the following development for the prototype of one of them. These APPs refer to some critical issues within the campus: the sharing of spaces for free study and work and the management of the demand and supply for the students housing. The project has also allowed to test a methodology with the aim of understanding the needs and of identifying the opportunities for the development of mobile services as interfaces between people and places in the campus and its urban context.

KEYWORDS:
Information and Communication Technologies (ICT), Smart (city-)region, Expo 2015, Bottom up, Servizi mobili, Innovazione territoriale, Mapping

## 1 QUALE SIGNIFICATO TERRITORIALE PER IL TERMINE "SMART"?

Nell'ultimo decennio, il paradigma della smart city si è diffuso ampiamente nelle politiche di sviluppo urbano, anche se non ne esiste una definizione univoca e condivisa[1]. In pochi anni, il significato di questa denominazione si è rapidamente evoluto dall'idea di "città digitale", legata allo sviluppo delle infrastrutture tecnologiche (hardware), a quella di "città socialmente inclusiva", legata alla valorizzazione del capitale sociale e umano e delle pratiche di partecipazione (software), per confluire nell'idea di "città con maggiore qualità della vita" in funzione di obiettivi di sostenibilità, integrando entrambe le componenti hardware e software (The European House-Ambrosetti 2012)[2]. Il concetto di "città intelligente" si è ormai esteso ampiamente, assumendo le accezioni di città interconnessa, attrattiva, sostenibile, confortevole, inclusiva (Rosina 2011).

La crescente rilevanza esercitata dagli agglomerati urbani, legata allo sviluppo della società post-industriale e di un'economia dei servizi, ha influito sulle recenti politiche comunitarie e nazionali, che valorizzano il ruolo delle città come poli propulsori di innovazione e coesione territoriale, sollecitando programmi e progetti per lo sviluppo di città smart come occasione di coordinamento di differenti strategie settoriali: in ambito comunitario, il Piano Strategico Europeo per le Tecnologie Energetiche (2007-2013), il Programma Europa 2020, il programma quadro della ricerca Horizon 2020 (2014-2020), l'Agenda Digitale Europea; in ambito nazionale, il bando PON Ricerca e Competitività 2007-2013, l'Agenda Digitale Italiana.

Dai primi anni del Duemila, la diffusione del concetto di smart city è stata esponenziale: una definizione ormai fortemente abusata, forse eccessivamente caricata di un valore salvifico e al contempo banalizzata, riconducendola frequentemente a ricette omologanti (indifferenti alle specificità locali) e a investimenti puntuali, estranei ad una visione organica di innovazione e sviluppo urbano e territoriale. Al di là delle mode, che ne sminuiscono il significato, il concetto di smart city indica comunque un ambito di teorie e di pratiche innovative, su cui sono riversate aspettative anche per stimolare il superamento dell'attuale congiuntura negativa indotta dalla crisi economico-finanziaria in atto nei paesi a economia capitalista matura o delle criticità sociali e ambientali prodotte dallo sviluppo dei paesi emergenti.

Nella mancanza di una definizione condivisa di un concetto ampio come quello di smart city, molte sono le interpretazioni in campo e molti sono i settori rispetto a cui viene declinato: l'energia, la mobilità, l'ambiente, la qualità della vita, il welfare, la governance, l'economia.

Significativo è l'impegno recentemente assunto dal Governo Italiano nella definizione di una "via italiana" alle città intelligenti, che potrebbe fondarsi sulle specificità locali: i borghi antichi, i centri storici e il patrimonio culturale diffuso, ovvero il rapporto della cultura italiana con il suo territorio, laboratorio di sperimentazione (sia per le tecniche costruttive, sia per il settore digitale) e opportunità di innovazione, insieme ad altre potenzialità da sviluppare (l'alimentazione, anche in vista dell'Expo di Milano 2015, le attività creative, l'artigianato) e a criticità da risolvere (la pressione antropica del turismo, l'invecchiamento della popolazione e il sistema del welfare, la convivenza multi-etnica) (Granelli 2012).

La città contemporanea già si caratterizza per un'ampia diffusione dei mezzi di comunicazione: sia garantendo flussi di informazioni costanti e accessibili, che incidono sulle attività economiche e sulle pratiche sociali; sia incidendo nello spazio urbano attraverso la collocazione delle relative infrastrutture e interfacce, che spesso qualificano spazi pubblici ed edifici. La prospettiva della smart city si esprime quindi anche nei

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1 La riflessione su questo tema si è sviluppata nei primi anni del Duemila, con un contributo fondamentale offerto da IBM e Cisco: multinazionali del digitale, che hanno elaborato un'offerta di prodotti e servizi per le città, fondati su un diffuso utilizzo della tecnologia.

2 The European House-Ambrosetti (2012) "Smart Cities in Italia: un'opportunità nello spirito del Rinascimento per una nuova qualità della vita", http://www.ambrosetti.eu

termini di "media city"[3], un approccio che tende però a enfatizzare oltremodo il ruolo delle tecnologie innovative per migliorare l'efficienza della città esistente, sottovalutando le ricadute, nel lungo periodo, sulla qualità e sulla sostenibilità urbana, senza un ripensamento critico sull'evoluzione delle città, orientato ad un cambiamento degli stili di vita. La tecnologia potrebbe invece essere intesa come opportunità per sostenere l'innovazione anche sociale, dove l'approccio ecologico non rimane ancora una volta subordinato alla crescita economica (Franz 2012). Se le città, nodi nevralgici del settore del terziario avanzato, giocano un ruolo di rinnovato protagonismo per le opportunità offerte in termini di sviluppo economico e socio-culturale, testimoniato dal crescente tasso di urbanizzazione del pianeta, al contempo le aree urbane contribuiscono all'incremento delle criticità ambientali e al loro interno sono sempre più lacerate da gravi problemi sociali: squilibri, povertà, insicurezza, conflitti etnici (Rosina 2011). Se le nuove tecnologie possono offrire un contributo prezioso per affrontare queste emergenze, da sole non sono però sufficienti: l'innovazione va inserita in una visione di sviluppo che necessita di competenze multidisciplinari e di azioni che spesso travalicano le capacità degli amministratori locali in materia di digitale. Viene riconosciuta l'esigenza di un coordinamento tra differenti politiche di settore, che potrebbero trovare un'occasione di sintesi nell'ambito della piattaforma della smart city, a partire dalla necessaria realizzazione di una grande infrastruttura tecnologica e immateriale che consenta di scambiare informazioni, produrre intelligenza e inclusione e migliorare la qualità della vita (Granelli 2012).

In questo contesto, la ricerca La smart region tra Torino e Milano. I servizi mobili come driver di innovazione territoriale in vista di Expo 2015[4] si propone come occasione di sperimentazione dell'uso delle Information and Communication Technologies (ICT) per lo sviluppo, la gestione e la comunicazione di un sistema integrato di servizi alla scala della regione metropolitana tra Torino e Milano, anche nella prospettiva dell'Esposizione Universale di Milano 2015. ICT intese anche come strumento di governance per la fase post-evento: non solo per analizzare le dinamiche e incentivare la fruizione e lo sviluppo dei territori, ma anche per promuovere la partecipazione alla definizione di politiche, piani e progetti, di scala locale o di area vasta, in una sintesi di approcci top down e bottom up.

Il progetto, articolato in fasi applicative relative a diversi temi e componenti territoriali, ha assunto come scenario di riferimento lo sviluppo di un sistema di servizi mobili in grado di incentivare nuove modalità di utilizzo degli spazi e nuovi comportamenti collettivi. Parallelamente, ha riconosciuto la necessità di superare alcune delle principali criticità (in termini di costi, efficacia ed efficienza) inerenti l'eccessiva frammentazione delle tecnologie e la continua sovrapposizione di infrastrutture, proponendosi di sollecitare, nelle prossime fasi, il coordinamento e l'integrazione di più piattaforme di servizio, a partire dalla valorizzazione delle opportunità offerte dall'Expo 2015.

È condivisa infatti l'esigenza di procedere attraverso una visione sistemica e di larga scala per canalizzare le risorse, sempre più scarse (sia pubbliche, sia private), superando la dimensione episodica delle esperienze-pilota finora realizzate a livello nazionale, nell'obiettivo di stimolare un maggiore equilibrio territoriale (Franz 2012). Inoltre, il tema della smart city attiva competenze e interessi necessariamente multidisciplinari: relazioni tra le nuove tecnologie digitali e gli studi territoriali alle diverse scale (locale, urbana e regionale) per la conoscenza dei fenomeni e per lo sviluppo di progetti innovativi in termini di valorizzazione dello spazio fisico e rafforzamento delle pratiche di relazione sociale.

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3 Come si è chiaramente delineato nel Seminario Internazionale "Media city: new spaces, new aesthetics" (Triennale di Milano, 7-9 giugno 2012).

4 Ricerca sviluppata nell'ambito di una convenzione tra il Dipartimento di Architettura e Studi Urbani (ex Dipartimento di Architettura e Pianificazione) del Politecnico di Milano (coordinatori: proff. Andrea Rolando e Corinna Morandi; gruppo di ricerca: Stefano Di Vita, Giorgio Limonta, Tijana Djordjevic, Abel Lizcano Silva) e Telecom Italia (referenti: ingg. Maura Turolla e Andrea Bragagnini).

L'evoluzione del sistema economico e sociale, le recenti dinamiche territoriali e lo sviluppo della tecnologia hanno imposto nel corso degli ultimi decenni un allargamento del concetto di servizi per la collettività, che nella città contemporanea si articola in forme differenti, integrando i servizi materiali con i servizi immateriali (slegati dalla fisicità dei luoghi), i servizi fissi con i servizi mobili (erogati attraverso il sistema delle telecomunicazioni). Lo studio si sofferma in particolare sulla tipologia dei servizi mobili, che tendono a scardinare le tradizionali relazioni tra servizio e utente, abbinando il flusso delle informazioni allo spostamento degli utenti stessi, favorendo l'immediata accessibilità e condivisione delle informazioni e l'utilizzo flessibile di un territorio sempre più smart.

## 2 LA DECLINAZIONE REGIONALE DEL CONCETTO DI SMART CITY: VERSO UNA "SMART (CITY-)REGION"?

La ricerca va ricondotta ad un più ampio filone di studi sul tema dell'evoluzione della geografia dei territori metropolitani, che affrontano i temi della competitività e della sostenibilità urbana e regionale, esito possibile dei rilevanti programmi di trasformazione di infrastrutture, grandi funzioni e servizi. Il progetto si inquadra nell'ambito delle attività sviluppate da quasi un decennio da un gruppo di lavoro coordinato da Corinna Morandi e Andrea Rolando presso il Politecnico di Milano, nell'ambito di una ricerca più complessiva che riguarda la configurazione territoriale della regione metropolitana compresa tra Torino e Milano[5], in cui il recente completamento del fascio infrastrutturale (autostrada e linea ferroviaria ad alta velocità) sta producendo rilevanti cambiamenti in tutto il sistema territoriale compreso tra i nodi principali (che sono agganciati alle cosiddette reti lunghe e veloci) e i luoghi e i paesaggi intermedi (che si pongono invece in relazione alle reti corte e più lente). Particolare attenzione viene prestata ai territori "di mezzo", che rischiano di essere interessati da processi di segregazione o comunque di non essere coinvolti da programmi di valorizzazione di diversa natura (ambientale, socio-economica, produttiva, turistica) supportati dagli interventi di infrastrutturazione recentemente realizzati o programmati. Territori che potrebbero però diventare teatro privilegiato dell'Expo 2015, tenendo conto delle loro caratteristiche economiche e paesaggistiche peculiari rispetto ai temi della manifestazione ("feeding the planet, energy for life"), che li rendono complementari rispetto al sito che ospiterà l'evento nei pressi del polo fieristico di Fieramilano a Rho-Pero, in funzione sia di attività di loisir, sia di attività produttive legate all'agricoltura.

Il tema si è sedimentato e consolidato nel tempo nell'ambito di differenti esperienze di ricerca e di didattica avanzata, anche attraverso i progetti multidisciplinari sviluppati a partire dal I ciclo dell'Alta Scuola Politecnica (ASP)[6], che hanno iniziato ad esplorare la questione di fondo della ricerca, cioè l'utilizzo di tecnologie innovative per l'ottimizzazione dell'accesso ai servizi come driver per la valorizzazione sociale ed economica del territorio, a partire dalle nuove relazioni che vanno formandosi tra persone e luoghi.

I progetti hanno sempre assunto come ambito di applicazione il territorio metropolitano tra Torino e Milano e sono stati orientati a:

- migliorare l'accessibilità dei luoghi attraverso un approccio multiscalare, considerando le potenzialità di valorizzazione delle aree di servizio autostradali e delle stazioni minori come opportunità di integrazione tra le reti infrastrutturali (reti lunghe e veloci) e il paesaggio locale (reti corte e lente);

[5] In particolare, va indicata la ricerca "*Torino Milano. Prospettive territoriali per una cooperazione competitiva*" coordinata da Alessandro De Magistris, Matteo Goldstein Bolocan e Andrea Rolando.

[6] ASP è promossa dai Politecnici di Milano e Torino e sostiene progetti multidisciplinari realizzati da team di studenti e tutor accademici ed esterni delle aree dell'ingegneria, dell'architettura e del design. I progetti multidisciplinari a cui facciamo riferimento sono CoMpI-TO (ASP, I ciclo), EXPOint (ASP, III ciclo), EXPhOst (ASP, V ciclo), E-Scape (ASP, VII ciclo) ed EXPeerIA (ASP, IX ciclo). Fonte: sito internet *www.asp-poli.it*.

- valorizzare le relazioni tra lo spazio fisico (hardware) e i fruitori attraverso la sperimentazione di soluzioni tecnologiche (ad esempio, tag NFC) che consentano di migliorare l'accessibilità dei luoghi (software);
- sviluppare un sistema di sensori che favorisca l'ascolto delle informazioni provenienti dal territorio, con potenziali ricadute dal punto di vista gestionale, produttivo e turistico-fruitivo;
- rilevare le tracce degli utenti che si muovono nello spazio e il loro possibile utilizzo in termini progettuali di riqualificazione territoriale (mapping).

Il territorio tra Torino e Milano si inserisce in un contesto macro-regionale più ampio, identificato come "mega-city region" (Balducci 2005) o "global city-region" (Perulli, Pichierri 2010) del Nord Italia: un sistema metropolitano policentrico, dai confini difficilmente riconoscibili, che comprende interamente l'area della Pianura Padana e che è formato da una rete di città di diversa dimensione e importanza, collegate tra loro da un articolato sistema infrastrutturale, ponendosi in diretta relazione con le principali città-regione mondiali.

La riflessione su questo contesto territoriale richiama all'attenzione le numerose descrizioni del fenomeno urbano contemporaneo, a partire da quella di "megalopolis" (Gottman 1961). Tra queste definizioni, le più recenti sono appunto quelle di "global city-region" (Scott 2001), che assume il punto di vista della geografia economica e politica, e di "mega-city region" (Hall 2006), che assume invece il punto di vista della geografia urbana e regionale[7].

Il riferimento della ricerca alla direttrice Torino-Milano è fondato sul riconoscimento della sua singolarità, riconducibile ad un sistema di relazioni già attive difficilmente individuabili lungo le altre direttrici della city-region del Nord Italia[8]: la nuova infrastruttura ferroviaria ad alta velocità, completamente in esercizio; la stagione dei grandi eventi dei due poli urbani principali (le Olimpiadi Invernali 2006, il 150° anniversario dell'Unità d'Italia 2011, l'Expo 2015); una serie di rapporti già avviati, quali l'Alta Scuola Politecnica (ASP), la joint venture tra le Camere di Commercio torinese e milanese, il Festival MiTo Settembre Musica.

La struttura portante del territorio tra Torino e Milano è formata da un sistema di nodi e reti, osservabile nelle sue componenti tramite un approccio multiscalare, che si sovrappongono ai tradizionali confini amministrativi, di cui tende a ridursi il significato, configurandosi come "collanti" di una regione metropolitana dotata di un elevato valore paesaggistico, dove emergono:

- i poli urbani principali e quelli minori, fortemente integrati alla struttura storica delle vie di comunicazione e del paesaggio agricolo;
- le grandi polarità commerciali e delle attrezzature per il tempo libero;
- i siti attrezzati per le attività della logistica;
- le reti ecologiche e le connessioni naturali (fiumi, montagne);

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7 La definizione di "*global city-region*" si riferisce a processi di concentrazione economica e sociale, che si sviluppano in contesti territoriali fittamente urbanizzati o caratterizzati da una tendenza alla polarizzazione spaziale: piattaforme territoriali dell'economia e della società post-industriale, che mettono in relazione i sistemi nazionali di appartenenza con il sistema economico globale (Scott 2001). La definizione di "*mega-city region*" si riferisce invece a vaste aree urbanizzate policentriche, formate da più città, fisicamente separate, ma funzionalmente interconnesse, che si concentrano attorno ad una o più città principali, formando regioni urbane economicamente molto forti, connesse da reti infrastrutturali percorse da flussi di persone, merci e informazioni (Hall 2006).

8 Fasci infrastrutturali che innervano la macro-regione, oltrepassando i confini della Lombardia, definendo una struttura territoriale originariamente radio centrica (soltanto parzialmente negata da una struttura reticolare che si è recentemente sovrapposta). Ad esempio, le direttrici Milano-Varese-Lugano, Milano-Varese-Laveno, Milano-Como-Chiasso, Milano-Monza-Lecco-Sondrio, Milano-Trezzo sull'Adda-Bergamo, Milano-Brescia-Venezia, Milano-Lodi-Piacenza, Milano-Cremona-Mantova, Milano-Pavia-Tortona-Genova, Milano-Vigevano-Mortara, Milano-Magenta-Novara-Torino. Fonte: Battisti E., Battisti F., Di Vita S., Guerritore C. (2011) "Expo Diffusa e Sostenibile", Unicopli, Milano.

- le infrastrutture (le reti lunghe e veloci dei corridoi europei V e XXIV, in parte già realizzati, e le reti corte e lente dei canali, delle strade provinciali e locali e delle ferrovie regionali, di origine storica, che negli ultimi decenni sono però state penalizzate da altre scelte di sviluppo);
- le nuove configurazioni territoriali legate alle reti della conoscenza e ai flussi delle informazioni.

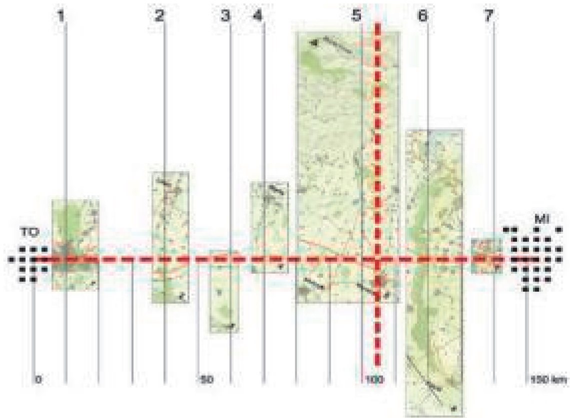


**Fig. 2: Il Canale Cavour nella regione metropolitana "tra" Torino e Milano**

**Fig. 3: I Corridoi Europei V e XXIV che attraversano la regione metropolitana tra Torino e Milano, intersecandosi nei pressi di Novara**

Il programma Smart cities and communities lanciato dall'Unione Europea nel 2011 ha stimolato numerose candidature anche in Italia, tra cui emergono quelle delle città di Bari, Catania, Genova, Milano, Palermo e Torino, oltre all'intera regione Sardegna. L'esistenza della regione metropolitana delineata tra Torino e Milano suggerisce di sviluppare la riflessione sulle potenzialità di un approccio al tema smart (interpretato in relazione sia all'innovazione tecnologica, sia all'integrazione sociale) che possa consentire di superare i localismi e di aumentare l'efficacia delle singole proposte. L'utilizzo delle nuove tecnologie di informazione e comunicazione viene quindi assunto nella nostra prospettiva di ricerca come fattore in grado di superare l'idea di smart city verso un più ampio concetto di "smart region". L'intento è quello di promuovere nuovi servizi che, sfruttando le opportunità offerte dalle ICT, producano effetti positivi non solamente sui principali poli urbani, ma soprattutto sui territori peri-urbani e infra-urbani, che possono trasformare la loro condizione marginale per diventare sempre più complementari e integrati ai nodi più forti.

Milano, polo urbano principale della macro-regione del Nord Italia, sconta una certa arretratezza in termini di dispiegamento e capitalizzazione dell'infrastruttura digitale rispetto alle città europee, che penalizza imprese e cittadini. Uno sviluppo della city-region, che da Milano si estende a tutta l'area padana, si intreccia quindi con una strategia di smart city estesa alla scala vasta, rispetto a cui è necessaria la convergenza di istituzioni territoriali (locali, regionali, nazionali e comunitarie), istituzioni funzionali, imprese e cittadini, nonché lo sviluppo di una forma di governance che consenta di integrare l'approccio top down con un approccio bottom up (Bassetti 2012). Una strategia che si potrebbe quindi declinare nella definizione di "smart city-region" o, più semplicemente, di "smart region".

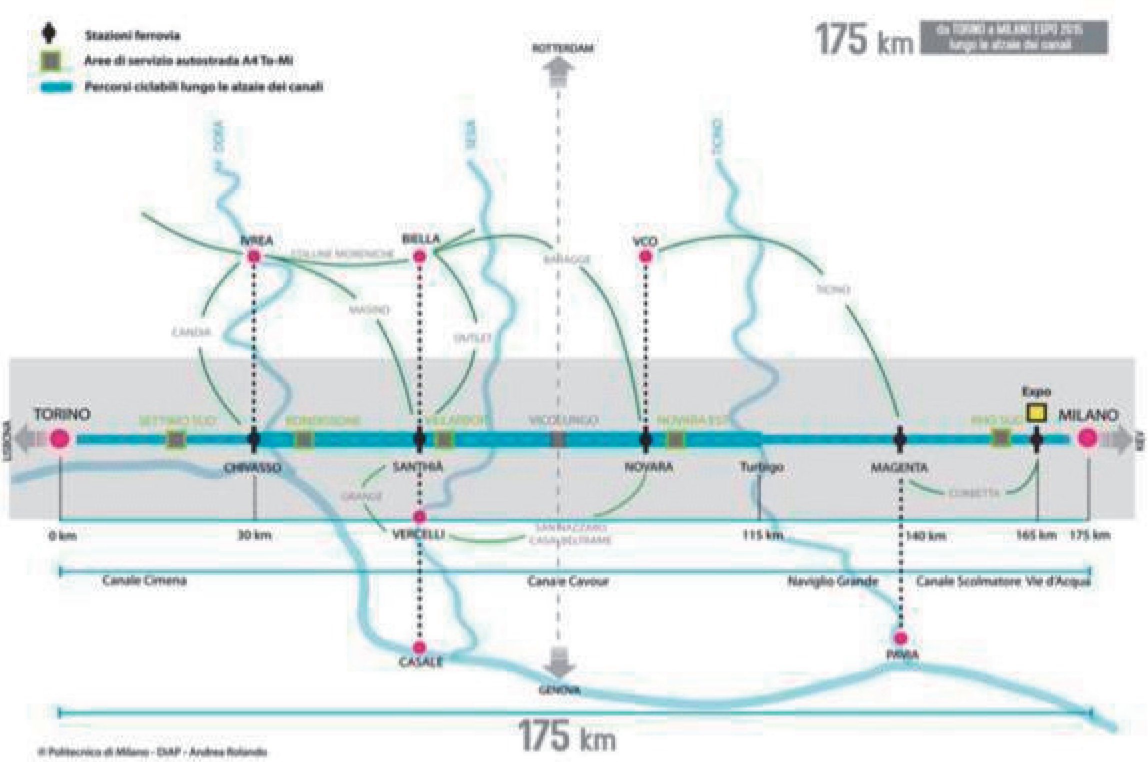


Fig. 4: I territori intermedi della regione metropolitana tra Torino e Milano: le interfacce tra reti lunghe e reti corte

## 3 LE INCOGNITE E LE PROSPETTIVE DELL'EXPO 2015 PER LA CITY-REGION DEL NORD ITALIA

Dal 2008, l'area milanese e, indirettamente, la città-regione del Nord Italia, sono coinvolti nel processo di programmazione e poi di realizzazione dell'Esposizione Universale del 2015: una manifestazione la cui organizzazione è stata però finora penalizzata dalla crisi economico-finanziaria, oltreché da numerose difficoltà locali di gestione (ad esempio, nel raggiungimento degli accordi politici necessari alla formazione della società Expo 2015 Spa e alla individuazione di una soluzione per la proprietà delle aree destinate alla realizzazione dell'evento), ma in cui allo stesso tempo continuano ad essere riconosciute numerose potenzialità, anche per superare l'attuale congiuntura negativa.

Nonostante il tema dell'Expo, legato all'alimentazione e alla nutrizione, sia eticamente rilevante e potenzialmente innovativo, l'evento è stato ancora una volta concepito come una tradizionale manifestazione espositiva, fondata sulla realizzazione di un apposito quartiere (1 milione mq circa) nei pressi del polo fieristico esterno di Fieramilano, che sarà (forse) integrato al territorio: sia attraverso il progetto della Via d'Acqua, orientato allo sviluppo del sistema della mobilità dolce e alla riqualificazione territoriale del margine occidentale dell'area metropolitana milanese, sia tramite opere infrastrutturali[9], mirate al miglioramento dell'accessibilità alla città di Milano e al sito Expo, confermando però un'impostazione fortemente "milanocentrica" della manifestazione.

9 La linea M5 e la prima tratta della linea M4 della metropolitana milanese (a scala urbana) e le autostrade BREBEMI, Pedemontana e TEEM (a scala regionale), oltre al potenziamento della viabilità locale nei pressi del quartiere espositivo e alla realizzazione di un sistema di parcheggi, remoti e di prossimità.

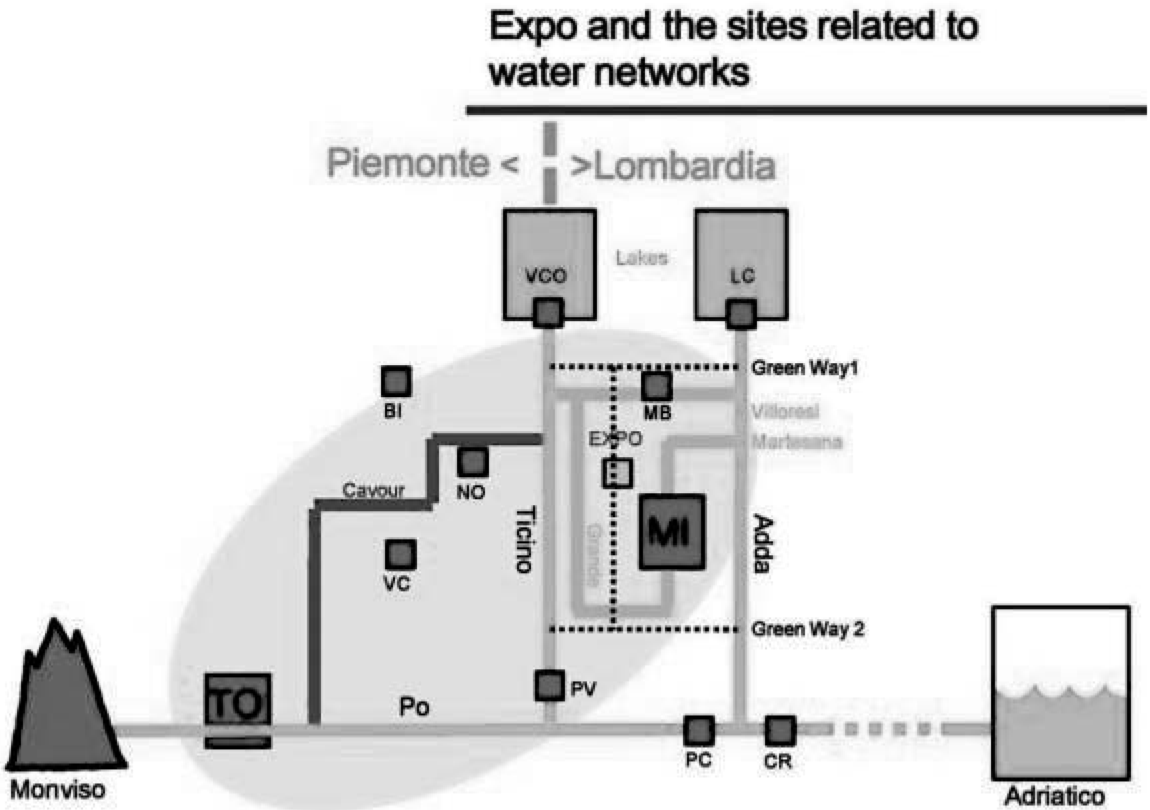


**Fig. 5: Il reticolo idrografico della regione metropolitana "tra" Torino e Milano e le relazioni con il sito Expo 2015 e i poli urbani principali**

La visione di sviluppo territoriale, che avrebbe dovuto accompagnare la manifestazione nella prospettiva del post-evento, stenta ad imporsi:

– l'Expo è nata esternamente ai tradizionali strumenti di pianificazione territoriale (il PGT del Comune di Milano, il PTCP della Provincia di Milano, il PTR della Regione Lombardia), peraltro ancora legati ad una suddivisione amministrativa del territorio non più corrispondente ai fenomeni di "metropolizzazione" in atto in tutto il Nord Italia;
– l'Accordo Quadro di Sviluppo Territoriale (AQST) "Expo 2015" promosso dalla Regione Lombardia con l'obiettivo di estendere l'evento alla scala vasta tramite un sistema di opere complementari (benché nell'ambito del solo territorio regionale e attivato secondo un tradizionale approccio top down) non è mai stato portato a termine;
– i numerosi Protocolli di Intesa, che la società Expo 2015 Spa ha stipulato con molte città e province lombarde e delle regioni confinanti, appaiono infine eccessivamente frammentati e dispersivi in termini di capacità di programmazione (Di Vita S. 2011).

Nonostante le criticità richiamate, vengono però ancora rilevate le opportunità dell'Esposizione Universale di Milano di attivare un processo di rigenerazione territoriale diffusa nel tempo (oltre il 2015) e nello spazio (al di là del nuovo quartiere espositivo), che potrebbero essere offerte da:

– una valorizzazione delle risorse locali (patrimonio storico-culturale, paesistico-ambientale, socio-economico) e una messa a sistema delle numerose iniziative bottom up recentemente nate in relazione ai temi della manifestazione[10];

[10] In particolare, si fa riferimento agli esiti della ricerca *Expo Diffusa e Sostenibile* del Politecnico di Milano, (responsabile scientifico: Emilio Battisti; gruppo di ricerca: Francesca Battisti, Stefano Di Vita, Camilla Guerritore).

– uno sviluppo del sistema dei servizi (materiali e immateriali) non solo alla scala della città o dell'area metropolitana di Milano ma, con geometrie variabili, ad una scala più ampia, nell'ambito della città-regione del Nord Italia.

Possibili strumenti di integrazione di Expo e del relativo sito espositivo (il cui progetto è stato recentemente ri-declinato secondo il tema della smart city) in uno scenario di sviluppo territoriale di scala vasta potrebbero quindi anche passare attraverso le numerose e innovative esperienze in atto nell'ambito del sistema delle ICT, che contribuiscono alla valorizzazione delle relazioni tra i luoghi fisici e l'esperienza delle persone che si muovono nello spazio.

## 4 UN'OCCASIONE DI SPERIMENTAZIONE: I CAMPUS UNIVERSITARI COME POLI DI INNOVAZIONE TERRITORIALE NELLA REGIONE METROPOLITANA TRA TORINO E MILANO IN VISTA DI EXPO 2015

L'approfondimento nell'ambito della ricerca sul tema dell'innovazione dei servizi per gli utenti delle università muove dalla consapevolezza dell'attuale fase di trasformazione di questa istituzione funzionale, che si lega al grande mutamento in corso nel sistema dell'informazione e della conoscenza: un cambiamento collegato alla diffusione di massa delle informazioni digitali su scala planetaria, che ha subito un'accelerazione esponenziale a partire dai primi anni del XXI secolo.

Dalle macchine per la produzione fisica della rivoluzione industriale, alle macchine per il lavoro intellettuale della rivoluzione digitale, con la conseguente trasformazione delle università da luogo di esclusivo sviluppo della conoscenza ad attore fondamentale dei processi di sviluppo economico e territoriale dell'economia e della società contemporanea (Martinotti 2010).

Riprendendo il concetto di "glocalizzazione" espresso da Roland Robertson (Robertson 1992), che pone in relazione il processo di globalizzazione con nuove modalità di valorizzazione del locale, e considerando il territorio urbanizzato del Nord Italia come un'unica city-region, le università possono essere identificate come uno degli spazi di incontro privilegiati tra scala locale e scala globale e quindi come una risorsa fondamentale per lo sviluppo territoriale (Bassetti 2010).

Questa condizione emerge già chiaramente nel sistema territoriale metropolitano tra Torino e Milano, dove l'Alta Scuola Politecnica rappresenta uno dei fattori di integrazione tra i due poli universitari principali, mentre il sistema policentrico dell'Università del Piemonte Orientale (insieme ai poli decentrati di altri atenei piemontesi) è una delle risorse strategiche per lo sviluppo dei territori intermedi (Emanuel 2011).

Le università offrono un'elevata concentrazione di servizi fisici e immateriali. L'efficienza e la capacità attrattiva di un campus universitario è determinata dalla quantità e dalla qualità dei servizi erogati, che possono essere valorizzati sia tramite un'attività di infrastrutturazione (hardware), sia tramite il miglioramento delle modalità di loro fruizione e gestione (software), anche tramite l'ottimizzazione e lo sviluppo delle ICT. Data la carenza di risorse disponibili per la realizzazione di costose opere pubbliche, amplificata dalla crisi economico-finanziaria, diventa dunque fondamentale la dimensione fruitivo-gestionale, verso cui si è orientata la ricerca. Una scelta sostenuta anche tramite una ricognizione di casi di studio che vedono lo sviluppo del sistema dei servizi mobili e in generale delle tecnologie digitali di prossimità come interfaccia tra persone e luoghi[11]. L'indagine ha consentito di individuare alcuni ambiti di sviluppo ancora poco coperti per il sistema dei servizi mobili, tra cui è emerso quello legato ai servizi per gli utenti dei

[11] Questa rassegna, orientata al tema del rapporto tra gli utenti e la conoscenza del territorio, è stata fondamentale per lo sviluppo della ricerca, anche se è stata condotta senza la pretesa di essere esaustiva a causa della crescita esponenziale, attualmente in corso, del settore delle ICT e della loro applicazione ai territori.

campus universitari[12] rispetto ad altri più trattati, come quelli della mobilità urbana, del tracciamento di persone e oggetti o dell'erogazione di informazioni per le attività legate al tempo libero.

I campus universitari della regione metropolitana tra Torino e Milano potrebbero offrire un utile supporto, attraverso lo sviluppo di un sistema coordinato e integrato di servizi materiali e immateriali, all'innovazione tecnologica del territorio e alla diffusione spazio-temporale dell'Expo, promuovendo attività culturali, ricreative, ricettive. L'Expo potrebbe in questo modo diventare un'opportunità di valorizzazione delle risorse locali (i campus) e di riqualificazione dei servizi e delle eccellenze (le università), non soltanto in funzione dell'evento, ma anche del post-evento, offrendo una reale e formativa occasione di incontro tra visitatori e società locale.

Per il territorio metropolitano tra Torino e Milano, strutturato e attraversato da un sistema sempre più articolato di reti, l'Esposizione Universale del 2015 potrebbe costituire l'opportunità per il rafforzamento di una "rete di saperi", i cui nodi sono rappresentati dai poli universitari: la valorizzazione e il coordinamento dei servizi materiali e immateriali erogati dalle università potrebbero contribuire ad aumentare il livello di sostenibilità e competitività territoriale.

A Milano le università svolgono una funzione rilevante nella formazione del capitale umano, nel trasferimento tecnologico e nel processo di internazionalizzazione su cui si fondano il sistema sociale ed economico locale. Un fenomeno che va peraltro letto alla scala vasta, visto il decentramento regionale degli atenei e data la dimensione e la complessità ormai assunta dalla regione urbana milanese, che si estende nel territorio di tre regioni italiane (Lombardia, Emilia Romagna e Piemonte) e che sconfina nel Canton Ticino, in Svizzera (Balducci, Cognetti, Fedeli 2010).

Il peso delle università nello sviluppo della società della conoscenza emerge anche nel caso di Torino, a partire dalla rilevanza del sistema universitario locale nel processo di trasformazione socio-economica e spaziale post-industriale della città; nonché, nei territori intermedi, a partire dal ruolo rivestito dall'Università del Piemonte Orientale nel processo di rinnovamento urbano della città di Novara e da quello attribuito al decentramento degli atenei piemontesi nei poli urbani minori.

La ricerca, che approfondisce il tema dell'innovazione dei servizi per gli utenti delle università, si articola tra una prima fase di sperimentazione presso il campus universitario di Città Studi nel capoluogo lombardo e una successiva estensione ad altri campus lungo la direttrice Torino-Milano. L'obiettivo è verificare le potenzialità dell'utilizzo dei servizi mobili per il miglioramento del livello di prestazione di alcune strutture, in funzione sia di utenti tradizionali, sia di fruitori non convenzionali, nell'ambito di diversi atenei presenti sul territorio, che si caratterizzano per differenti strategie di distribuzione spaziale:

- il sistema multipolare reticolare del Politecnico di Milano e dell'Università del Piemonte Orientale;
- il sistema multipolare radiale del Politecnico di Torino.

La prospettiva, una volta sperimentata la struttura e la metodologia della ricerca sul campus milanese, è quella dell'applicazione ad altri campus tra Torino e Milano: il Campus satellite Mirafiori del Politecnico di Torino (che è integrato al sito del principale stabilimento urbano di FIAT ed è parte di un progetto di riorganizzazione urbanistica dell'intero complesso e delle aree circostanti) e quello dell'Università del Piemonte Orientale a Novara, diffuso nel centro storico.

[12] Un esempio significativo è rappresentato da "*Campus Guiden*", APP per *smartphone iPhone e Android*, ancora in sperimentazione, che consente la ricerca di luoghi di interesse all'interno del campus universitario di Gloshaugen a Trondheim (Norvegia). L'APP, che consente di trovare aule, auditorium, sale studio, servizi igienici, utilizza la rete WI-FI negli spazi interni, mentre si appoggia alla rete GPS all'esterno. Fonte: http://www.campusguiden.no.

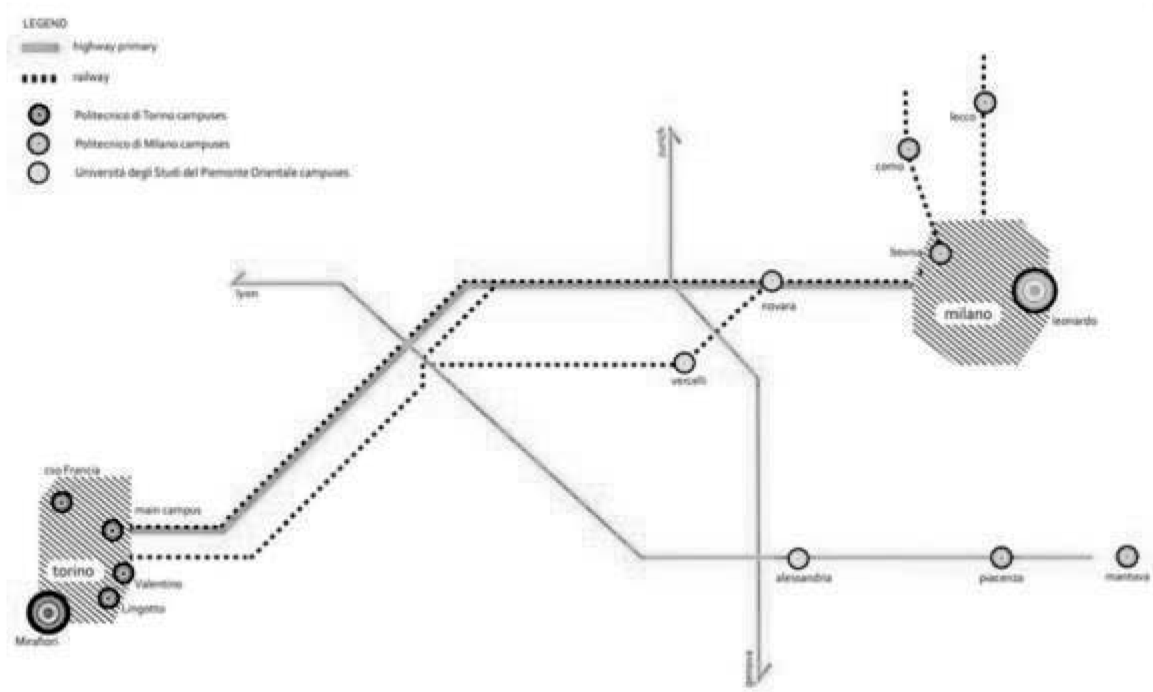


**Fig. 6: I campus universitari di Politecnico di Milano, Politecnico di Torino e Università del Piemonte Orientale nella regione metropolitana "tra" Torino e Milano**

## 5 PRIMI ESITI DI UNA SPERIMENTAZIONE SUL CAMPUS DI CITTÀ STUDI A MILANO

La prima parte applicativa della ricerca è stata sviluppata nel secondo semestre del 2012 con il focus sull'area di Città Studi a Milano. Alcune motivazioni hanno supportato questa decisione:

- l'opportunità di operare in un ambito spaziale circoscritto noto per poter valorizzare la prima attività di sperimentazione attraverso l'ottimizzazione di conoscenze di base già disponibili e di relazioni consolidate con gli utenti nella prospettiva di un processo bottom up;
- l'esistenza del progetto Campus Sostenibile promosso da Politecnico e Università degli Studi di Milano, che costituisce un contenitore di azioni mirate intorno alle quali c'è attenzione e sensibilità da parte dei principali attori coinvolti (rettori, municipalità, docenti e studenti, zona di decentramento);
- la realizzazione di un sito come parte fondante del progetto Campus Sostenibile, che costituisce una piattaforma web interattiva tra diversi soggetti coinvolti e coinvolgibili nella ricerca.

L'obiettivo di Campus Sostenibile è la trasformazione del quartiere universitario di Città Studi in una settore della città esemplare per la qualità della vita e la sostenibilità ambientale. Il progetto fa leva sulla partecipazione attiva sia di studenti, ricercatori e personale tecnico-amministrativo, sia di abitanti del quartiere, che possono segnalare le loro idee e contribuire allo sviluppo dei cinque tavoli di lavoro appositamente istituiti in funzione di specifiche questioni legate al tema della sostenibilità: il Tavolo City, il Tavolo Accessibility, il Tavolo Environment, il Tavolo Energy e il Tavolo People.

Quest'ultimo tavolo si occupa di partecipazione attiva di tutti gli utenti del campus, con particolare attenzione a utenti con forme di disabilità; di creazione di spazi collettivi vivibili e confortevoli; di sviluppo della piattaforma web dedicata e di miglioramento dell'accessibilità ai servizi web del campus; di realizzazione di nuovi servizi accessibili sia alla comunità del campus, sia ai residenti del quartiere[13].

Rispetto a questi temi, la parte applicativa della ricerca può rappresentare un utile ambito di sperimentazione e di messa a punto di un metodo di lavoro, assumendo come ulteriore e concreto scenario di riferimento la

[13] Fonte: sito internet www.campus-sostenibile.polimi.it.

parte del progetto Campus Sostenibile promossa nell'ambito del Tavolo People: sia mirando a valorizzare il ruolo urbano del complesso universitario di Città Studi, sia migliorando la disponibilità, l'accessibilità e la flessibilità di spazi e servizi rivolti agli utenti tradizionali del campus (studenti, docenti e personale tecnico-amministrativo), sia ampliando il loro utilizzo agli abitanti dei quartieri circostanti e ad altri city user.

In questo contesto, il concetto di "smart" si è declinato nello sviluppo di uno specifico sistema tecnologico nel campo dei servizi mobili unitamente ad azioni mirate a promuovere un comportamento consapevole e virtuoso da parte degli utenti, teso all'ottimizzazione dell'utilizzo di spazi e servizi disponibili.

I presupposti della ricerca sono l'approccio bottom up per la definizione delle caratteristiche e dei requisiti dei servizi e il continuo riferimento, per le operazioni di localizzazione dei servizi stessi e per l'analisi dei comportamenti degli utenti, ad un supporto spaziale riconoscibile e delimitato (mappatura):

- realizzazione di focus group e l'interlocuzione con gli utenti per la costruzione delle funzionalità delle applicazioni;
- somministrazione di un questionario online agli studenti per l'affinamento delle funzionalità delle applicazioni;
- svolgimento dell'attività di tracking attraverso il tracciamento passivo degli spostamenti non intenzionali degli utenti nello spazio (mappatura dei flussi) per l'individuazione dei principali luoghi di interesse, dentro il campus e nel contesto urbano circostante, su cui testare il progetto delle applicazioni.

La prima fase applicativa della ricerca ha avuto come esito l'impostazione preliminare di due applicazioni per smartphone, concepite come interfaccia tra utenti e servizi (materiali e immateriali) e inerenti a due questioni ritenute rilevanti all'interno del campus: la condivisione degli spazi per lo studio e il lavoro individuale e la gestione della domanda e dell'offerta degli alloggi per gli studenti.

Le funzionalità ipotizzate per l'APP "Spazi per lo studio e il lavoro libero" riguardano:

- la condivisione di informazioni in tempo reale sulla possibilità di utilizzare gli spazi del campus (appositamente attrezzati per lo studio e il lavoro individuale o destinati ad altre attività);
- la geolocalizzazione e l'orientamento degli utenti rispetto a tali luoghi, consentendo di ricevere indicazioni di percorso e di fornire segnalazioni.

L'APP "Ricettività" è stata invece pensata come una sorta di bacheca digitale per favorire e agevolare l'incontro tra la domanda e l'offerta di alloggi, con una duplice finalità:

- sociale e culturale, pensando alle esigenze sia della domanda, sia di quella parte di offerta che offre ospitalità gratuita in cambio di alcune prestazioni immateriali;
- commerciale, pensando alle esigenze di quella parte di offerta che offre ospitalità a pagamento.

Queste ipotesi sono state quindi verificate ed estese attraverso le attività di partecipazione citate. La sperimentazione si è conclusa con l'elaborazione dei requisiti del prototipo della prima delle due applicazioni previste, destinata agli spazi per lo studio e il lavoro libero: l'APP "URBAN CheckIN", sviluppata dal gruppo di ricerca DAStU-Telecom con l'apporto della tesi di laurea di Tijana Djordjevic (Alta Scuola Politecnica, dicembre 2012)[14].

La futura realizzazione dell'applicazione e il suo successivo utilizzo da parte degli utenti potrebbe consentire di ottenere ulteriori rilevanti informazioni sia sulle attuali modalità di utilizzo degli spazi del campus e del contesto urbano circostante, sia sulle esigenze degli studenti rispetto alla dotazione e alla localizzazione delle attrezzature disponibili. Queste informazioni potrebbero altresì tradursi in requisiti progettuali per la riqualificazione degli stessi spazi del campus e delle aree limitrofe e per il miglioramento dei servizi offerti.

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[14] Djordjevic T., "Smart Campus: placemaking of in-between spaces through information communication technologies", Tesi di laurea, Politecnico di Milano, A.A. 2011-2012 (relatore: prof. Andrea Rolando, Politecnico di Milano; co-relatore: ing. Andrea Bragagnini, Telecom Italia), sviluppata anche attraverso un tirocinio realizzato presso i laboratori di ricerca di Telecom Italia a Torino.

Le infrastrutture necessarie al funzionamento dell'applicazione (ad esempio, gli eventuali pannelli informativi dotati di tag NFC) potrebbero a loro volta diventare occasione di riqualificazione degli spazi, interni ed esterni al campus (ad esempio, le fermate dei trasporti pubblici e altri principali luoghi di incontro o di passaggio), dove saranno opportunamente collocati.

In analogia, la stessa metodologia di indagine e le conseguenti proposte di sviluppo di servizi e di progetti di riqualificazione dello spazio fisico, avanzate attraverso la sperimentazione sul campus e il suo contesto di scala urbana, potrebbero essere successivamente trasferite all'area Expo e al suo contesto di scala regionale.

Gli esiti della prima fase della ricerca sono stati presentati con il seminario Comunicazioni mobili: luoghi e servizi. Una sperimentazione su Campus Sostenibile (Politecnico di Milano, Dipartimento di Architettura e Studi Urbani, 21 gennaio 2013)[15].

Nel 2013, la ricerca, anche nella prospettiva di partecipazione al Joint Open Lab, in corso di attivazione da parte di Telecom Italia e Politecnico di Milano sul tema "smart spaces", si orienterà su alcune linee di lavoro:

- il proseguimento e il completamento del lavoro su Campus Sostenibile con la realizzazione degli applicativi;
- l'estensione dell'ambito di studio ai Nuclei di Identità Locale (NIL) definiti dal Piano di Governo del Territorio del Comune di Milano, che sono il riferimento territoriale di Città Studi, con l'obiettivo di individuare, utilizzando metodologie desunte dal campo degli studi urbani integrate con metodologie proprie degli strumenti digitali (mapping, tracking) luoghi adatti ad ospitare nuovi "condensatori" di funzioni fisiche e virtuali;
- l'estensione della sperimentazione attivata sul Campus di Città Studi agli altri campus universitari tra Torino e Milano (il Campus di Novara dell'Università del Piemonte Orientale e, a seguire, il Campus Mirafiori del Politecnico di Torino);
- la connessione continua del lavoro di ricerca con lo scenario dell'Expo 2015, non solo rispetto al sito espositivo e alla città di Milano, ma anche rispetto alla regione metropolitana, promuovendo l'attivazione di un confronto tra i progetti sviluppati da Politecnico di Milano, Telecom Italia, Expo 2015 Spa e Comune di Milano.

[15] L'iniziativa ha lasciato ampio spazio al confronto con i rappresentanti di Telecom Italia, con i delegati della società Expo 2015 Spa e dell'Assessorato a "*Politiche per il lavoro, Sviluppo economico, Università e ricerca, Smart City*" del Comune di Milano (nel ruolo di potenziali destinatari delle riflessioni sviluppate), nonché con altri ricercatori di vari dipartimenti del Politecnico interessati dalle tematiche multidisciplinari affrontate, ha consentito di ricavare utili spunti per l'orientamento delle successive fasi del lavoro.

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TeMA
Journal of
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# TeMA*Lab*

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TeMA*Lab* è il Laboratorio Territorio Mobilità e Ambiente del Dipartimento di Ingegneria Civile, Edile e Ambientale dell'"Università degli Studi di Napoli Federico II, istituito nel dicembre 2006. Nell'ambito di TeMA*Lab* vengono svolte attività di ricerca, consulenza scientifica e formazione che approfondiscono il tema delle relazioni tra mobilità e processi di governo delle trasformazioni urbane e territoriali, con una particolare attenzione alle ricadute ambientali.

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TeMA. Journal of Land Use Mobility and Environment is available on line
www.tema.unina.it

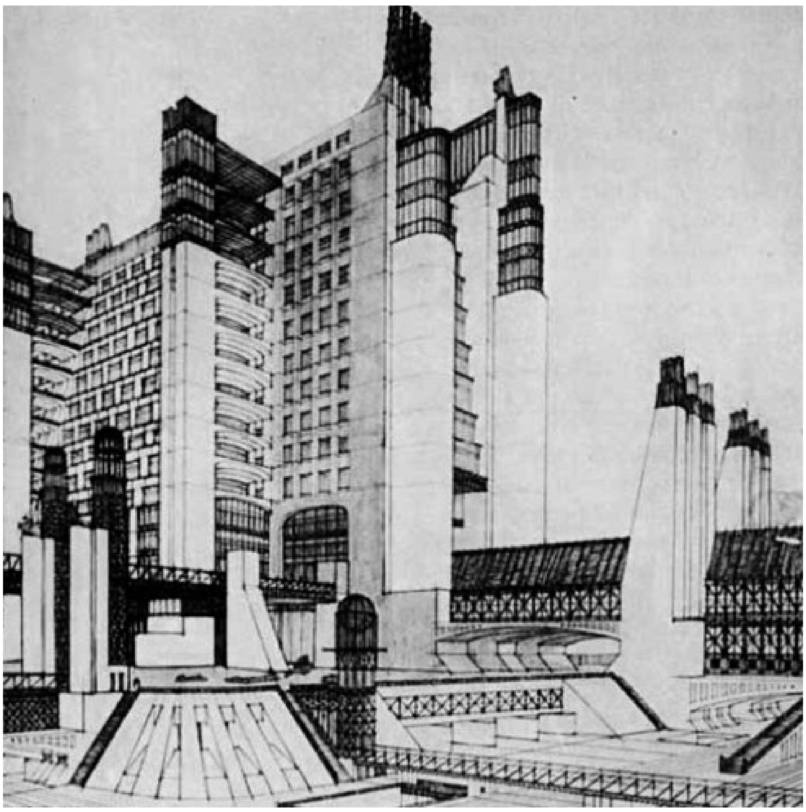
TeMA

Journal of
Land Use, Mobility and Environment

TeMA 1 (2013) 35-45
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1459

review paper received 10 February 2013, accepted 08 April 2013

www.tema.unina.it



# LE CITTÀ SMART E LE SFIDE DELLA SOSTENIBILITÀ

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ABSTRACT

The paper proposes an idea of smart, secure and inclusive city that generates new directions for architecture and urban spaces, and especially better management, which encourages the use of alternative energy optimization and energy saving in "optical circular urban metabolism", mobilizing resources and technological behaviors that can make sustainable, and therefore more competitive territory. Future city concept focuses on the optimization of the relationship between technological advancement and challenges of sustainability at the urban scale.
A common element in all the cities of the future must be the environmental virtuosity and the participation of smart community. To address the social problems of urban and metropolitan (mobility, security and territorial monitoring, etc.) is not enough to imagine individual services compared to question varied of services, energy control, urban security; policy must be implemented for environmental performance (efficiency and environmental virtuosity) optimizing the participation of the urban community. The implementation of the new idea of the city will strengthen the effective participation of citizens in decision-making: promoting of digital pages and the use of tools that allow you to influence the drafting of policies through electronically dialogue systems.
An approach to the city and urban society problems focuses on "prevention"; the answers given by the planning instruments to the new social needs do not end in the "spatialization" of welfare policies.
Multi-ethnic city and security. To elaborate a scientific structure (of knowledge) focused on man, common in multi-ethnic cities in Europe, with the purpose to (evaluate different options) boost the communication and trans-cultural and inter-cultural interaction.

KEYWORDS:
Smart City, Inclusive City, Energy

## 1 IL CONCETTO DI CITTÀ SMART, CITTÀ DEL FUTURO

Il saggio intende proporre un'idea di città intelligente, inclusiva e sicura che generi dal proprio interno nuove direzioni per l'architettura e lo spazio urbano e soprattutto migliore capacità di gestione, che incentivi l'uso di energia alternativa, l'ottimizzazione e il risparmio energetico nell'ottica del "metabolismo circolare urbano", mobilitando risorse tecnologiche e comportamenti capaci di rendere sostenibile, e per questo più competitivo, il territorio. Il saggio affronta le questioni relative alla crisi della città, alla sua complessità e alle nuove aspettative per la città del futuro. Una città del futuro è quella che riesce a garantire l'accessibilità e a risolvere i nodi critici, le situazioni di rischio ambientale e tecnologico, che riesce a regolamentare il tipo di frequentazione degli spazi e la vigilanza presente anche in tempo reale, che affronta l'efficientamento energetico e la messa a norma dell'esistente, che accoglie e si offre rinnovata ai city users, alle comunità in transito. È una città versatile, moderna, intelligente.

Il concetto di città futura privilegia l'ottimizzazione del rapporto tra avanzamento tecnologico e sfide della sostenibilità alla scala urbana. Un elemento comune a tutte le città future deve essere la virtuosità ambientale e la partecipazione della smart community.

Ridare senso a un progetto smart, oltre la retorica, ad un'idea di città efficiente, sicura, inclusiva, partecipativa, senza sprechi - in uno scenario di gestione di risorse ridotte - significa dunque ripensare e riorganizzare l'idea di città, dal reale all'ottimale astratto. Ma non solo. Per affrontare i problemi sociali di scala urbana e metropolitana (es.: mobilità, sicurezza e monitoraggio del territorio, educazione/informazione, benessere/salute, patrimonio culturale e turismo, green cloud computing, energie rinnovabili e efficienza energetica, giustizia..) non basta immaginare singoli servizi attualizzati rispetto ad una domanda variegata di servizi per la mobilità, il controllo energetico, la sicurezza urbana e altri ad alto valore per il cittadino; bisogna realizzare policy relative all'efficienza ambientale (efficientamento e virtuosità ambientale) ottimizzando la partecipazione della urban community e armonizzando in maniera "intelligente" le risorse della stessa città con le attività dei cittadini, autonomi e consapevoli. La realizzazione della nuova idea di città rafforzerà la reale partecipazione dei cittadini nei processi decisionali: promuovendo agende digitali e l'utilizzo di strumenti di facile impiego che permetteranno di influenzare la fase di stesura delle policies attraverso sistemi di dialogo elettronico. Ma le funzioni della città "intelligente" non si esauriscono all'interno di un processo di policy, di riorganizzazione delle infrastrutture a-spaziali. Le implicazioni del "progetto di città" interessano più livelli e fattori, a volte interconnessi.

Gli obiettivi alla base del nuovo progetto di città vanno individuati:

- nella ricomposizione della forma urbana promuovendo la riqualificazione/rifunzionalizzazione e il rilancio delle aree dismesse o degradate, per limitare il consumo di suolo agricolo. È questo lo spirito di molte leggi urbanistiche regionali (quali ad esempio la Lur 19/02 e s.m.i. della Calabria);
- nella rigenerazione degli ambiti urbani attraverso interventi specifici che riescano ad ottimizzare il rapporto tra sostenibilità ambientale e prestazionalità dell'offerta di città. La Commissione Europea ha istituito nel 2010 il premio "European Green Capital Award" che ha visto il riconoscimento di città vincente a Stoccolma, Amburgo, Vitoria Gasteiz e Nantes, il quartiere di Leed Neighborhood è un esempio di ecoquartiere che sviluppa le aree verdi sfruttandone la funzione sociale, paesaggistica e soluzioni per l'antiinquinamento (Cancilia, Bosso, 2012), propone un mix equilibrato di funzioni urbane, favorendo la realizzazione di edifici ad alta efficienza energetica;
- nel rapporto tra edificato e vuoti urbani, migliorando l'accessibilità. Una città del futuro è quella che riesce a garantire l'accessibilità e a risolvere i nodi critici, le situazioni di rischio ambientale e tecnologico, che riesce a regolamentare il tipo di frequentazione degli spazi e la vigilanza presente

anche in tempo reale, gli accessi soggetti a controllo, la viabilità regolamentata e vigilata nei punti strategici e le responsabilità di gestione. Prevede la mappatura dei servizi e del loro grado di integrazione con la città, con gli altri servizi e con i trasporti, per comparare le performance ambientali dei diversi quartieri con la presenza umana al loro interno; individua i quartieri più vigilati e quelli più sicuri, con riferimento alle diverse fasce orarie e all'utilizzazione degli stessi nelle ore notturne considerando l'adeguata illuminazione e vigilanza (Moraci, Fazia, 2012) e la possibilità di collegamento.

Le nuove soluzioni intelligenti, per l'adeguamento delle città esistenti e per la progettazione di quella futura devono garantire una visione integrata delle azioni di trasformazione e riprogettazione. Ciò determina la necessaria acquisizione di apporti disciplinari diversi, secondo un approccio interagente. Tale macro diversificazione implica condizioni tecnico-scientifiche differenti in cui trovano collocazione concetti di progetto che richiedono azioni e regole diverse: la messa in sicurezza della città esistente e la sua riqualificazione; la compatibilità delle scelte di pianificazione con la città futura (sostenibilità, mobilità, consumo di suolo, ecc.).

## 1.2 DALLA CITTÀ COMPLESSA E "IN CRISI" ALLA CITTÀ INTELLIGENTE E DEL FUTURO

Ma la città intelligente è tale se riesce a rispondere alla "growing complexity" (Albrechts, 2006), "la crescente complessità", vale a dire nascita di nuove tecnologie, cambiamenti nei processi produttivi, la crisi della democrazia rappresentativa, la diversità, la globalizzazione della cultura e dell'economia. Di queste questioni il new urbanism aveva affrontato le implicazioni (Fazia, 2012). Alcuni principi ricorrenti nel new urbanism sono stati: la possibilità di accogliere diversi tipi di residenze e di offerte lavorative in un ambiente a sviluppo equilibrato, la riduzione del consumo di suolo, la mobilità sostenibile ecc.. Alla base della teoria vi è il riconoscimento che queste strategie siano la strada migliore per elevare il livello qualitativo/prestazionale degli aggregati urbani, per aumentare l'accessibilità alle residenze, per ridurre il tempo impiegato nel traffico, e per governare l'urban sprawl (le cui implicazioni negative si leggono negli effetti della rapida ed estesa crescita delle aree metropolitane, suburbs o exurbs con caratteristiche di zoning monofunzionale) e la bassa densità (che comporta maggiore consumo di suolo, collegamenti non razionali, maggior consumo di risorse ecc..) garantendo al contempo la sicurezza stradale, la conservazione storica, gli edifici verdi e il recupero dei suoli industriali inquinati, brownfield land (requisiti contemplati nella Carta del New Urbanism, che rappresenta il trattato del movimento).
Questo perché la città, nella sua stratificazione storica, testimonia un'organizzazione degli spazi in funzione di poche e fondamentali esigenze dell'abitare. È quasi sempre satura, e gli elementi addizionali ad essa non sono stati in grado, nel passato ma anche in tempi recenti, di attualizzare la gamma dei servizi e l'offerta di spazi pubblici. Alcune città, che presentano un ritardo storico nell'adeguamento dei servizi e delle attrezzature collettive, sono adesso impreparate a dare risposte adeguate alla domanda diversificata di servizi sempre più specialistici, di necessità di risparmio energetico, di adeguamento/recepimento delle nuove normative impiantistiche, di accessibilità e di fruizione della città sicura. Ma è evidente il ruolo sempre più difficile dell'architettura e dell'urbanistica nella costruzione delle smart city: l'housing sociale, lo spazio pubblico, le scuole, i trasporti, la mobilità sostenibile, i quartieri sensibili, la sicurezza urbana, la complessità e mixité sociale e culturale, impongono un controllo urbanistico e un disegno urbano che metta a sistema le prestazionalità richieste, che si confronti con la dinamicità della società dovuta alla mobilità considerando la forte individualizzazione che sta avvenendo grazie all'innovazione tecnologica e trasporto veloce, al tempo stesso espressioni di bisogni e testimonianza di innovazioni tecnologiche incalzanti. Processi che impongono la necessaria rivisitazione del "modello" di città contemporanea e che devono tradursi in spinte di

rinnovamento, di riorganizzazione degli spazi pubblici nell'ambito delle città intelligenti nei percorsi smart growth per le compact city, come quelli sperimentati a Vancouver e Portland. Servizi e nuovo welfare contribuiscono alla capacità erogativa della città in termini di qualità urbana, sicurezza ed empowerment. Ma è evidente il ruolo sempre più difficile dell'architettura e dell'urbanistica nella "costruzione" delle città intelligenti: dalla domanda indifferenziata di servizi di base si passa a sempre più diversificate richieste quasi individuali.

Più un territorio è refrattario ai cambiamenti e meno è disposto a mettersi in gioco, quindi ad investire su se stesso e ad attrarre le "occasioni" di rinnovamento sollecitate dalle politiche urbane. La città, pertanto, deve rinnovarsi, deve affrontare la complessità delle questioni legate al suo essere città "contemporanea", città dei cambiamenti. Ma lo è con un gap strutturale: non riesce infatti a seguire i "tempi" e le velocità delle trasformazioni sociali e fisiche della città stessa. In mancanza di una puntuale e adeguata risposta progettuale, la città subisce l'inerzia pianificatoria, la mancanza di adeguati interventi di riqualificazione, la rapida estensione del tessuto abitativo, commerciale, industriale e turistico.

Città e territori, nei contesti della governance esprimono sofferenze e profonde trasformazioni:

- le trasformazioni della civiltà e delle città nell'uso del tempo e dello spazio;
- urbanizzazione e sprawl;
- la mobilità e le nuove popolazioni perennemente in transito;
- la globalità dell'economia;
- segregazione, immigrazione, integrazione e densità ed eterogeneità dell'insediamento urbano;
- città, crisi e paradigma ambientale;
- tecnologie dell'informazione e della comunicazione ed effetto città.

Di conseguenza anche le problematiche ambientali connesse alle "questioni urbane", l'inefficienza energetica e i cambiamenti climatici non sono affrontati con idonei strumenti di supporto alla crescita intelligente - smart growth[1]. In conformità con i principi del new urbanism - rispondendo alla sfida di aumentare la propria competitività - la città futura deve identificare le forme di servizio e i modelli di gestione innovativi che, relativamente alle tipologie di attività previste, riescano ad utilizzare in modo efficace le risorse disponibili, le potenzialità inespresse, le competenze. Questo si potrebbe tradurre in un nuovo modello di città - del pragmatismo visionario, dell'efficienza aperta al future - che costruisce percorsi di sviluppo su "se stessa" partendo dai fattori pre-competivi, riorganizzandoli funzionalmente in una logica di sistema, che punti a scenari "macro" ma che non trascuri le dimensioni "micro". Vale a dire privilegiando strategie focalizzate sulle tematiche delle tecnologie per il risparmio energetico, dei sistemi di supporto alle decisioni, dei servizi avanzati per i cittadini, degli smart building, della mobilità sostenibile dell'housing di qualità per la città del futuro, sicura, ipertecnologica, economica e costruita dal basso, secondo i principi legati alle logiche di costruzione partecipata della città con meccanismi di redistribuzione dei benefici sociali. Lo sviluppo urbano integrato promuove inoltre il dialogo sociale ed interculturale.

[1] Il new urbanism è un planning movement la cui popolarità è particolarmente aumentata tra la fine degli anni '80 e gli inizi degli anni '90. Include vari tipi di progetti, dall'urban retrofits al suburban infill. Quest'ultimo descrive lo sviluppo di terre in aree suburbane esistenti che sono state lasciate vuote durante lo sviluppo del suburbio incoraggiando la densificazione delle aree urbane per ridurre l'uso delle automobili, la pedonalità e di conseguenza risparmiando energia. L'influenza delle politiche urbane e dei criteri urbanistici nelle configurazioni sociali, era già stata trattata da Jane Jacobs. Nei primi anni '60 Jane Jacobs ha pubblicato "Death and Life of Great American Cities", un testo che ha posto le basi per le tendenze del New Urbanism, condannando la pianificazione convenzionale di quel periodo.

Le strategie di sviluppo urbano integrato, la gestione dello sviluppo urbano cooperativo e il buon governo possono contribuire ad un utilizzo significativo del potenziale di tutte le città europee, specialmente riguardo alla competitività e alla crescita, così come alla riduzione delle disparità all'interno dei quartieri e tra di essi. In definitiva, esse forniscono ai cittadini un'opportunità di partecipazione sociale e democratica e un'attenzione speciale ai quartieri degradati all'interno del contesto cittadino. Creare e assicurare infrastrutture e spazi urbani funzionali e ben progettati è un compito che deve essere affrontato congiuntamente dallo Stato e dalle autorità regionali e locali, ma anche dai cittadini e dalle imprese.

La politica di sviluppo urbano integrato può contribuire a migliorare questi fattori, per esempio riunendo le parti interessate, dando sostegno alle reti e ottimizzando le localizzazioni.

All'interno di una città possono esistere differenze considerevoli in termini di opportunità economiche e sociali nelle diverse zone, ma anche in termini di diversa qualità dell'ambiente. Inoltre, le differenze sociali e di sviluppo economico continuano ad accrescersi; ciò contribuisce al fenomeno della destabilizzazione nelle città, con conseguenze legate al fenomeno "insicurezza" urbana.

La sicurezza è infatti un altro campo d'azione importante per la politica di sviluppo urbano integrato finalizzata all'idea di città intelligente.

Bisogna offrire prospettive e sostegno nonché misure preventive ai residenti dei quartieri urbani che sono minacciati da degrado fisico, economico, sociale ed ambientale ed esclusione sociale. C'è bisogno di un coinvolgimento attivo dei residenti e un dialogo migliore tra i rappresentati politici, i residenti e gli attori economici, al fine di trovare le soluzioni migliori per ogni area urbana degradata.

Rispetto a queste problematiche, sono fondamentali le seguenti strategie di azione, inserite in una politica di sviluppo urbano integrato, di cruciale importanza per i quartieri urbani degradati.

Perseguire strategie per migliorare l'ambiente fisico. L'alta qualità dell'architettura, sviluppo urbano e spazi pubblici, come pure alloggi salubri ed economici possono rafforzare lo spirito di appartenenza delle persone con il proprio quartiere e renderli più vivibili sia per gli anziani che per i giovani. Devono anche essere accresciute le opportunità di impiego e di formazione dell'economia etnica (Fazia, 2011).

Le iniziative dell'UE, sostenendo la creazione di fondi di sviluppo urbano e fondi per le PMI, usando strumenti di ingegneria finanziaria per impiegare il capitale privato nell'attuazione delle strategie di sviluppo urbano integrato, hanno fornito opportunità promettenti per accrescere l'efficacia delle risorse finanziarie nazionali ed europee in ambiti ritenuti "complessi" dal punto di vista sociale.

Uno scambio sistematico e strutturato di esperienza e conoscenza nel campo dello sviluppo urbano sostenibile è fondamentale. Una piattaforma interattiva, che metta insieme questo scambio in modo più profondo, è determinante per sostenere gli attori coinvolti nello sviluppo urbano, a tutti i livelli e in tutti i settori. L'inclusione sociale e l'intercultura sono pertanto esiti importanti di un processo culturale complesso e a geometria variabile, in cui la condivisione sociale necessita di risposte concrete in termini di azioni e strategie di città. L'esperienza di ciascun individuo sociale di vivere il rapporto con la città produce infatti senso di appartenenza (o di esclusione), capacità di riconoscersi (o di non ritrovare alcun legame ma comunque di trovare le città ospitale attraverso l'offerta dei servizi materiali e immateriali). L'inclusione sociale dipende dalla città e passa anche attraverso le misure e gli interventi volti ad assicurare maggiore sicurezza urbana. Mentre sono chiari i fattori che generano l'inclusione sociale, rimane aperta la questione relativa a quali siano le morfologie sociali dell'esclusione: dipendono dalla dimensione urbana o dalla condizione specifica dell'individuo? La nuova sociologia economica, la cultura della domiciliarità dei servizi assistenziali legati al welfare informale genera aspettative non esclusivamente legate a rapporti di reciprocità con le famiglie ospitanti. Le città devono garantire servizi nuovi, più aderenti ai bisogni di comunità eterogenee che importano culture, modi e stili di vita diversi e soprattutto nuove domande sociali e "bisogni transazionali", generati dai comprensibili legami con la madrepatria, da scarse prospettive e orientamenti verso il futuro sia rispetto al percorso migratorio proprio che dei figli. Alimentare la crescita dal basso di spazi di aggregazione di socialità informale, di mutuo aiuto, di presenze culturali-segno aiuta comunque a ri-costruire il senso di appartenenza. Sono queste alcune questioni alla base dei processi integrativi delle comunità ospitate nelle città e le chiavi di lettura scelte per descrivere e superare i limiti delle grandi urbanità nelle città del terzo millennio. Significa approfondire le questioni relative al rapporto tra culture, identità nella definizione e configurazione dei luoghi e al processo di assimilazione dell'interculturalità che è alla base della riorganizzazione dell'offerta di città inclusiva e "intelligente".

Le istituzioni facilitatrici, la loro distribuzione territoriale, ma anche i servizi di socialità, di aggregazione informale, la cui carenza determina la frammentarietà e debolezza del tessuto associativo che si sviluppa spontaneamente tra connazionali, devono trovare ubicazione in spazi discreti di ascolto, di socialità laica. Così, molte altre questioni: le esclusioni e ineguaglianze sociali all'attenzione di numerose politiche di rinnovamento urbano possono essere risolte attraverso interventi che combinano il welfare, il terzo settore con l'apertura all'imprenditorialità urbana. In linea con questi assunti, la coprogettazione quale efficace modalità operativa, prevista in diversi progetti di Inclusione Sociale e Culturale degli immigrati (tra cui quelli promossi dall'Assessorato alle Politiche Sociali del comune di Reggio Calabria, ma anche da molte altre province e comuni anche nell'ambito dei piani di zona ex l. 328/00, o delle iniziative specifiche dei singoli assessorati - il CINFORMI della provincia di Trento è un esempio) è uno strumento potenzialmente capace di innovare sensibilmente anche le forme di rapporto più consolidate, in quanto il soggetto del terzo settore che si trova ad essere coinvolto nell'attuazione dei progetti viene a operare non più in termini di mero erogatore di servizi, ma assume un ruolo attivo investendo risorse proprie e soluzioni progettuali.

Rispetto alla costruzione partecipata dell'offerta di città futura, la maggiore integrazione delle comunità locali nell'ambito dei processi di governo generale rende necessario il ricorso a modalità che consentano di valutare il grado di flessibilità/adattabilità nell'attuazione delle strategie, per evitare di introdurre elementi di conflitto nei confronti di determinate realtà locali. All'interno dei processi di governance è necessario misurare il ruolo attivo delle politiche urbane e sociali che si configurano:

- come un laboratorio sperimentale: i comitati delle regioni potranno elaborare relazioni preliminari alle proposte della commissione, organizzare lo scambio d'informazioni ed altre modalità di partecipazione con i cittadini, esaminare e valutare l'incidenza locale delle politiche comunitarie;
- come "pacchetti" in grado di contenere i criteri/principi anzidetti attribuendo le funzioni alle autorità territorialmente più vicine alle comunità interessate (nel rispetto del principio di sussidiarietà), con l'obbligo di verificare che i soggetti pubblici titolari di responsabilità e funzioni siano adeguati dal punto di vista organizzativo (nel rispetto del principio di adeguatezza).

La governance presuppone capacità negoziali e di gestione dei conflitti cui gli enti locali non sono preparati, dimostrando spesso difficoltà ad approntare una struttura organizzativa dotata di risorse umane, finanziarie, tecniche e conoscitive; le conoscenze ambientali (in cui gli aspetti tecnici sono in rapida evoluzione e le connessioni con altre politiche settoriali sono così rilevanti), la formazione sul lavoro, on the job, e la mobilità intersettoriale degli addetti ai lavori deve essere promossa e incentivata.

Pertanto, gli altri obiettivi per la smart city inclusiva, sicura e proiettata al futuro, sono di:

- favorire l'identità e l'intercultura nella città contemporanea: analizzare le aspettative nello spazio delle infrastrutture multietniche;

- riorganizzare (attraverso strumenti correlati quali il Piano dei Servizi) la domanda di servizi differenziata rispetto alla città plurale: integrazione multifunzionale delle esigenze ai fini della qualità urbana e sociale;
- definire le attività, le infrastrutture e i servizi da riorganizzare e georiferire rispetto alla geografia del transito delle comunità migranti, e rispetto alla domanda inespressa di città, ai processi diversi e mutevoli di inserimento sociale;
- integrare all'interno dei processi di pianificazione i temi della sicurezza urbana, in particolar modo per quanto riguarda i servizi e le infrastrutture.

Con gli anni Sessanta gli studiosi di città di tutto il mondo si trovano di fronte alla crescente ondata di conflitti sociali sui temi urbani, e le scienze sociali conoscono un nuovo sviluppo in parte per derivazione dalla sociologia nordamericana in parte per una naturale evoluzione. Dai primi fondamenti di una teoria sociologica della città, alle linee generali sulla teoria antropologica del comportamento sociale nelle aree urbane, sono stati prodotti diversi pensieri in merito alla crisi della città (ma la città è ancora impreparata a dare risposte certe); gli ultimi sono stati oggetto sicuramente di "attenzioni" meditate nelle arene di focus group, nelle audizioni popolari, nei forum on line e in tutte le modalità di e-democracy che oggi la tecnologia ci consente di usare avvicinando virtualmente gli attori, i protagonisti delle trasformazioni volute o subìte, delle nostre città e dei territori. Il passaggio dalla prima modernità alla nozione di sviluppo ha determinato una spinta verso la «razionalità ideale» che ha prodotto l'istituzionalizzazione dell'agire economico, amministrativo e sociale degli uomini guidati ad un fine teleologico: il benessere (Pitto, 2004).

## 1.3 TANTE IDEE PER UNA FUTURE CITY, EFFICIENTE E INTELLIGENTE

La città del futuro offre un ambiente creativo e promuove l'innovazione; ha una visione strategica del proprio futuro, incentiva l'uso di auto elettriche ricaricabili con l'energia prodotta negli edifici, la messa in rete dell'energia prodotta da fonti rinnovabili, un diverso e più sostenibile sistema edilizio e di mobilità urbana. Ma quali sono i requisiti richiesti alla "città del futuro"?
È una città in cui c'è un elevato livello di qualità della vita, dove gli spazi urbani sono più vicini ai desideri della collettività, ci aiutano a muoverci in maniera più agevole, ottimizzando il tempo. La città del futuro dovrà fornire supporti decisionali, servizi di assistenza, e modalità di gestione in modo coordinato, veloce e accessibile da Amministrazioni, Enti, Imprese, Società erogatrici di servizi, dai gestori dei Beni Culturali coinvolti nel progetto attraverso una serie di azioni volte a:

- offrire una costante valutazione delle decisioni, identificare le lacune e le esigenze di marketing, migliorare le prestazioni globali alla base degli obiettivi di valorizzazione.
- migliorare l'efficienza, la reattività e la flessibilità dell'offerta e ridurre i costi di gestione, quali principali obiettivi di ogni progetto di razionalizzazione e ottimizzazione.

Attualmente, le autorità urbane e i fornitori di servizi gestiscono sempre più le loro reti in tempo reale. I dati generati, tuttavia, attualmente sono tenuti separati, mentre è vero che il funzionamento proprio di ciascuna rete contiene potenzialità non ancora utilizzate soprattutto in scenari diversi che combinano dati provenienti da fonti dinamiche, implementabili e accessibili agli utenti.

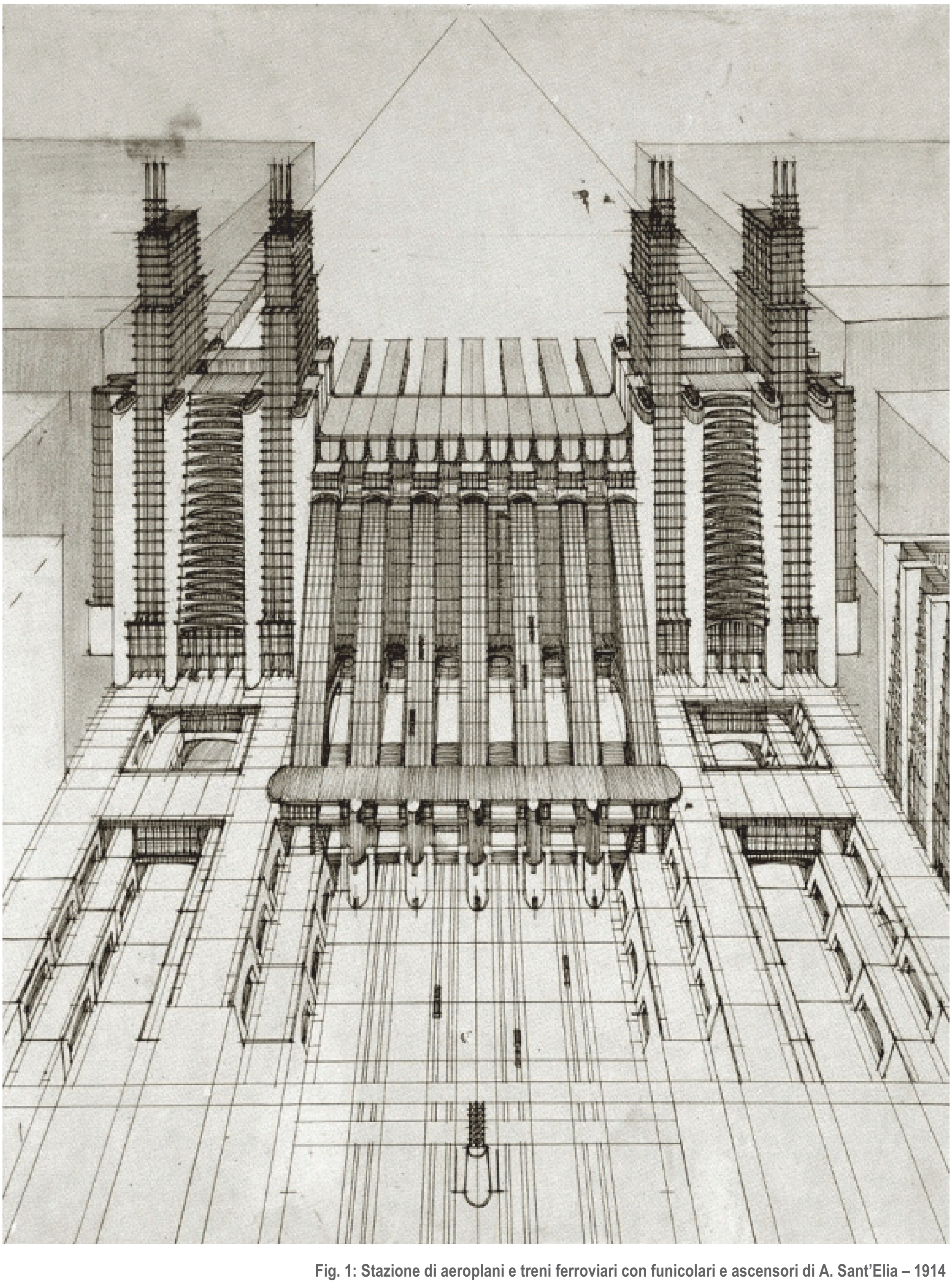

Fig. 1: Stazione di aeroplani e treni ferroviari con funicolari e ascensori di A. Sant'Elia – 1914

La messa in rete dei servizi e del loro funzionamento, la mappatura sul territorio, le informazioni sulle modalità di erogazione, sui tempi, sedi, struttura può accrescere la competitività in termini di visibilità, e generare nuove attrattività legate a prodotti e servizi, specificando e indirizzando l'offerta verso una domanda dinamica, georiferita, multietnica, che renderà pertanto la città inclusiva.

Anche le dotazioni urbane, le infrastrutture, gli esercizi commerciali, le iniziative imprenditoriali saranno collegate in maniera complementare all'utilizzazione di tali servizi e coordinate da un indirizzo strategico finalizzate a migliorare l'accessibilità (attraverso il collegamento con i mezzi di trasporto pubblico), la fruizione, l'efficienza e a valorizzare le innovazioni emergenti. L'obiettivo è quello di consentire agli attori coinvolti la messa a sistema dei servizi territoriali e urbani e un accesso rapido e unificato in modalità plurilingue.

Si persegue tale obiettivo attraverso azioni integrate per la sostenibilità, la gestione delle risorse naturali e socio-culturali e della biodiversità in aree urbane e la costruzione di un sistema informativo di controllo e monitoraggio real-time. Bisognerà inoltre attivare una piattaforma interattiva attraverso parametri selezionati e dati forniti da fonti diverse, dagli erogatori di servizi implementati dai fruitori (community) della città smart, con riferimento alle reti di telecomunicazioni.

Un sistema per la gestione interattiva delle risorse potrà essere collegato ai sistemi informativi geografici, agli erogatori e ai fruitori dei servizi. Attraverso il portale multimediale sarà possibile attivare dei portali tematici, le schede di presentazione ed eventuali circuiti alternativi, acquistare i biglietti on-line, conoscere orari e prodotti locali.

La questione dei rifiuti, dell'energia e dell'acqua potrà essere affrontata nell'ottica del metabolismo circolare naturale e urbano. Lo scopo è di perseguire la concretizzazione di modelli teorici che vedono nell'informatizzazione dei sistemi la chiave per ottenere, da un lato, una "risorsa" energetica da flussi di scarto, dall'altro, migliorare la complessiva qualità ambientale delle città attraverso la riduzione dei carichi e pressioni.

L'applicazione dei sistemi informatici-tecnologici consentirebbe di innovare in modo pervasivo ed efficace l'intero ciclo, intervenendo quindi, sia sul funzionamento meccanizzato degli elementi sia sul controllo quali-quantitativo dei frazionamenti di rifiuti, sia sul monitoraggio dei modelli di produzione del rifiuto.

La città del futuro dovrà fornire la diagnostica del rischio, verificare l'accessibilità e i nodi critici, le situazioni di rischio ambientale e tecnologico, le relazioni tra aumenti stimati in temperatura e il consumo di energia, il tipo di frequentazione degli spazi e la vigilanza presente anche in tempo reale, gli accessi soggetti a controllo (tele sorveglianza pubblica e privata, con relativa mappatura), la viabilità regolamentata e vigilata nei punti strategici e le responsabilità di gestione. Dovrà inoltre prevedere la mappatura dei servizi e del loro grado di integrazione con la città, con gli altri servizi e con i trasporti; individuare, i quartieri più vigilati anche con forme di auto presidio o di vigilanza privata, quindi i quartieri più a rischio sicurezza (anche spazializzando le località in cui si sono verificati delitti e reati differenziandone le diverse tipologie) e quelli più sicuri, con riferimento alle diverse fasce orarie e all'utilizzazione degli stessi nelle ore notturne considerando l'adeguata illuminazione e vigilanza e la possibilità di collegamento. Un'applicazione sul monitoraggio delle condizioni della viabilità potrebbe consentire di rilevare in tempo reale le condizioni fisiche dei punti di raccolta per l'emergenza, delle viabilità, della loro risposta agli eventi meteorologici (rispetto all'efficienza del sistema di smistamento delle acque piovane) e agli eventi calamitosi in generale.

La ricerca di Cittalia per Siemens[2] prende in considerazione 54 città medie e grandi - i capoluoghi di provincia con più di 90mila abitanti - analizzate sulla base di alcuni indicatori considerati prioritari per la smart city: verde urbano, acqua, aria, rifiuti, patrimonio immobiliare e qualità dell'abitare, energia, sanità, mobilità e logistica. Ma la città del futuro deve possedere un requisito in più, deve avvicinarsi virtualmente alla gente, alla smart community del terzo millennio.

In un quadro sociale profondamente trasformato dalla rivoluzione tecnologica, le innovazioni strumentali a disposizione possono contribuire in modo significativo a sostenere la partecipazione dei cittadini nei processi decisionali, rafforzando e ampliando le modalità di partecipazione E-Democracy (per una smart community)[3].

Dovrà prevedere spazi più innovativi di adozione delle nuove tecnologie e di integrazione delle forme di partecipazione tradizionali, anche attraverso l'utilizzo di strumenti semplici di facile impiego che permetteranno di influenzare la fase di stesura delle policies attraverso e-mail, chat, consultazioni on line.

L'idea è che raccogliere, gestire e analizzare le informazioni in tempo reale rappresenti una soluzione ottimale per la migliore comprensione di come funziona una città e per consentire l'"interfacciabilità della città" con gli abitanti in termini dinamici (eventi, emergenze, ecc.), in modo da rendere più efficiente e sostenibile sia questa interazione che il sistema urbano con le sue componenti ambientali.

La città del futuro è pertanto quella che assicura la gestione smart di un sistema urbano e delle sue risorse attraverso azioni integrate e modalità nuove per il controllo/monitoraggio delle fenomenologie urbane e ambientali e per l'accessibilità/fruibilità dei dati attraverso la mappatura dinamica della città per la gestione intelligente.

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2 A registrare performance sopra la media in tutti i comparti sono quattro "città ideali", di media dimensione e tutte al Nord, in cui l'eccellenza negli indicatori garantisce ai cittadini un livello elevato di qualità della vita. Si tratta di Bergamo, Brescia, Padova e Trento di Pierangelo Soldavini -Il Sole 24 Ore- http://www.ilsole24ore.com/art/impresa-e-territori/2012-11-08/smart-cities-molti-modelli-204114.shtml?uuid=Ab172I1G

3 L'Agorà Telematica, come politica digitale per la città", è un'idea-progetto proposta dal Labstutep (responsabile scientifico, prof. F. Moraci; responsabile tecnico arch. C. Fazia). È stata finalista con altre 16 proposte presentate agli Stati Generali del Mezzogiorno a Catanzaro (30.06.2012) sulle 700 pervenute nell'ambito del concorso "ItaliaCamp- la tua idea per il paese".

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## FONTE DELLE IMMAGINI

Fig. 1: http://www.tumblr.com/tagged/antonio%20sant%27elia

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**INNOVAZIONE NELLA PIANIFICAZIONE URBANISTICA E TERRITORIALE**

***Smart City: planning for energy, transportation and sustainability of the urban system***

8th International Conference on Innovation in Urban and Regional Planning

**Naples, June 4-6 2014**

From 4 to 6 June 2014 the Congress Center of the University of Naples “Federico II” will host the 8th International Conference on Innovation in Urban and Regional Planning, titled Smart City: planning for energy, transportation and sustainability of the urban system, which is jointly organized by the Department of Civil, Building and Environmental Engineering (Dipartimento di Ingegneria Civile, Edile e Ambientale) of the University of Naples “Federico II” and by the Department of Engineering (Dipartimento di Ingegneria) of the University of Sannio. The general theme of INPUT 2014 is: “Smart City: planning for energy, transportation and sustainability of the urban system“. Smart City seems to be the new dimension every city should aim at. From an urban planning point of view, it’s not very clear which is the best way to achieve this new dimension and more fundamentally what a “smart city” actually is. At present, the questions widely spreading among cities are: how is it possible to become a smart city? Which factors are strategic to drive the cities towards this new dimension? How can urban smartness be promoted? The conference tries to answer these questions by adopting a new approach to study the city and to discover a new urban way of planning, in order to drive the city development towards sustainable states. This allows to consider the city as a Technological innovation as a whole, which is a key factor interacting with the different urban dimensions, not only in a mechanic way. The conference aims at investigating this new urban dimension within the field of urban sciences and considering the relationship between technological innovation and town planning. Scholars and practitioners are invited to submit their contributions on innovative experiences within the framework of the general theme and in the light of the crosscutting technology domains. Since the first conference, held in 1999, INPUT has represented an opportunity to reflect on the use of Information and Communication Technologies as key planning support tools. It has especially focused on models, techniques, and tools used to support planning processes, paying special attention to case-studies and shedding light on issues related to democracy, efficiency, sustainability, and equity in planning.

## Conference Topics

Smart City-Planning for Energy-Healthy Cities-Evaluation and planning-Strategic planning-Data sources for planning
Planning for cultural heritage-Rural development and planning-Models in planning-Decision aid and planning

## Key Dates

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Apr 20, 2014 End of paper reviews
Apr 30, 2014 Final submissions and start registration
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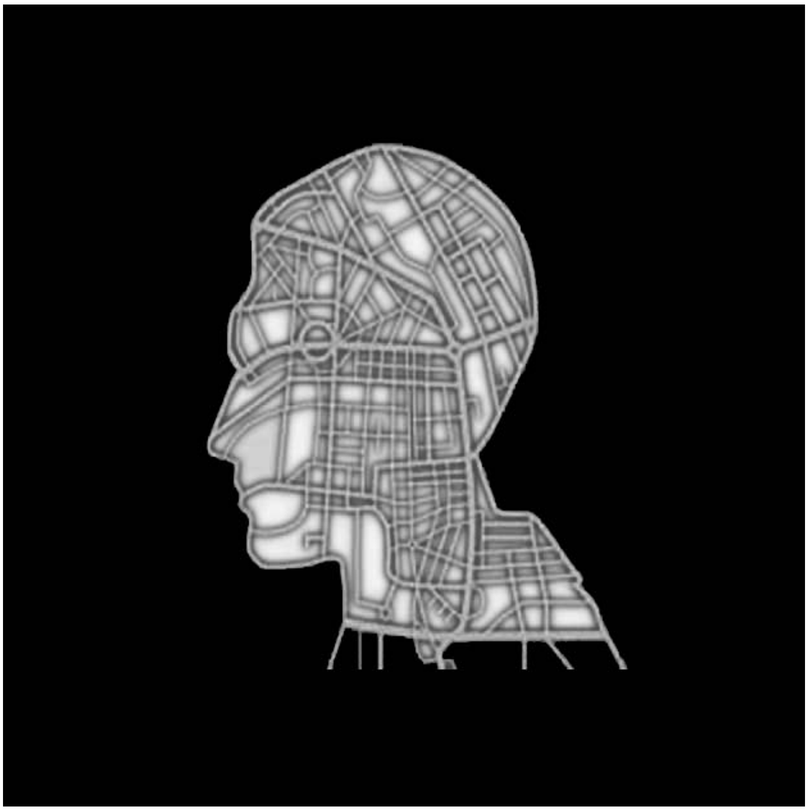
TeMA

Journal of
Land Use, Mobility and Environment

TeMA 1 (2013) 47-60
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1460

review paper received 11 February 2013, accepted 08 April 2013

www.tema.unina.it



# SMART CITY

## RIFLESSIONI SULL'INTELLIGENZA URBANA

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ABSTRACT

Anticipating future urban settings where technologies enable actions and interactions among individuals unimaginable only a few years ago, has always been one of the research topics most interesting of the urban sciences although probably not sufficiently considered in the town planning field, in the last twenty years.

The acceleration towards these issues, which can be generally identified with the name Smart City, has been strong also because of the recent calls of the European Community and the Italian Ministry of Education and Research. In this important change, supported by a number of technology companies, devices and media, it seems experience a discontinuity in the theoretical definition of the processes involved in structuring and management of the Smart City. Numerous investigations on this topic seem to be developed away from urban sciences and away from the main subject area of interest: the urban planning.

In this paper we attempt to bring back the dynamics of development of the Smart Cities in their natural site of theoretical development, by recovering operational approaches and methodological references related to the study of the relationship between new technologies and changes inside the urban system, never really considered in order to envisage a new process of urban and regional planning.

KEYWORDS:
Smart City, Urban Planning, ICT and City, Systemic Approach, Urban Entropy

## 1 CONSIDERAZIONI INIZIALI

Prefigurare assetti urbani nei quali le nuove tecnologie consentano azioni e interazioni fra gli individui, inimmaginabili solo pochi anni fa, ha rappresentato una delle tematiche di ricerca ed approfondimento più affascinanti nel campo delle scienze urbane anche se, probabilmente, poco considerata nel dibattito urbanistico italiano degli ultimi venti anni.

L'accelerazione verso tali tematiche è stata consistente a partire dallo sviluppo delle tecnologie di rete e dalla nascita del *cloud computing,* due fra i fattori generatori della Smart City (SC), tema sul quale si sono recentemente aperti i bandi della Comunità Europea e del Ministero dell'Istruzione e della Ricerca Italiano (MIUR). In questa importante svolta, supportata dalle numerose aziende produttrici di tecnologie, dispositivi e media, sembra tuttavia verificarsi una discontinuità nell'ambito della definizione teorica dei processi connessi alla strutturazione ed alla gestione della SC. I numerosi approfondimenti sul tema sembrano svilupparsi lontano dalle scienze urbane e distanti dal principale ambito disciplinare di riferimento: l'urbanistica. Tale distanza è probabilmente da attribuire a due fattori: da una parte la già richiamata marginalizzazione del tema relativo a città ed innovazione tecnologica nel dibattito urbanistico nazionale, concentratosi su altri argomenti e, dall'altra, la genesi della materia sostanzialmente verificatasi in ambito aziendale ove, vigendo regole ispirate alla logica di mercato, si tralascia la formalizzazione teorica per privilegiare l'implementazione operativa della tecnologia. Per risolvere tale anomalia verranno proposti approcci, ipotesi e riflessioni, ancora non strutturate per definire un organico sviluppo teorico, ma probabilmente in grado di aprire dimensioni del ragionamento ed indicare possibili scenari che possano essere successivamente ripresi, confutati e riarticolati alfine di definire un nuovo modo di interpretare ed orientare lo sviluppo urbano.

In altre parole molte delle riflessioni presentate nel seguito rappresentano semplici spunti che necessitano di ulteriori approfondimenti e sviluppi, ma pare utile avviare comunque un ragionamento che dimostri come la proposizione del modello "smart" per i moderni sistemi urbani non derivi unicamente da necessità tecnicisticamente aziendali (che spingono al mero utilizzo di *device* sensoristici di controllo), ma possano essere visti come uno stadio evolutivo della città del quale già da tempo si erano prefigurati gli sviluppi. Obiettivo finale di questo paper è quello di tentare di ricondurre le dinamiche di sviluppo della SC nel loro naturale alveo di sviluppo teorico-operativo, anche recuperando approcci e riferimenti metodologici riconducibili allo studio del rapporto fra nuove tecnologie e trasformazioni del sistema urbano da tempo sviluppati in sede di ricerca, ma mai concretamente adottati per la definizione di nuovi processi di governo della città.

## 2 COSA È UNA SMART CITY?

In questi tempi di crisi economica diffusa, di preoccupante aumento della popolazione urbana, di scarsità di risorse energetiche, di elevata conflittualità sociale, di crisi della rappresentatività politica, di deriva etica e smarrimento disciplinare (Fistola 2011), il tema della SC polarizza, anche grazie alle consistenti risorse economiche appostate, un consistente interesse da parte di molti ambiti disciplinari e di ricerca che sembrano però accettare il modello di riferimento proposto e rimandare a ragionamenti ex-post lo sviluppo di basi teoriche sulle quali fondare anche le politiche di sviluppo, trasferimento ed implementazione industriale.

In altri termini in un Paese che sembra ignorare l'importanza dei contesti urbani e metropolitani, veri e propri elementi chiave per il rilancio sostenibile della nazione, dove il "piano per le città" e "l'agenda digitale", enfaticamente annunciati solo pochi mesi fa come fattori di contrasto e potenziale risoluzione della crisi economica, appaiono oggi politiche deboli e forse solo un altro modo per finanziare interventi isolati o progetti supportati da grandi gruppi industriali, un deciso impulso alla definizione di scenari e prospettive urbane viene dai bandi del MIUR, sulla SC, che appostano risorse per 665,5 milioni di euro a livello nazionale e 240 milioni di euro, esclusivamente per le regioni del meridione.

Non si richiamerà in questa sede il contenuto dei bandi e/o le caratteristiche delle *call* in quanto la maggior parte dei contributi, che attualmente è possibile rinvenire nella pur giovane letteratura di riferimento, descrive ampiamente tali iniziative.

La notevole disponibilità di fondi ha spinto il mondo industriale verso una rinnovata attenzione sull'innovazione urbana ed una corsa alla definizione e formalizzazione del modello di SC.

La SC è divenuto conseguentemente un concetto dai confini difficilmente tracciabili in quanto ogni competenza che abbia in qualche modo a che fare con l'intervento sulla città, propone la propria visione molto spesso poco correlata alle altre.

Ma cosa è una "Smart City"?

In generale è possibile affermare che una SC è una città in cui tutte le risorse siano accessibili attraverso una infrastruttura di rete telematica efficiente ed ove siano disponibili servizi informativi attraverso i quali il cittadino e l'amministrazione possono dialogare (Lyra 2010). Tuttavia non è immediato definire in cosa consista effettivamente la "smartness" di una città ed è sintomatico che gli approfondimenti su tale tema provengano numerosi dal contesto aziendale (si vedano in tal senso gli studi ed i report prodotti da: IBM, Siemens, Oracle, etc., segnalati in sitografia), ma poco presenti nella letteratura riconducibile alle scienze urbane, anche se in alcuni casi esistono prime riflessioni di notevole interesse (Concilio *et alia* 2012). Tale circostanza va ricondotta al fatto che la ricerca e lo sviluppo delle idee si declinano attualmente lontano dal dibattito urbanistico che, ancora una volta, stenta a comprenderne origine, componenti e scenari anche se già dagli anni '90, come si dirà in maniera più estesa nell'immediato seguito, il tema del rapporto fra innovazione tecnologica e trasformazioni urbane e territoriali è stato approfondito da alcuni gruppi di ricerca, ma mai realmente incluso nelle tematiche di riferimento dell'urbanistica nazionale.

Potrebbe essere interessante, alfine di comprendere pienamente o di proporne una definizione confutabile, analizzare il termine *smart* in modo dicotomico rispetto al termine *intelligent*, di matrice anglosassone e ugualmente diffuso.

Entrambi i termini sono stati spesso utilizzati nel campo dell'innovazione per rimarcare un considerevole avanzamento ed una possibilità endogena di strutturare processi cognitivi per risolvere un determinato problema.

Tuttavia pare possibile operare una sostanziale distinzione fra i due termini proprio considerando i percorsi risolutivi. L'aggettivo *intelligent* sembra sottointendere la potenzialità di attivare uno sviluppo di azioni per pervenire alla risoluzione di un problema attraverso l'uso di metodi e informazioni contenuti in una base di conoscenza. In tal senso il termine sembrerebbe naturalmente ricondursi all'innovazione di processo.

Il termine *smart* sembra possedere, oltre al patrimonio cognitivo (magari non strutturato analiticamente), anche le potenzialità per risolvere "operativamente" il problema posto, indicando anche quali "strumenti" materialmente utilizzare a tale scopo. È evidente che in questo caso anche l'innovazione di prodotto contribuisce alla definizione dei percorsi risolutivi. In buona sostanza, mentre *l'intelligent* pensa, elabora e propone quali modelli adottare per pervenire alla soluzione, lo *smart* indica anche come procedere operativamente e quali *device* utilizzare. L'attenzione agli strumenti (sensori) rappresenta una componente fondamentale della SC che non può però essere considerata come l'unica o la prevalente nel nuovo modello urbano (Ratti 2012).

Una città intelligente è anche una città che, utilizzando tra l'altro l'innovazione tecnologica, riesce a spendere meno e meglio senza abbassare la quantità e la qualità dei servizi forniti a cittadini ed imprese (Forum PA, 2011).

In definitiva è forse possibile affermare che la SC è una città in grado di monitorare i fenomeni che in esse si verificano, si generano, evolvono, si spostano e terminano, perché è una città sensibile (Ratti *et alia* 2011). In tale ottica la sensibilità urbana sembra quindi alla base della *smartness*.

Approfondendo il discorso è possibile affermare che la sensibilità della SC debba declinarsi in due dimensioni: una sensibilità tecnologica ed una sensibilità sociale (fig. 1). La prima prevede l'esistenza di elevati standard nell'innovazione di prodotto e di uso della tecnologia all'interno del contesto urbano. In tale dimensione la SC è caratterizzata dalla presenza di sensori in grado di monitorare in tempo reale lo stato del sistema urbano. La seconda implica la presenza nel sistema urbano, ed in particolare nel sottosistema socio-antropico, di un capitale sociale (consapevolezza diffusa) in grado di assicurare il raggiungimento di adeguati livelli di vivibilità attraverso un opportuno uso delle risorse, in primis quella energetica.

L'intersezione delle due dimensioni genera i "sensori antropici" che sono rappresentati dai cittadini che, attraverso tecnologie personalmente gestite (smartphone, tablet, etc.), possono monitorare, riprendere e memorizzare le caratteristiche di un fenomeno urbano.

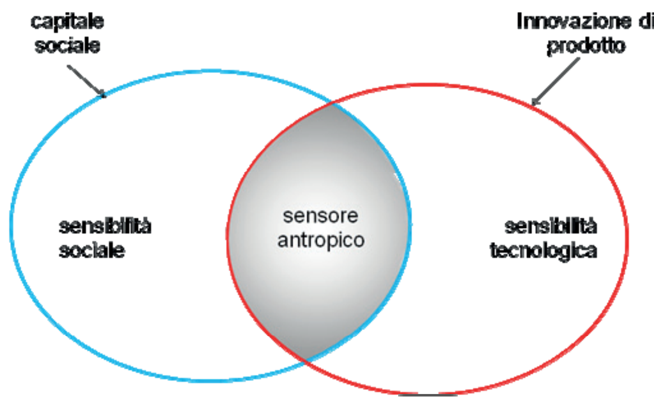


**Fig. 1: Il sensore antropico**

In altri termini i cittadini, che per la prima volta possono referenziare geograficamente la loro posizione sul territorio e condividerla attraverso il *cloud*, divengono sensori "umani" dei fenomeni "urbani" e possono rilevare, segnalare e localizzare malfunzionamenti e discrasie all'interno della città (Sagl *et alia* 2012).

Alcune sperimentazione in tal senso sono già attive ed è questo il concetto generatore del progetto "Urban Membership", lanciato tre anni fa, per consentire ai cittadini di utilizzare un sito attraverso il quale descrivere e comunicare all'amministrazione gli inconvenienti all'interno della città[1].

È evidente che la SC funziona se i dati raccolti vengono poi elaborati per mettere in essere opportuni interventi, ma soprattutto se vengono resi disponibili, in tempo reale alla collettività che può quindi conseguentemente fare delle scelte, prendere delle decisioni e/o definire il proprio comportamento nello spazio urbano (*real time behavioral change*).

La disponibilità di informazioni sullo "stato del sistema" e la possibilità di accedervi facilmente rappresentano condizioni inalienabili per lo sviluppo di una *smartness* urbana. Tale disponibilità di informazioni deve essere verificata in particolare per funzioni vitali quali la mobilità; la conoscenza in tempo reale della posizione dei vettori del trasporto pubblico locale, l'informazione sui livelli di congestione da traffico veicolare nei diversi

1 Il progetto Urban Membership offre la possibilità ai cittadini di segnalare, compilando un form on-line, tipologie diverse di anomalie, discrasie urbane e condizioni di pericolo da quelle riconducibili al sistema funzionale (anomalie nel trasporto pubblico locale, problemi alla reti di servizi, sosta selvaggia, etc.) a quelle segnatamente ascrivibili al sistema fisico (disconnessione del manto stradale, presenza di buche, rifiuti abbandonati, etc.) Il sito è raggiungibile dalla pagina: www.romanofistola.it/free.html cliccando nella sezione Urban Membership.

rami della rete su gomma, la consapevolezza sulla disponibilità di parcheggio presso la destinazione, possono condizionare la scelta relativa alla modalità, al percorso ed ai tempi dello spostamento urbano.
Richiamando l'approccio sistemico all'interpretazione urbana (Fistola 2009) è possibile affermare che da un punto di vista del sottosistema fisico si osserva che nella SC la disponibilità di un accesso diffuso (sperabilmente pubblico) alla rete internet in modalità wi-fi (liberi da vincoli spaziali) e la possibilità offerta dal *clouding,* consentono di superare la necessità di definire un luogo di lavoro.
Inoltre la tecnologia consente un facile recupero di luoghi defunzionalizzati all'interno delle città storiche per realizzare spazi di *temporary working* con disponibilità di attrezzature diverse e funzioni di supporto: caffetteria, parco, palestra, etc..
Nella fase matura della SC la tecnologia dovrebbe divenire totalmente pervasiva, perdendo la sua consistenza materica e scomparendo dalla percezione in quanto tutte le funzioni e i *feed back* sensoriali agiscono in maniera nascosta ed il cittadino può utilizzare i sensi antropici per l'interazione tecnologica, superando cosi anche il problema del *knowledge divide*[2].
In una città realmente smart si ritorna a dar valore alle relazioni interpersonali, non mediate, in quanto la tecnologia e tutt'intorno all'uomo, ma assolutamente invisibile nella sua dimensione hardware.
In conclusione è forse possibile dire che La SC è dunque uno spazio fisico nel quale la tecnologia diffusa, disponibile ed inclusiva supporta la crescita del capitale sociale e consente lo sviluppo di sistemi funzionali che, virtualizzando un certo numero di attività (Fistola, La Rocca 2001), consentono un recupero di spazi e di tempi che possono contribuire ad elevare i livelli di vivibilità del sistema urbano. La presenza di una tale strutturazione urbana consente di veicolare naturalmente la diffusione di comportamenti orientati alla condivisione di valori di solidarietà, alle pratiche del riciclo e riuso, all'utilizzo responsabile delle risorse, al risparmio energetico, alla mitigazione ed all'adattamento ai cambiamenti climatici, che rappresentano fattori strategici per innescare processi neghentropici che contribuiscano ad abbattere i fenomeni entropici che caratterizzano attualmente i sistemi metropolitani del pianeta.

## 3 LA SMART CITY: EVOLUZIONE E PIANIFICAZIONE

L'aggettivo "smart" ha sempre rappresentato la volontà di indicare uno stato "evolutivo" di una specifica tematica riconducibile ai più recenti sviluppi dell'innovazione tecnologica. In passato molte volte tale associazione ha lasciato intravedere dimensioni futuristiche in molti campi dell'attività umana con uno specifico riferimento all'agire ed all'interagire all'interno degli insediamenti umani. Già agli inizi degli anni '90 l'interesse per gli smart building, importato dagli Stati Uniti e dal Giappone, coinvolse una vasta parte degli studiosi italiani e degli operatori dell'edilizia. Tale interesse generò una consistente letteratura ed una ragguardevole produzione di contenitori all'interno dei quali la semplice corrispondenza azione-reazione, governata da sistemi di sensori ed attuatori collocati nell'edificio, sembrava traghettare il contesto edificato (erroneamente identificato con: la città) verso prospettive fino ad allora rappresentate esclusivamente nelle fantascientifiche prefigurazioni di Philip Dick. Tuttavia, già allora un altro tipo di approfondimento, riconducibile allo studio dei sistemi cognitivi ed alle potenzialità dell'applicazione della intelligenza artificiale nei processi di governo delle trasformazioni urbane, considerava l'adozione, e non l'addizione, delle nuove tecnologie per lo sviluppo sostenibile della città.
Già con gli studi dei primi anni 90, raccolti in alcuni volumi ed in un'enciclopedia (Beguinot, Cardarelli 1992), si consideravano le enormi possibilità delle nuove tecnologie che lasciavano intravedere ed immaginare assetti urbani nei quali molte delle attività sul territorio sarebbero state totalmente reingegnerizzate dalla

[2] Un'efficace esempio di interazione sensoriale antropica con dispositivi tecnologici è offerto dai nuovi smart TV che interagiscono con l'utente riconoscendone il volto e offrendo specifiche personalizzazioni o attraverso l'interpretazione dei gesti (magari per cambiare canale o ridurre il volume) o rispondendo a comandi vocali.

telematica. Si intuì che la cablatura in fibra ottica del territorio avrebbe rappresentato un'infrastruttura fondamentale per lo sviluppo delle economie urbane inferendo che le nuove tecnologie avrebbero impattato anche sulla trasformazione dei paradigmi tecnici e scientifici della conoscenza (Papa 1992). Negli anni successivi alcuni studiosi hanno continuato ad approfondire il tema riflettendo sulla possibilità di ridefinire il sistema funzionale urbano grazie alle ICT che nel frattempo andavano rapidamente sviluppandosi in particolare nel campo delle tecnologie di rete (Fistola, 2002).

Tuttavia la comunità urbanistica italiana, come ricordato, ha spostato la propria attenzione verso altri temi probabilmente ritenendo lo studio del rapporto fra nuove tecnologie e trasformazioni del territorio rappresentasse un tema eccessivamente visionario, connesso a sviluppi, quelli della tecnologia, di difficile previsione e forse troppo lontano dalle esigenze concrete e immediate del territorio.

In tal senso potrebbe affermarsi che una parte della crisi che l`urbanistica italiana attraversa attualmente è riconducibile all'incapacità, dei decenni passati, di superare il rigido dibattito sul piano e sviluppare una visione "aperta" ed un pensiero "lungo" sugli scenari territoriali (Benevolo 2012).

Negli studi di allora, di cui il gruppo di ricerca coordinato da Corrado Beguinot era promotore, è possibile ritrovare alcuni elementi, successivamente obliati, che appaiono fondanti rispetto all'attuale approfondimento sulle *smart cities*:

- la necessità di un approccio olistico allo studio della città;
- l'adozione della teoria della complessità e della logica sistemica che consente di interpretare la città come sistema dinamicamente complesso;
- lo studio delle potenzialità dell'innovazione tecnologica considerata come elemento propulsivo ed evolutivo del sistema delle funzioni urbane;
- l'intuizione delle potenzialità dei flussi informativi e della rete telematica come infrastruttura portante nella nuova dimensione urbana;
- l'identificazione del sotto-sistema socio-antropico come determinante nella nuova prospettiva urbana;
- la necessità di elaborare nuovi sviluppi della disciplina urbanistica per poter efficacemente governare le trasformazioni del sistema urbano anche indotte dalla diffusione delle nuove tecnologie dell'informazione e della comunicazione.

Accanto a tali considerazioni può essere indicativo, alfine di comprendere compiutamente le caratteristiche della SC, analizzare l'evoluzione urbana in considerazione all'economia di riferimento di ciascun assetto storico ed ai processi di pianificazione urbanistica e governo delle trasformazioni posti in atto (fig. 2).

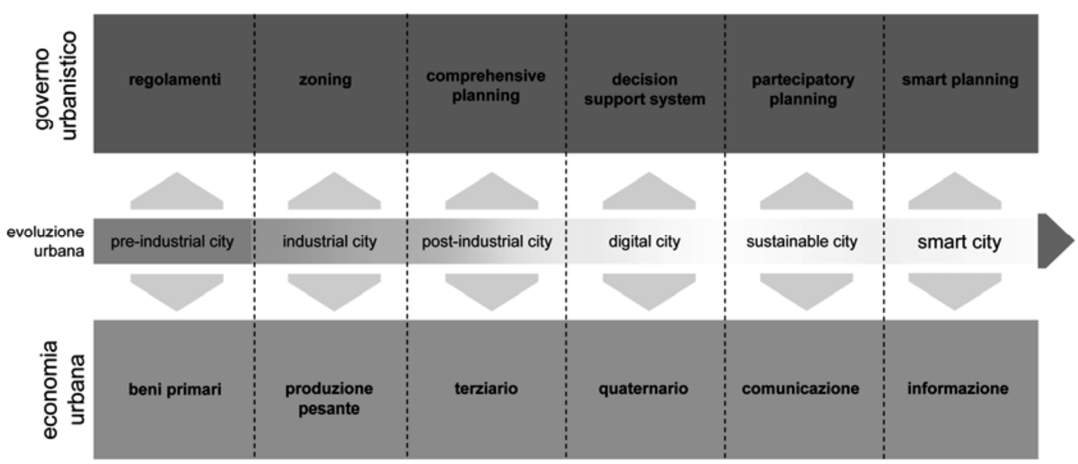


**Fig. 2: L'evoluzione urbana dalla città pre-industriale alla smart city analizzata in rapporto all'economia urbana ed al governo urbanistico**

La città pre-industriale era sostanzialmente basata sull'economie di produzione primaria e di scambio e veniva governata da norme e regolamenti riconducibili al governo monocratico. La città ottocentesca scopre le prime forme di economia industriale e intuisce la necessità di dotarsi di metodi per regolare destinazione ed intensità d'uso dei territori urbani attivando prime forme di intervento urbanistico che si concretizzerà successivamente nello *zoning*.
La città post-industriale governa le trasformazioni del sistema urbano attraverso il *comprehensive planning* di matrice anglosassone e individua la sua base produttiva nei servizi.
Successivamente la città, che subisce il potente impatto delle nuove tecnologie info-telematiche, smaterializza ulteriormente i beni di produzione, producendo, elaborando e scambiando informazione. In questo passaggio storico dell'evoluzione urbana sono le basi cognitive e gli strumenti di supporto alla decisione a divenire di riferimento per la pianificazione urbanistica.
I passaggi più recenti sono quello della *sustainable city*, che affida al *partecipatory planning* ed ai processi valutativi il proprio governo, ma non riesce a trasformare concretamente in tal senso l'economia urbana.
Infine la *smart city*: in questo assetto il governo è affidato all'informazione sulla modificazione delle funzioni urbane, raccolta in *real time* all'interno del sistema urbano. La città diviene *seanseable* in grado di fornire, istante per istante, dati sullo stato delle proprie componenti sulle quali si può intervenire tempestivamente per abbattere le entropie e reindirizzare la trasformazione.
Se si osserva l'intero sviluppo descritto si rileva che l'elemento del processo di governo che tende ad una costante contrazione nei diversi passaggi evolutivi è: il tempo; con maggior dettaglio è possibile affermare che si riduce progressivamente il tempo che intercorre fra l'analisi degli assetti urbani e la predisposizione di azioni di governo che, nella SC tende a zero. Tale considerazione sembra conseguentemente privare di senso e considerare inefficaci i metodi e gli strumenti canonici di pianificazione del territorio. È per questo che diviene oggi urgente, riconsiderando le mutate condizioni del sistema, ripensare totalmente i processi di governo delle trasformazioni urbane e territoriali allontanando l'ipotesi che la nuova dimensione smart della città non richieda azioni di indirizzo, consapevole e compatibile con le risorse, del sistema urbano.

## 4 OGNI CITTÀ PUÒ ESSERE SMART?

Da quanto detto e considerando le caratteristiche descritte appare evidente che sistemi urbani affetti da consistenti processi entropici non possano sviluppare un opportuno potenziale di *smartness* al loro interno. In tal senso lascia perplessi la quantità di iniziative italiane che propongono scenari smart per città quotidianamente sull'orlo della crisi strutturale (Papa *et alia* 1995).
Nella volontà di definire un primo orientamento anche in tale ambito è possibile affermare che la SC può essere definita relativamente a tre fattori:

- Dimensione
- Organizzazione
- Funzionamento

Esistono molte iniziative che propongono l'attuazione di una dimensione smart per città di grandi dimensioni che sicuramente posseggono le vocazioni territoriali per tale sviluppo, ma che devono prioritariamente considerare l'esistenza di condizioni ostative alla *smartness* riconducibili alle entropie urbane.
La città intermedia, come definita da Thomas Sieverts ed in altri studi (Papa, Piscopo 1998), compresa in una dotazione demografica fra i 50 ed i 200 mila abitanti, in generale paiono poter più facilmente attivare la *smartness* in quanto caratterizzate da un tessuto urbano non eccessivamente esteso ed in molti casi dotate di funzioni di livello metropolitano. Per le città di piccole dimensioni invece è forse eccessivo parlare di riconfigurazione smart, ma può essere più utile riferirsi a politiche ed interventi che, anche attraverso le

nuove tecnologie dell'informazione e della comunicazione, orientino il sistema verso stati sostenibili ed efficienti. Per quanto attiene all'organizzazione tale fattore descrive la necessità che all'interno del contesto urbano esista un'infrastruttura digitale a supporto del trasferimento dell'informazione e che vi sia la predisposizione per realizzare *smart grid* per il controllo energetico. Infine il funzionamento della città deve essere caratterizzato da processi neghentropici, con un'elevata resilienza sistemica ed una diffusa sostenibilità delle traiettorie evolutive.

I fattori citati consentono di individuare sistemi urbani predisposti allo svilupparsi della dimensione smart di una città per la quale esistono inoltre alcune altre precondizioni che possono essere suddivise in precondizioni di processo e precondizioni di sistema.

Le precondizioni di processo assicurano che all'interno del sistema non siano attive entropie urbane potenzialmente in grado di comprometterne la dinamica evolutiva verso stati caratterizzati da elevati livelli di vivibilità.

Le precondizioni sistemiche sono strettamente riconducibili agli assetti dei sottosistemi urbani che devono essere caratterizzati da elementi e condizioni generati dall'adozione dell'innovazione tecnologica all'interno del generale processo evolutivo del sistema urbano. Per ciascun sottosistema possono essere individuati, tra gli altri, alcuni fattori strutturali:

*sistema fisico*

- presenza di un'infrastruttura telematica
- possibilità di realizzare *smart grid*
- presenza di una rete di sensori sul territorio urbano

*sistema funzionale:*

- attivazione di politiche di *e-governance*
- disponibilità di open data
- possibilità di accedere al *free internet*

*sistema socio-antropico*

- sviluppo del capitale sociale
- abbattimento del *digital divide*
- diffusione del *crowdsourcing*

Considerando quanto esposto è anche possibile affermare che il *clouding* rappresenta l'omologo nel ciberspazio della rete telematica presente all'interno della città. I sensori antropici e tecnologici costituiscono il link di connessione fra le due dimensioni informative necessarie alla SC.

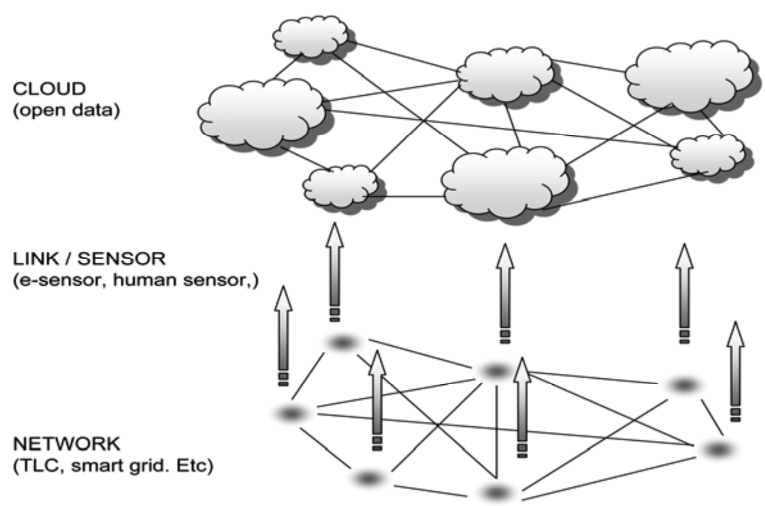


**Fig. 3: I sensori antropici e tecnologici come elementi di connessione fra l'infrastruttura telematica ed il cloud**

Come visto l'approccio sistemico costituisce il riferimento paradigmatico più idoneo per l'interpretazione della nuova struttura urbana ed è anche possibile rappresentare concettualmente l'integrazione fra le diverse dimensioni. Tale integrazione è assicurata dall'esistenza di elementi di connessione quali: l'infrastruttura di rete, il link sensoriale, il cloud.

Richiamando anche il sottosistema geo-morfologico, rappresentato dal supporto fisico, dagli elementi e dalle connessioni sul territorio, si può immaginare come tutte le dotazioni infrastrutturali di rete (fibra ottica, smart grid, etc.) possano essere integrate all'interno di tale primo strato materico (fig. 4) in quanto operativamente collocate nel sottosuolo urbano. Su tale sistema è posizionato il sistema fisico della città che contiene gli spazi (aperti o contenenti) ed i canali di connessione fra questi. Nell'insieme dei canali vanno considerate anche le reti infrastrutturali oltre ai dispositivi (antenne wifi, sensori) che divengono l'elemento concatenante fra i due sistemi. All'interno degli spazi urbani (aperti o chiusi) si collocano le attività che definiscono complessivamente il sistema funzionale. La connessione fra sistema funzionale e cloud è assicurata dal link, altrove definito: "sistema comunicazionale", che consente anche lo svilupparsi dei processi di virtualizzazione delle funzioni di cui si dirà nell'immediato seguito. Va infine, ancora sottolineato, che il sistema socio-antropico rappresenta il determinante di base per qualsiasi riarticolazione dell'insediamento umano. Tuttavia nel nuovo assetto smart la tecnologia, gestita dall'uomo, gioca un ruolo fondamentale per lo sviluppo sostenibile del sistema ed il il cloud rappresenta lo strato più alto della struttura della SC senza il quale tale articolazione non potrebbe esistere.

La considerazione delle precondizioni per lo sviluppo della SC conduce naturalmente alla necessità di pensare, seppur in prima approssimazione, ad una riconfigurazione generale del processo urbanistico per il governo del sistema urbano che ora deve tener conto della nuova dimensione del cloud che rappresenta un utilissimo supporto per il *retrival*, l'elaborazione e la finalizzazione dell'informazione, in tempo reale, utile alla tempestiva definizione delle scelte.

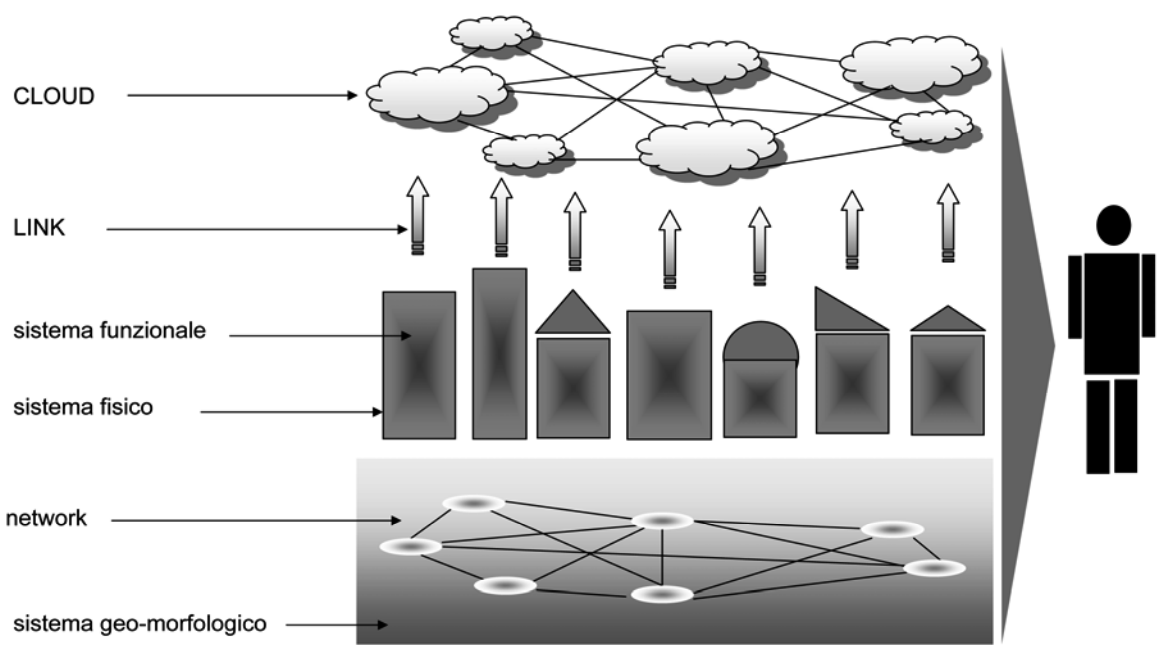


**Fig. 4: L'integrazione dei sottosistemi urbani con gli elementi della smart city**

## 5 L'URBANISTICA NELLE NUVOLE

Il nuovo approccio per comprendere e prefigurare procedure efficaci di governo della SC deriva, per quanto esposto, quindi dall'interpretazione sistemica della città e dagli sviluppi teorici che tale paradigma ha generato nel tempo. La rete rappresenta l'infrastruttura necessaria sulla quale individuare la *smartness* urbana. Pare tuttavia possibile fornire una nuova interpretazione del rapporto fra rete e città proponendo un'analogia con il sistema neuronale umano (fig. 5)

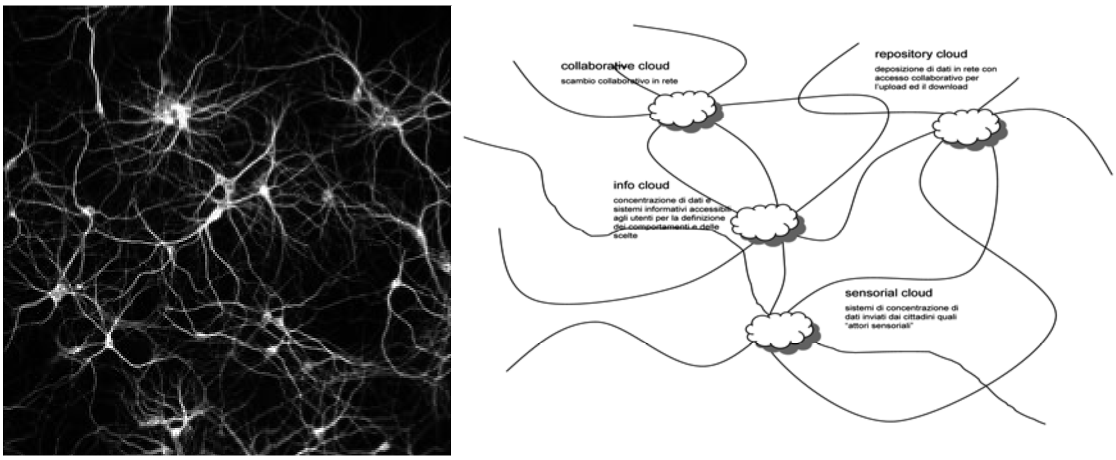


**Fig. 5: Il sistema neuronale umano analogo all'articolazione del clouding di rete**

Principalmente va richiamato il concetto di "virtualizzazione funzionale" (Fistola 2001) che riesce a connettere efficacemente i processi di reingegnerizzazione info/telematica delle funzioni urbane con la nascita del *clouding,* principale riferimento per l'esistenza della SC. La virtualizzazione funzionale è il fenomeno che viene a generarsi a causa dell'introduzione delle nuove tecnologie info-telematiche all'interno dei sistemi urbani.

Il sottosistema funzionale viene impattato prioritariamente dai potenziali delle nuove tecnologie ed alcune funzioni si trasferiscono dalla realtà fisica al ciberspazio, come è avvenuto, in toto o in parte, per molte attività urbane: banche, uffici amministrativi, uffici postali, agenzie turistiche, etc..

Una parte o tutta l'attività urbana perde la sua fisicità di allocazione, l'interrelazione fisica e diviene virtuale, trasparente, come una nuvola trasferendosi dal livello della città reale a quello del cloud dove rappresenta un "nodo di attività", uno dei poli a nuvola interconnesso con tutti gli altri.

Ciascuna di queste nuvole può essere conseguentemente classificata a seconda delle specificità che ricopre.

In altre parole è possibile distinguere, in prima analisi, quattro tipologie di nuvole:

- nuvole che consentono lo scambio collaborativo di contenuti (*collaborative cloud*) che vengono create per supportare processi di produzione e sviluppo di protocolli orientati a soluzioni specifiche;
- nuvole che raccolgono informazioni generali sullo "stato" del sistema urbano (*info cloud*) in generale generate, in maniera automatica, dai sensori esogeni ubicati all'interno della città e che consentono agli attori urbani di definire specifici processi di scelta in relazione ai propri obiettivi;
- nuvole che costituiscono dei veri e propri data-base informativi (*repository cloud*) ai quali gli utenti urbani possono accedere per scaricare contenuti o inviare dati utili alla costituzione strutturata dell'informazione utilizzabile da altri utenti;
- nuvole (*sensorial cloud*) che raccolgono i dati inviati dai sensori antropici (cittadini) che rilevano svilupparsi di fenomeni o segnalano, in maniera georeferenziata, la presenza di un'entropia urbana consentendo la modifica delle interazioni degli altri utenti all'interno della città.

È evidente che la tassonomia proposta è di pura utilità interpretativa in quanto il concetto stesso di *clouding* porta ad una considerazione olistica di quanto presente nella nuvola.
La SC e le sue componenti strutturali devono innestarsi su di un supporto fisico, funzionale e socio-antropico privo di eccessive entropie sistemiche che potrebbero vanificarne gli effetti per lo sviluppo o generare uno sviluppo parziale solo di alcune componenti.
Il sistema urbano va indirizzato verso stati compatibili con le risorse disponibili evitando che la propria traiettoria evolutiva, determinata dalla sequenza degli stati assunti nella dinamica di trasformazione spazio-temporale, decada in quelle che sono state individuate come zone antropiche ove si generano processi di degrado del sistema che, se non opportunamente contrastati utilizzando energie e risorse disponibili, compromettono l'evoluzione della città (Fistola 2009).
Una strutturazione in SC produce un effetto di abbattimento delle zone antropiche in quanto, il continuo feed-back dei sensori urbani, produce un controllo in tempo reale della traiettoria (prioritariamente funzionale) del sistema urbano (fig. 6).
Tale monitoraggio consente di rilevare in tempo reale la generazione di entropie urbane sulle quali è possibile agire tempestivamente riducendo cosi i tempi di implementazione delle azioni di governo delle trasformazioni.
Il monitoraggio, con la gestione e la valutazione, diviene un momento fondante della nuova pianificazione (Mazzeo 2012). Tuttavia, se si adotta tale approccio, si deve conseguentemente assumere che nella SC non sia più attuabile la pianificazione urbanistica canonicamente intesa ed attualmente messa in essere sul territorio nazionale. Vanno definite nuove procedure in grado di governare, attraverso l'adozione delle nuove tecnologie info-telematiche, l'evoluzione del sistema.
Tali procedure possono essere comprese sotto il nome di *smart planning* che rappresenta una radicale riconsiderazione delle politiche, strumenti ed azioni di governo del territorio affatto dissimili e probabilmente assai lontane dal concetto di piano urbanistico come oggi inteso.

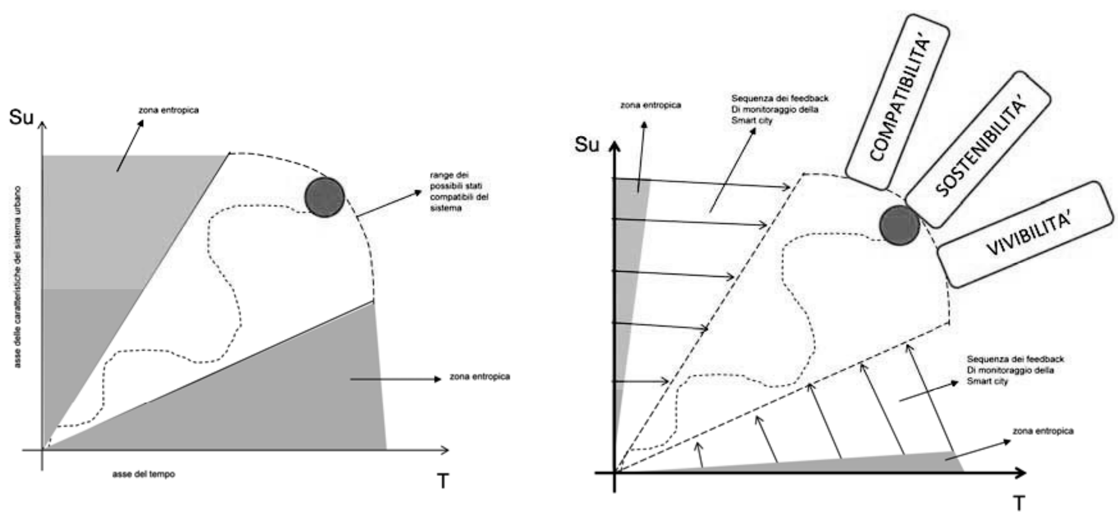


**Fig. 6: La traiettoria evolutiva del sistema urbano nella concezione classica (a sinistra) e nel nuovo assetto della smart city ove le zone entropiche si contraggono grazie al monitoraggio in tempo reale delle condizioni e della traiettoria evolutiva**

## 6 CONCLUSIONI

Al termine di queste riflessioni è possibile dire che la SC rappresenta una nuova dimensione urbana che va costruita attraverso l'inclusione consapevole dell'innovazione tecnologica nella struttura sistemica della città. In tale dimensione la tecnologia non sostituisce l'uomo nello sviluppo delle attività, ma consente l'attivazione di processi neghentropici quali: l'incremento del capitale sociale attraverso una modernizzazione inclusiva, il consapevole utilizzo delle risorse e lo sviluppo di energie alternative, la virtualizzazione funzionale orientata alla riduzione dell'intensità d'uso sul territorio, l'adozione diffusa di etiche di mobilità sostenibile, etc., in grado di contrastare l'insorgere di entropie urbane e favorire uno sviluppo sostenibile e compatibile della città. La *senseable city*, che molti identificano come generatrice della SC, è dunque una città sensibile non solo in forza della sua dotazione sensoristica, ma in quanto in grado di innescare nuove etiche e percezioni nel sistema socio-antropico che diviene, attraverso i sensori antropici, rilevatore e controllore dei livelli di vivibilità urbana.
È, quindi, vero che la SC è in grado di monitorare, in tempo reale, le condizioni delle sue variabili ed intervenire tempestivamente su eventuali generazioni entropiche, ma tale potenzialità non esclude la necessità di dover definire le modalità e le azioni dell'intervento urbanistico e, più in generale, la prefigurazione delle traiettorie di sviluppo del sistema verso stati compatibili/sostenibili.
È invece importante, come si è tentato di mostrare, recuperare le caratteristiche dell'approccio sistemico al governo delle trasformazioni territoriali in particolare considerando le nuove potenzialità tecnologiche quali il cloud. Il superamento del piano classico, che ha mostrato nel tempo tutta la sua inefficacia, deve avvenire attraverso la logica innovata del governo delle trasformazioni che va attuato attraverso l'adozione dell'innovazione tecnologica nella definizione dei processi di controllo dell'evoluzione sistemica.
Al termine di queste riflessioni e con l'intento di favorire ulteriori approfondimenti si ritiene utile discostarsi dalla definizione di SC nata in ambito aziendale e provare a sviluppare all'interno del campo delle scienze urbane, considerando anche l'approccio descritto, un'ipotesi per nuovi processi di governo del sistema.
Solo cosi si ricostruisce uno sviluppo organico dell'approfondimento scientifico/disciplinare e si riconsegna all'urbanista innovatore il ruolo di riferimento nella proposizione di azioni complesse utili al governo sostenibile delle trasformazioni urbane e territoriali.

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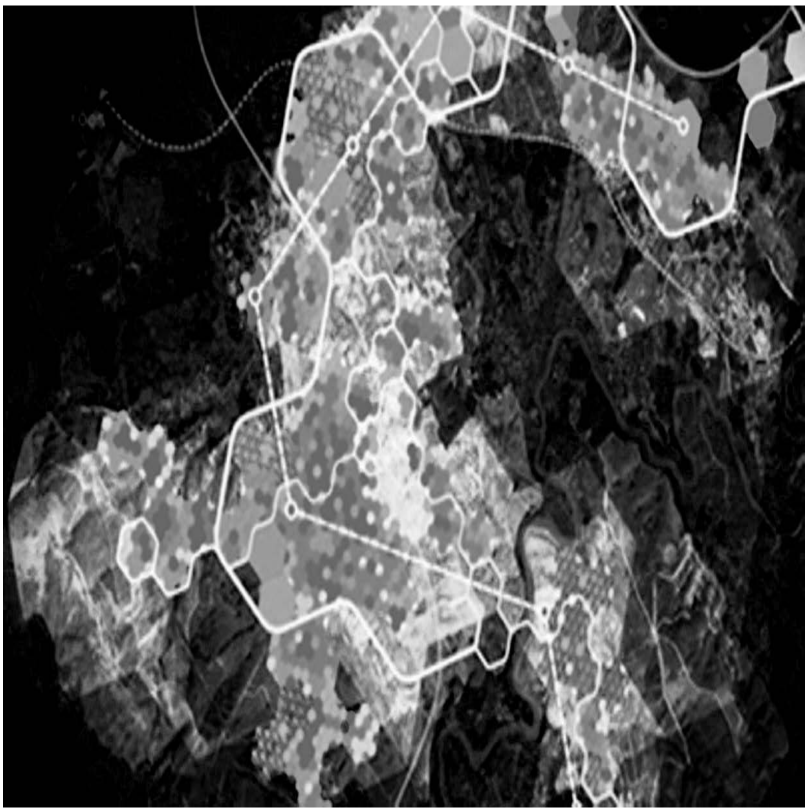
TeMA

Journal of
Land Use, Mobility and Environment

TeMA 1 (2013) 61-72
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1455

review paper received 09 February 2013, accepted 8 April 2013

www.tema.unina.it



# EUROPEAN STRATEGIES FOR SMARTER CITIES

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ABSTRACT

Cities and regions must tackle the challenges set by the radical change in our society and in our economy, aiming to develop effective public policies and boost their managerial, evaluation and planning skills. Therefore, it is essential to put a new idea of city at the centre of the smart strategies in order to bring policies back to their former central position, since technologies alone cannot generate welfare and prosperity. We are in a new phase of urban growth centred on the economy of services characterized by widespread digital technologies and new innovative organization patterns, which encourage the participation in the civic policy processes through the realization of structures to share information and data so as to define intervention policies. The most recent studies and trials about innovation and competitiveness, such as the examples illustrated in the present work (Amsterdam, Paredes, Aarhus and Gent), show a growing interest in measuring the relationship between innovation and economic growth at various territorial levels, key factors in conceiving inclusive smart strategies, linked to principles of sustainability and territorial cohesion, and building smarter cities. In the light of these remarks, the article is divided into three main parts: the first part is focussed on the above-mentioned central issues of the international debate; the second part examines four significant European initiatives; the third part draws preliminary conclusions and directions for further research.

KEYWORDS:
European cities; ICT; Innovation; Participation; Smart strategies for sustainability.

## 1 CITIES, SUSTAINABLE DEVELOPMENT AND INNOVATION: CHALLENGES AND OPPORTUNITIES OF A COMPLEX AND FUNDAMENTAL RELATIONSHIP

On a worldwide scale, cities and regions must tackle the challenges set by the radical change in our society and in our economy, aiming to develop effective public policies and boost their managerial, evaluation and planning skills.

According to data of the United States Department of Economic and Social Affairs, in 2007 for the first time in human history, 50% of the entire global population lived in urban areas, while only a century ago this figure stood at 13%, and it is now predicted to reach 69% by 2050. Besides, with a population share of just above 50 % but occupying less than 2 per cent of the earth's surface, urban areas concentrate 80 % of economic output, between 60 and 80 % of energy consumption, and approximately 75 % of $CO_2$ emissions (European Union). Therefore, cities have to cope with negative effects of urbanisation and international division of labour (urban sprawl and spatial disparities, congestion and pollution, social issues and distressed areas) but, they also have to produce proactive actions to improve and sustain their competitiveness position and foster agglomeration economies.

The urban paradox is evident in the hard and conflicting coexistence of dynamic growth and social exclusion in urban regions. This may be overcome thanks to strategies and common actions aimed at pursuing an urban and territorial competitiveness based on the key factors of environment quality and multilevel governance, and at implementing urban policies within a regional and national framework, which may involve all the citizens and enhance potential and peculiarities of the different urban areas (OECD and China Development Research Foundation 2010).

The phenomenon of urbanization is of the utmost importance in relation to the global and local interactions between population, environment and development, to such an extent that any reflection concerning the elaboration of possible sustainable development patterns leads to wonder about the future of cities. In the last two decades these have turned into increasingly important decision-making and strategic centres owing to the growing role that services and finance play in the world economy (Sassen, 2012). Therefore, the governance of the new cities should be based on a strategic development vision which takes into account both the global space of flows and the local one of physical spaces, with a view to finding a dynamic balance between the contradictory expressions of the values and interests of the numerous subjects living and operating in them. Thus, it is necessary to aim at the enhancement of urban common assets and at the creation of technological infrastructure which may connect people and objects, integrate information, foster social inclusion and improve the quality of urban life. This is why data, their accessibility and their reliability are of particular significance in the smart city. Moreover, the way data are used to study the city and plan urban policies in a perspective of collaboration with the citizens (CITTALIA-Fondazione ANCI Ricerche) is not a minor aspect, either. Cities must take upon themselves the difficult task to combine needs, resources and expertise by means of an adequate planning and, at the same time, play an active role within international networks. In short, accessibility and reliability of data as well as the way these are used must be oriented in such a manner as to discover and appraise the city itself, thus enhancing civic culture and social capital.

If the enormous potential of modern technologies the smart city can rely on should only be applied to reduce pollution or accelerate the use of information to have access to services, without aiming first at job creation and, consequently, at wealth creation, we will soon have to cope with the contradiction of a far better and healthier but also poorer and weaker city to live in. Meanwhile, this view of the future cannot disregard the ever-growing inequalities within the cities and must inevitably concentrate on the reduction of gaps, related not only to technology, but above all to the unequal possibilities of access reserved to the various social classes.

Some local governments are particularly active in the diffusion of their urban management practices (urban governance flows) through cooperation and, in promoting this exchange of practices, they intervene in global governance and act as network-makers or sub-nodes of the global governance network. Furthermore, on an international level, many cities are pursuing the goal to become "smart", in the broadest sense of the concept with its multiple structuring elements - smart economy, smart people, smart governance, smart mobility, smart environment, smart living –, by working in synergy with local public and private actors to build a project and operational platform which enables them to produce high technology, reduce building energy consumption, promote clean transport and improve the overall quality of life of its inhabitants focusing on low CO2 emissions.  In many cases (CITTALIA-Fondazione ANCI Ricerche, 2012), ICT tools have been used successfully in order to improve liveability, boost townspeople's participation and upgrade their use of urban areas. Similarly, innovative research has proved capable of attracting investments in order to create real knowledge and sustainable cities through green innovation. Anyway, it is essential to put a new idea of city at the centre of the smart strategies in order to bring policies back to their former central position, since technologies alone cannot generate welfare and prosperity. Local leadership, integrated planning and a rich social fabric go hand in hand, the social capital being able to produce an added value for the cities. The main point is not introducing new sensors in the cities so much as better using the existing ones with a view to implement an efficient data management system within an organized pattern aiming at joint work between administration and citizens. We are exactly in a new phase of urban growth centred on the economy of services characterized by widespread digital technologies and new innovative organization patterns, which encourage the participation in the civic policy processes through the realization of structures to share information and data so as to define intervention policies.

The path towards the building of the economic and social vocation of an intelligent city cannot be traced any longer by few people operating on their own, although they are influential; in fact, citizens should be increasingly involved in those policies where they play both the role of receivers and the role of (co)producers.

## 2 EUROPEAN UNION'S POLICIES FOR SMART AND INCLUSIVE GROWTH

Although, according to the Mercer 2012 Quality of Living Survey, European cities represent over half the cities amongst the top 25 in the ranking, the global economic and financial crisis has meant that Europe is faced with some serious structural challenges, which can only be addressed by profound structural reforms and renewal and by a comprehensive and joint effort to construct smart, sustainable and inclusive growth.

Since, as everybody knows, the current economic, financial and debt crisis has a serious effect on local and regional budgets, coordination between European, national and local policies and their financial support are to be considered more important than ever.

The surveys carried out by Europe 2020 monitoring platform offer a great variety of examples of policies pursuing the aim of a sustainable growth. Most of them focus on targets 20-20-20 (reduction of emissions, reduction of energy consumption and wider use of renewable energies); others aim to provide additional indicators which could contribute to leading local and regional authorities towards a greater growth and more jobs in a low-carbon society, including the estimate of the carbon dioxide footprint of a community. Several cities belonging to Covenant of Mayors are now working out or putting into effect action plans linked to sustainable energy. In the field of industrial policy, some projects aim to improve the business environment through the provision of services oriented towards an environmentally-friendly growth; for instance, other actions concern water management to protect coastal areas against inundation and provide fresh water even through the recovery of rainwater. Thus, policies, strategies, experiences adopted at a local and regional level belong to a wider strategy at European level promoting the interaction between the Horizon 2020 Programme and the CSF funds, in order to develop Smart Specialisation Strategies at the regional level and to reinforce the interaction between research and innovation agents and businesses on the ground.

The most recent studies about innovation and competitiveness show a growing interest in measuring and illustrating the relationship between innovation and economic growth at various territorial levels, key factors in conceiving inclusive smart strategies, linked to principles of sustainability and territorial cohesion. Regional innovation, in particular, has been placed at the heart of the 2020 strategy as Europe's competitiveness and capacity to create new jobs depends on driving innovation in products and services. It is also the best means of successfully tackling major societal challenges, such as climate change and energy efficiency (European Commission, 2012).

The European Commission's proposals for the 2014-2020 programming period invite Member States and regions to unlock the power of innovation by drawing up comprehensive research and innovation strategies for smart specialisation, that has been proposed as a pre-condition for using European Regional Development Funds (ERDF) for the next programming period. The aim is to catalyse a strategic process, whereby each Member State or region identifies those knowledge-based investments that are most likely to deliver growth and jobs and to do this through a broadly-based process of direct stakeholder involvement, including knowledge providers and entrepreneurs in the regions. Such entrepreneurial discovery process is about working with the business sector to identify the specific actions needed to upgrade existing clusters through Research, Technological Development & Innovation (RTDI) investments. It is also about creating an environment in which entrepreneurs have an incentive to explore the economic potential in those domains that have been identified for a region as being the most promising. The smart specialisation conditionality and the reinforced partnership during all stages of programming and implementation of the Structural Funds that goes with it, is essential to deliver better performance and more impact for the Funds.

In October 2011 plenary session, as requested by the Polish presidency of the Council of the European Union, the Committee of the Regions (CoR) adopted an opinion entitled The Role of Local and Regional Authorities in Achieving the Objectives of the Europe 2020 Strategy where, among the main recommendations, the 'triple helix' concept for a partnership between the academic world, businesses and local authorities represents a model for a coherent development of regions and cities. European programmes and current actions, at urban and regional level, concerning different thematic areas (innovation policy, digital agenda, climate change, social inclusion), implement the European strategy's three priorities of smart, sustainable and inclusive growth.

Ultimately - thanks to the formulation and implementation of smart strategies changing the Cities and Regions of tomorrow into platforms for smart and sustainable development, innovation, democracy, cultural dialogue and diversity - cities and regions can successfully face the numerous and complex challenges they have to cope with in order to preserve and increase their standard of prosperity in an ever-changing reality characterized by a global economic crisis and by many other critical factors: States coming to the rescue of banks; ageing populations threatening the competitiveness of our economies and the sustainability of our social models; downward pressure on costs and wages; the challenges of climate change and increasing energy dependence; and the Eastward shift in the global distribution of production and savings, and, above all, threats of terrorism, organized crime and the proliferation of weapons of mass destruction hang over us (European Union, 2010).

## 3 THE CITIES AS LABORATORIES OF INNOVATION: A COMPARISON OF EUROPEAN EXPERIENCES

A great number of European cities are doing their utmost to become smart, much has been said about this subject as well as several initiatives have been taken at European level to point out the features of a smart city. "Smart cities & communities European innovation partnership (SCC)" (European Commission 2012) is among these. It is a partnership across the areas of energy, transport, information and communication with the objective to catalyze progress in areas where energy production, distribution and use, mobility and transport and information and communication technologies (ICT) are intimately linked and offer new interdisciplinary opportunities to improve services while reducing energy and resource consumption and greenhouse gas (GHG) and other polluting emissions. This initiative will be restricted to a couple of demonstration projects which will be carried out in association with the cities. Starting from the observation that almost three quarters of Europeans live in urban areas consuming almost 70% of the EU's energy, smart urban technologies can make a major contribution to tackling many urban challenges through better provisioning and less waste. That is why for 2013 alone, € 365 million in EU funds (compared to 81 million in 2012) have been earmarked for the demonstration of these types of urban technology solutions. Currently many obstacles limit the potential of innovative smart technologies, for example high technological risk, difficulties over uncertain returns on investment or regulatory difficulties. In practical terms, EU will help to establish strategic partnerships between those industries and European cities to develop and roll out the urban systems and infrastructures of tomorrow. Projects will receive funding mainly in the construction sector and in urban mobility. Moreover, analyzing the ideas at the heart of the theoretical debate on smart city, it is worth considering a "bottom-up" concept of smart cities in which citizens themselves take steps to improve the life of the city. The promoter of this concept is the American scholar Henry Jenkins, professor at University of Southern California. He proposes the idea of a "new civic ecology" that not only focuses on the transmission of information but that takes into account rituals that reinforce a sense of social and cultural belonging. He says: "Civic ecology is the way citizens shape the information that circulates and how they use it for decisions. This can come about on various levels depending on how the tools of communication are used" (Jenkins 2006). To achieve the hoped-for scenario, it is necessary to maximize the circulation of important and credible information and make citizens more aware of it and willing to use it firsthand. In Italy, a response to the exciting experiments mentioned by Jenkins can be seen in proposals for the reconstruction of L'Aquila, where the goal was to encourage projects and "bottom-up" ideas to help revitalize the city of Abruzzo destroyed by the earthquake.In this work some examples of smart cities are taken into account since they share the prevalence of two main aspects making them smart: technology and participation. These aspects were also highlighted for their significance in SCC partnership and within the concept of "civic ecology" by Jenkins. Then, in the four analyzed cases, these two main aspects are applied to achieve different specific goals. Three of these cities – **Amsterdam**, **Aarhus**, **Gent** – are located in Northern Europe and one of them, **Paredes**, is in Portugal. The use of highly innovative technologies characterizes all the cities. As to Amsterdam, these technologies focus on CO2 reduction; as to Paredes, they aim at urban regeneration and development; whereas in the case of Aarhus, the innovative technologies propose patterns of business and policies whose results everybody can benefit from. Finally, in the case of Gent, technologies are applied in order to consolidate the instruments of e-democracy and e-participation aimed at strengthening cooperation between citizens and general government (CITTALIA-Fondazione ANCI Ricerche 2012).


Fig. 1: Amsterdam Smart City, location of the main projects

The city of **Amsterdam** (Amsterdam Smart City, http://amsterdamsmartcity.com/) has developed the initiative Amsterdam Smart City, a unique partnership between businesses, authorities and the people of Amsterdam whose goal is to reduce CO2 emissions by means of a package of actions carried out over the urban area. Technologic innovation and improvement of the quality of life go hand in hand in the strategy of this initiative.

Amsterdam has always been concerned about the issues of urban sustainability, and has chosen to concentrate not only on mobility and urban regeneration, but also on energy and technology efficiency in order to foster a bottom-up approach to share policies and actions. The results of *Amsterdam Smart City* actions will also help to achieve the goals of New Amsterdam Climate, the intervention plan which will reduce CO2 emissions by 40% within 2025 through targeted projects in private building and transport sectors and in the planning of urban spaces. Although the numerous projects in progress are all aimed at reducing urban emissions, they can be divided into three different types. All the types involve the citizens favouring the knowledge of their private consumptions for learning to manage them better. All the projects have found large consent from the citizens. The first includes energy management actions aimed at enabling the residents to become more aware of their private energy consumption. This is the target of *West Orange* and *Genzenveld* projects, the former involving four hundred homes and the latter five hundred homes, which have been provided with new energy meters with an additional energy feedback display containing tips and guidelines to improve their energy consumption at home. The Smart Challenger project, on the contrary, is an attempt to spread a greater awareness of energy consumptions among the employees of local companies through the use of new technologies. Moreover, thanks to the *Ship to Grid* project, about two hundred stations have been set up so that vessels may be connected to the electric grid for power when docked. Thus, ship's devices are supplied by a clean source of energy with no need for polluting diesel generators. A second type of projects is aimed at promoting autonomous energy supply. For instance, *Onze Energie* is fostering a collaborative energy supply for the residents of North Amsterdam, who, by joining the programme buying low shares, can buy green energy generated by windmills that are situated in the surrounding areas. This assures considerable savings and involvement in the decision-making process of the local consortium, which aims at supplying 20% of local households with green energy. Numerous energy supply initiatives have concerned public and private buildings, combining design and technological innovation

in order to improve energy performances in the wide built heritage of the Dutch capital. The introduction of the Fuel Cell Technology stands out among these interventions: it has replaced the traditional fossil fuel plants in a 17th-century building leading to over 50% emission savings. Following this pilot action, the intention is to extend this system to a large number of private buildings enabling them to generate the energy they consume. Finally, the *Utrechtsestraat Climate Street* initiative aims at reducing CO2 emissions through the action of forty entrepreneurs from the homonymous neighbourhood, who have contributed to mapping emissions and to progressively installing Smart meters and Smart plugs to reduce consumptions. At the same time, the installation of energy-saving lighting systems in the streets and at the tram stops has contributed to making public spaces energy-efficient. This case and those mentioned above share a common thread with the other actions of Amsterdam Smart City: citizens' participation, which has found its visibility in the transformation of Utrechtsestraat into the first sustainable and participatory commercial street in Europe.
Through the initiative *Living PlanIT*, the city of **Paredes** (http://living-planit.com/default.htm) has relied on the most innovative technologies to become an open-air laboratory of urban development which is obtaining results, to be exported all over the world, but also decisive effects on the quality of life of its citizens. Located only 15 kilometres from Oporto, Paredes has been for long time the focus of ambitious initiatives of cultural and economic revitalization related to its nature of cluster of design and creativity. Digital connectivity is an extra key factor for the development and the competitiveness of its territory, which boasts a growing number of public spaces with wireless connection and a marked sensibility of its citizens to innovation and sustainability. The city has embarked on the challenge to upgrade the city according to the logic of the software industry rather than to the traditional approaches of town planning. In fact, by 2015, it will become the first urban centre in the world completely connected to a network of one hundred million sensors managed by a smart control system that will allow to replan development and competitiveness on an absolutely new basis. The sensors will enable to bring the information about the operation of all urban services online in order to improve the management of the different sectors by the municipal administration and to develop completely new services.


**Fig. 2: Through the initiative PlanIT, Paredes will become an open-air laboratory of urban development**

The project has been carried out by a team of engineers, town-planners and computer scientists and has been defined as a "living laboratory", which is ready to implement and experiment in the field with a series of excellence solutions to be exported in next-generation smart cities. Citizens will be involved directly because the advanced system of sensors will not work only in common spaces but will also connect private households with each other, so that they will be able to manage their heating and energy consumption systems more efficiently. Like all the other urban infrastructures, the system of sensors will not be applied only to new buildings but it will also contribute to improving the efficiency of the already existing ones. However, new buildings will enjoy the most significant advantages, above all on an economic level.

The city of **Aarhus** (http://www.stateofgreen.com/Profiles/City-of-Aarhus), the last city in Denmark to pursue the traditional union between innovation and sustainability for its own urban development, has founded its smart strategy on citizens' involvement. Its ambitious objective to become completely carbon neutral within 2030 is common to other similar plans implemented by big and small cities in the Scandinavian country. Yet, in no other case has sustainability been so strongly supported as in the tradition of innovation of its urban context, which develops in different sectors of local life: from energy supply to research clusters. Aarhus has combined entrepreneurial and scientific fabric with civic participation in order to focus the urban development of the future on symbolic facilities, which also physically represent meeting points for the local business and scientific communities. *Smart Aarhus* aims to promote a bottom-up participation in the definition of innovative development strategies to be carried out in its various neighbourhoods. The project objective is to favour the constant sharing of information between citizens by proposing a real "digital revolution" where new technologies back up sustainability. The interdisciplinary character of the concept of smart city proposed by Aarhus is the reason of its uniqueness: the Danish city has chosen not to focus only on the implementation of a technological model, but, above all, on a business and policy model enabling local authorities and businesses to use information technologies in solutions which may benefit citizens, companies and policy makers. The actions of participation and innovation, which have been pursued in Aarhus, will be an example to follow for other cities in Europe and around the world. In order to implement this mix of actions, Aarhus relies on the active participation of the local energy businesses which have made this part of the country one of the world leaders in clean energy generation. In fact, the city has a unique position in the global market of wind power and is one of the world's major research centres on this subject. The historic bonds of collaboration between businesses, suppliers, scientific communities and local administration are a crucial precondition for the development of new projects of smart cities. A significant example of this collaboration is the technological campus of Katrinebjerg, which is located in the north western area of the city and is conceived not as a scientific campus isolated from the urban context, but as an integral part of the urban fabric, a constantly evolving cluster which aims to become a "world-class environment" for technological businesses. The cluster, which already hosts a significant number of businesses and research institutes in the field of new technologies, aims to become an incubator of ideas regularly involving users and experts in innovation in a continuous cooperation with other companies situated in the rest of the territory. To facilitate international exchanges, to better support the investors who wish to back local research and development projects and to network local businesses and research institutes are the priorities of this smart neighbourhood which revolves around one of the world's top 100 universities. However, the Smart Aarhus of the future will be represented by *Navitas Park*, a facility that will stand in the port area of the city and will host various schools, highly specialized in the sector of technology and engineering. It keeps the bond with the city business community intact with a view to reasserting the importance of research for the future development of the whole urban context. Therefore, Navitas Park aspires to become the beacon of the future smart city, a centre characterized by state-of-the-art spaces for learning, innovation and entrepreneurship, a model and inspiration for students, researchers, teachers and local entrepreneurs.

The Belgian city of **Gent** (Ghent, Gand) (http://www.gent.be/gentincijfers/) has bet on its citizens' empowerment and involvement to improve the quality of the urban life through crowdsourcing. To achieve an increasingly green economy and to give rise to an open and transparent society, which can be fuelled by smart citizens' creativity, is the goal this city aims to pursue by 2020. Furthermore, thanks to its university and over sixty-six thousand students, Gent is the biggest university city in Belgium and a springboard for innovation and technological research. The strength of the strategy pursued by the city consists in its citizens: smart citizens for smart city. In fact, the goal of Gent smart strategy is to encourage the citizens' participation in the implementation of innovative projects for the city digital development (smart engagement) and of green policies for the reduction of urban emissions (smart environment), by relying on sustainable mobility and urban security (smart mobility). These goals are achieved above all through digital platforms. As a matter of fact, in April 2011, Gent administration, in a partnership with IT businesses, launched the crowdsourcing platform "My digital idea for Ghent". The project has been conceived as a web 2.0 platform where users are asked the question: "How can ICT make it even more pleasant to live in Ghent?". Citizens, businesses and organizations have uploaded their projects, voted and commented on the proposals submitted by other users. The objective was to gather the citizens' opinion on how new technologies can be applied to daily life with the purpose of defining concrete projects to be carried out in the city. Gent has chosen crowdsourcing to start a process of citizens' collaboration and involvement in the digital development of the city. This tool is increasingly establishing itself as a means for the promotion of a new business model in which a company or a public institution demands the development of a project, a service or a product to people who are organized in a virtual community. It is a system ensuring mutual advantages: for businesses, it is a new model of open enterprise; for private actors, it gives the possibility to offer their services on a global market; for public institutions, it is a form of collaboration with citizens. Gent smart initiatives are part of the European project "Smartip-Smart Metropolitan Areas Realised Through Innovation and People", whose goal is to spread the use of new ICTs in all the European cities, starting from five pilot cities (Gent, Manchester, Cologne, Bologna and Oulu) and directly involving citizens.

## 4 CONCLUSIONS

Cities are where some of the world's most pressing challenges are concentrated: unsustainable resource and energy consumption, carbon emissions, pollution, and health hazards. Yet, cities are also magnets attracting hundreds of millions of people in search for economic opportunities and hope for a better future (UNEP 2011). Today's still-difficult economic environment requires not losing sight of long-term competitiveness fundamentals amid short-term urgencies (World Economic Forum, 2012). More competitive economies tend to be able to produce higher levels of income for their citizens by betting on closely interrelated fundamental pillars, among which, besides the strictly economic ones, the following play a crucial role: *Institutions* (their quality plays a key role in the ways societies distribute the benefits and bear the costs of development strategies and policies); *Infrastructure* (well-developed infrastructure integrates the national market, cheaply connecting it to markets in other countries and regions); *Health and primary education* (a healthy workforce is vital to a country's competitiveness and productivity); *Higher education and training* (their quality is crucial for economies that want to move up the value chain beyond simple production processes and products); *Technological readiness* (it measures the agility with which an economy adopts existing technologies to enhance the productivity of its industries, with specific emphasis on its capacity to fully leverage information and communication technologies (ICT) in daily activities and production processes for increased efficiency and competitiveness); *Innovation* (it is particularly important for economies as they approach the frontiers of knowledge and the possibility of integrating and adapting exogenous technologies tends to disappear). However, it is above all the development of social capital that plays a crucial role in the development of diversified and knowledge-intensive local economies. Social capital relates not only to education and skills, but also to the ability of people to trust each other, to be willing to cooperate, to engage in social networks and dialogues, as well as to be pro-active regarding challenges and sharing common goals. It is vital for the development of entrepreneurship and small business creation.

The comparison of all the projects carried on to make European cities smart reveals that the term "smart" still lacks political weight. So far, though starting from different backgrounds, in its various European experiments, the smart city has always been considered as a city able to supply services with the highest technological content. Today, instead, new semantic horizons are looked for, as it has been realised that the correlation between a technology-centred city and prosperity is not so univocal (Europe 2020 monitoring platform). The city is not only the optimization of the individual's performance or the perpetuation of the family social status. The city is a space of potentially subversive solidarity; it is the experimentation of diversities reconciled by citizenship; it is the place where opportunities are not merely equal, where they are rather occasions to make people more or less equal.

Europe is facing 21st-century challenges with an ambitious economic policy aimed at pursuing a smart, sustainable and inclusive economy. Such a policy is based on three mutually reinforcing priorities, which are indispensable to deliver high levels of employment, productivity and social cohesion (European Commission, Europe 2020). Moreover, it considers that urban competitiveness is mainly driven by endogenous factors and that performance in the productivity level of urban regions is strongly associated with economic specialisation, as well as human and physical endowments.

The city is the place where culture made up of products is consumed, but where culture made up of intellectual, spiritual, artistic and technical contents is produced. This goal is also part of the challenges looming ahead of Europe and on which Horizon 2020 research programme will invest 85 billion Euros over the next few years. This investment will be partially devoted to the research on smart cities (Barresi & Pultrone, 2012). Therefore, cities and territories must face a challenge, which is more cultural than economic, through smart strategies able to turn them into actual driving forces behind sustainable development, thanks to actions aimed to improve the quality of the citizens' life and, at the same time, to relaunch their city brand on an international level. Nevertheless, in order to build better cities, technologies alone are not enough: if there is no content behind and inside technology, cities remain dumb areas. In order that they may become smart for all, in the strictest sense of the term, cultures of justice, knowledge and politics are needed, which do not have to be smart: they only have to guarantee Justice, Knowledge and Politics.

## Note

Within this article, resulting from some joined-up thinking, the contributes of each author are also clearly distinguished as follow: "Cities, Regions, Sustainable Development and Innovation: Challenges and Opportunities of a Complex and Fundamental Relationship" and " European Union's Policies for smart and inclusive growth "(G. Pultrone); "The Cities as Laboratories of Innovation: a Comparison of European experiences" (A. Barresi); Conclusions (joint work, A. Barresi and G. Pultrone).

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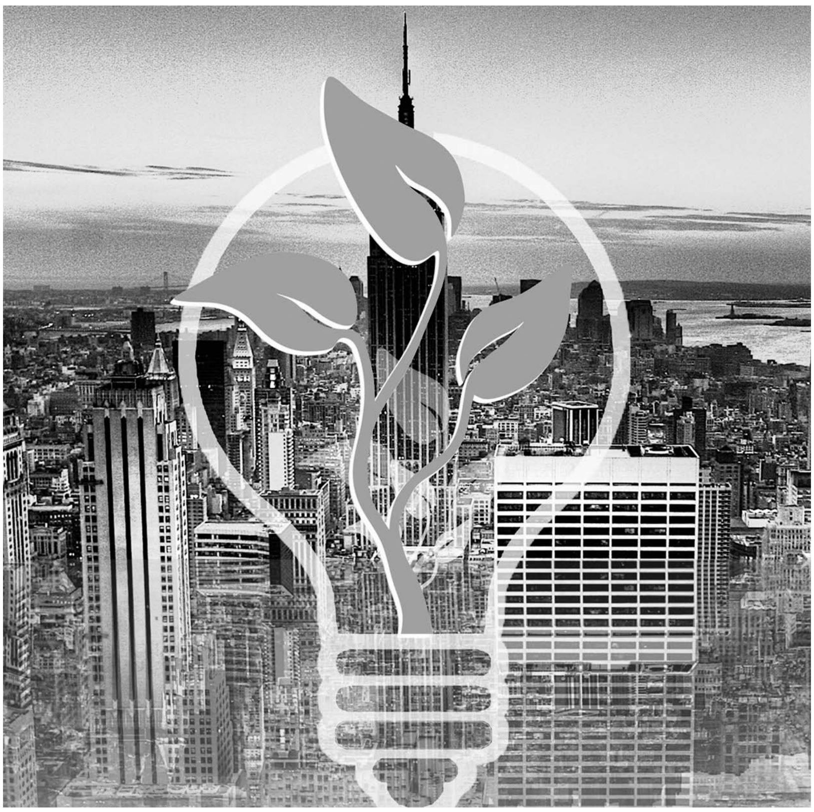
TeMA

Journal of
Land Use, Mobility and Environment

TeMA 1 (2013) 73-86
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1496

review paper received 24 February 2013, accepted 10 April 2013

www.tema.unina.it



# TOWARDS INTELLIGENTLY-SUSTAINABLE CITIES?

## FROM INTELLIGENT AND KNOWLEDGE CITY PROGRAMMES TO THE ACHIEVEMENT OF URBAN SUSTAINABILITY

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ABSTRACT

In the quest for achieving sustainable cities, Intelligent and Knowledge City Programmes (ICPs and KCPs) represent cost-efficient strategies for improving the overall performance of urban systems, especially when compared with the costs of physical restructuring and/or retrofitting projects. However, even though nobody argues on the desirability of making cities "smarter", the fundamental questions of how and to what extent can ICPs and KCPs contribute to the achievement of urban sustainability lack a precise answer. In the attempt of providing a structured answer to these interrogatives, this paper presents a methodology developed for investigating the modalities through which ICPs and KCPs contribute to the achievement or urban sustainability. Overall, our research suggests that ICPs and KCPs can potentially contribute to all three dimensions of sustainability (i.e. economic, social and environmental), but their main efficacy lies in supporting cities achieve a sustainable urban metabolism through optimization, innovation and behavior changes.

KEYWORDS:
Sustainable urban metabolism, Smart city, Assessment criteria, Regional Planning

## 1 INTRODUCTION

As urban population growth is expected to increase dramatically in the following years (Cohen, 2006), governments all around the world urgently need to find solutions for accommodating huge influxes of citizens in a way that is socially, economically and environmentally sustainable (Angel et al., 2011). But if achieving sustainability appears as a straightforward solution, the same cannot be said regarding the strategies required for turning this new paradigm of development into concrete actions (European Environment Agency, 2006). Up to date, there are many and widely disputed plans and policies for enabling sustainable development in all its forms, but they all agree on one point: cities are called to take the lead in this transformation (United Nations, 2012). Stemming from the need to re-think how our cities function, how they are built and managed, Sustainable Urban Development (SUD) has affirmed itself as the new planning rationale of our century (Stren et al., 1992). However, there is still little agreement on the most desirable urban forms and management strategies that will make cities simultaneously more sustainable and competitive (Jabareen, 2006). This is partly the consequence of an ambiguous definition of the concept, which is relatively new and embedded in a complex multi-actor system (Wallbaum et al., 2011).

Moreover, the strength of the sustainability concept is also its main weakness. In fact, sustainable development embodies multiple values, such as those represented by 'people', 'planet' and 'profit', which makes it possible to bridge conflicting interests between these values when defining ambitions. However, the wicked and intractable character of the concept surfaces when these ambitions have to be made tangible and measurable, prioritizing values and allocating costs and benefits, which make conflicting interests resurface (e.g. Hajer, 1995).

Consequently, no consensus seems to exist among scholars and urban planners on the definition of SUD Indicators (Tanguay et al., 2010). At the present moment there is deep uncertainty concerning the strategies and policies that can effectively implement principles of sustainability within urban systems and how these can be measured and monitored (Robinson, 2004).

In this scenario, governments seem to favour investments in making their cities "smarter" while assuming that these will also reveal more sustainable. Intelligent and Knowledge City Programmes (ICPs and KCPs) are thus regarded as a cost-efficient strategy for making cities more flexible, efficient, sustainable, urban, aesthetic and functional (Mega, 1996), especially when compared with the costs of physical restructuring and/or retrofitting projects (Accenture, 2011). Nonetheless, there is little evidence supporting the argument that Intelligent and Knowledge Cities are necessarily more sustainable. No one disagrees on the fact that smarter cities are highly desirable and that enhancing their performance will improve the quality of life of its inhabitants (Santinha & Castro, 2010). The smart city is thus a positive management concept, just as sustainable development is, appraising a value that is rated positively by all actors (Hajer, 1995). But the contribution of ICPs and KCPs to the achievement of sustainability targets is often vague, left implicit, normative and affected by wishful thinking. Therefore, if ICPs and KCPs are to become a success story, the assumed positive relationship between cities being smart and consequently sustainable needs to be supported by evidence.

The aim of this study was to shed light on the connection between ICPs-KCPs and the concept of urban sustainability, thus providing public and private organizations with a framework for designing smarter cities that also reveal more sustainable. The main research question tackled was therefore: "How are Intelligent and Knowledge City Programmes contributing to the achievement of urban sustainability?" To answer this question, it was necessary to proceed step by step through a series of sub-questions concerning the following four elements: (i) sustainable development; (ii) urban sustainability; (iii) Intelligent and Knowledge City Programmes and; (iv) a methodology for tracking down the contribution.

Starting with the first question, the aim was to clarify the meaning of sustainable development and to identify its main features, providing a working definition of the concept to be used as a theoretical basis for the following parts of the research through a literature survey. With regards to the second, the main structural and functional characteristics of cities planning for sustainability were identified and successively used for formulating a working definition of this urban ideal. Moreover, a system for monitoring the progress of cities towards sustainability was developed, with the objective of defining a method for articulating the complexity of sustainable cities in a set of indicators. Third, the meaning, features and value added of ICPs and KCPs were explored, with the intent of developing a conceptual model for recognizing and describing the contribution of these two programs to the achievement of urban sustainability. Final conclusions and reflections, including a discussion on the limitations and value of the research are presented at the end of the paper.

## 2 KEY CONCEPTS

Developing a methodology for assessing the contribution of ICPs and KCPs to urban sustainability required to identify clear working definitions of these three concepts. A thorough bibliographic research was needed to perform this activity, mainly because there are many and contrasting views of what the assets and features of the Sustainable, Intelligent and Knowledge City should be.

### 2.1 SUSTAINABILITY AND SUSTAINABLE CITIES

Considering the first of these urban ideals, there are literally hundreds of definitions and visions currently under debate (for a review, see Alusi et al., 2011; Berke, 2002; Cooper et al., 2009; Dixon and Fallon, 1989; Guy and Marvin, 1999; Haughton, 1997; Jabareen, 2006; Robinson, 2004). This is certainly the consequence of the confusion that still exists on the meaning of sustainable development which represents the core principle of urban sustainability (European Sustainable Cities and Towns Campaign,1994; Lélé, 1991; Næs, 2001). Most of the disputes over what sustainability really is mainly derive from the multi-faceted nature of the concept, the fact that it can be approached with two opposite mindsets (i.e. *reductionism* versus *holistic thinking*), its dependency on the delineation of system boundaries, its ethical dimension which makes the concept cultural-dependent, the fact that it attracts different interests of a variety of actors, the lack of consensus on the level of criticality and elements of the problem that it should solve, and the physical contradictions and difficulties underlying the goal of achieving a sustainable system. Overall, the question of how (and if) should sustainable development be achieved comes through as a wicked problem: it is both un-tamed from a social perspective (there is a lack consensus among global leaders regarding the level of urgency and necessity of transforming current patterns of development, besides the ethical values that the principle should embody) and scientific (the effects of current development dynamics and human actions on the ecosystem are not fully demonstrated).

From these and other considerations regarding the origins, meaning and key features of sustainable development, we came to the conclusion that sustainability should be thought in terms of a verb indicating a process of change rather than a noun referring to an end state. We thus defined the concept of "*to sustainabilize*" in the following way (fig. 1):

To sustainabilize is the long-term process of transforming the structure and functioning of a system, in such a way that it uses progressively less non-renewable energy sources and exploits ecosystem services at a rate that is smaller than the time needed for self-regeneration, while improving the living standards, environmental well-being and economic performance of human settlements. The process needs to be guided by a vision accepted by stakeholders and needs embody the moral values and principles of good governance of the local community, while being aligned with globally shared objectives. Moreover, the process should be based on an integrated approach that considers the interactions within and outside the targeted system.

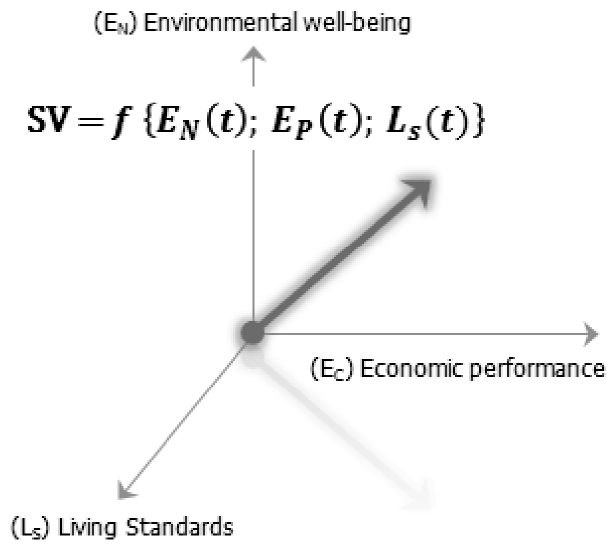


**Fig. 1: A graphical visualization of the concept "to Sustainabilize"**

Having formulated a working definition of sustainability, the following step consisted in transposing the concept to urban systems, thus resulting in a vision of the *"Sustainabilizing City"*. Moreover, following from the belief that "you cannot achieve what you cannot measure", the final goal of this activity was to identify a set of measurable Sustainable Development Indicators (SDI) applicable to urban settlements. But because "there is no single recipe for designing and conducting an evaluation of sustainable development" (Becker, 2004), we developed our own evaluation methodology based on considerations taken from the review of more than a dozen attempts to measure urban sustainability[1]. The methodology basically consisted in breaking down the vision of the Sustainabilizing City in a sequence of elements subdivided on three levels of progressive detail (fig. 2). These levels represent the "pillars", "parameters" and "indicators" of the Sustainabilizing City, and were formulated based on the following guiding principles:

1. the assessment methodology needs to be embedded within a conceptual framework and vision of the sustainable city;
2. recognize which features of urban sustainability are generally acknowledged as objective fundamental requirements ("*sustainable imperatives*") and which ones are specific for each city/actor ("*contingent sustainability*").
3. indicators need to be formulated in terms of rates of change (in order to comply with the definition of the verb "*to sustainabilize*")
4. the measurement system should focus on the essence of sustainable development and be kept as simple as possible.

1 For example, Becker, 2004; Bossel, 1999; Brugman, 1997; Fricker 1998; Gaspartos *et al.,* 2009; Hopwood *et al.*, 2005; Levett, 1998; Li *et al.,* 2009; Moles et al., 2008; Parris & Kates, 2003; Reeds *et al.*, 2005; Tanguay *et al.,* 2010.

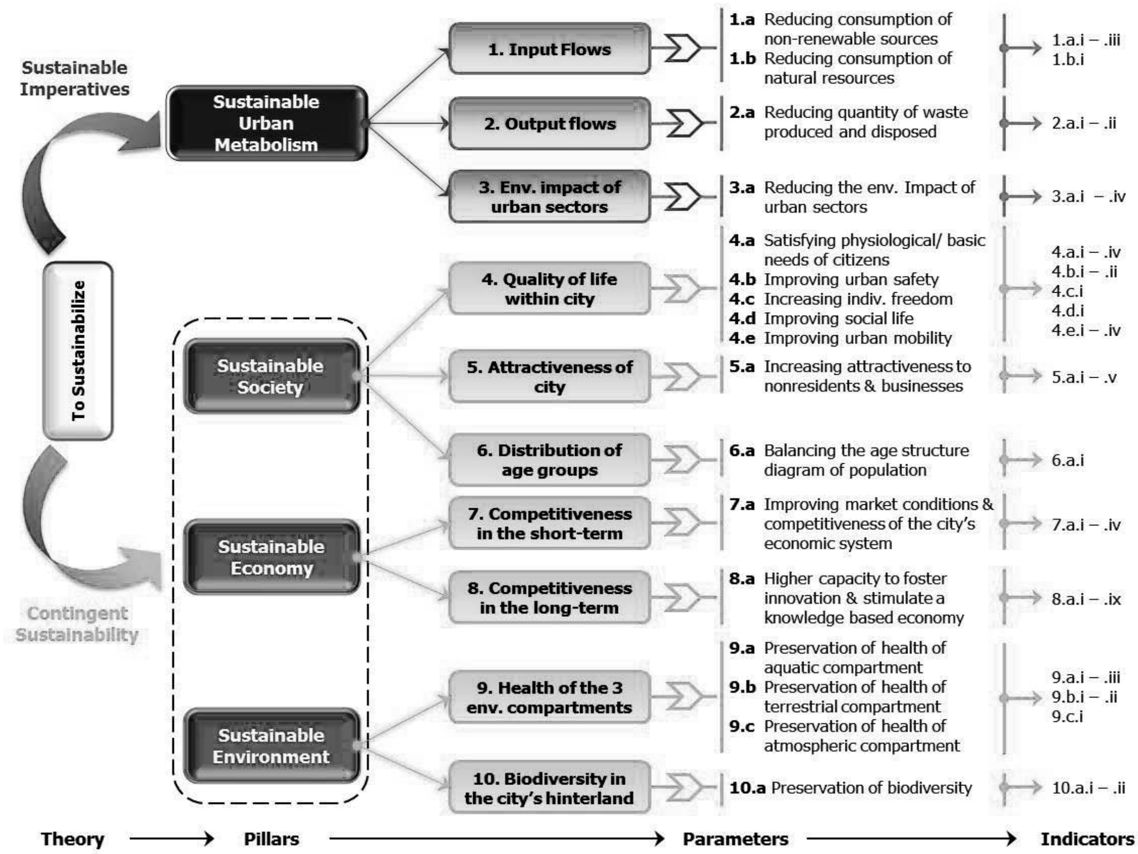


**Fig. 2: The structure of the "Sustainabilizing City Tree"**

The real element of innovation brought by the measurement system developed is given by the subdivision of SDIs among two fundamental categories that separate those elements that are inherently malleable and those that refer to more objective physical features of urban systems (Craglia et al, 2004). We called these two different sets "sustainable imperatives" and "contingent sustainability" and defined them in the following way:

– Sustainable imperatives: the sine qua non requirements of sustainability. These are the features that are generally acknowledged as representing the fundamental requirements that any system should possess in order to comply with the physical definition of sustainability. The Sustainable Urban Metabolism pillar is part of this set, and examples of SDIs pertaining to this group are: Share of renewable electricity in gross final electricity consumption (GFEC) of the city; Share of municipal waste recycled; Consumption of natural resources per urban sector and resources type; Green House Gas emissions per urban sector.
– Contingent sustainability: the features of sustainability which lack general consensus as they are subject to the different interests, values, and system of beliefs of the actors pertaining to the urban community. For this reason, these elements have to be determined specifically for each city through public participation and stakeholder negotiations. The Sustainable Society, Economy and Environment pillars belong to this set, and examples of SDIs pertaining to this group are: Share of population regularly using public transportation means; Provincial Gross Domestic Product by entertainment industry; Net exports of the city; Number of new start-ups per industrial sector; Share of land sealed.

Given the way with which we classified elements of urban sustainability, it is clear that there can be no universally definable set of parameters and indicators. In other words, what we mean by a sustainable economy, society and environment varies according to the system of beliefs and interests of urban stakeholders and the physical and cultural features of the city that we want to sustainabilize (Levett, 1998). Therefore, while the parameters of a sustainable urban metabolism should be the same for each city, those that belong to the "contingent sustainability" set necessarily have to be negotiated with the main stakeholders of the urban system. One final point to be mentioned is that, in order to comply with the definition of "to sustainabilize", all indicators of urban sustainability were formulated in terms of time derivatives (with a pre-defined direction of desired change) which provide a clear indication on the speed with which the implemented strategies are making the system more (or less) sustainable (an example is provided in tab. 1).

**PILLAR 1: SUSTAINABLE URBAN METABOLISM**

| PARAMETERS | | INDICATORS | SYMBOL |
|---|---|---|---|
| **1. Input Flows** | **a. Reducing the consumption of non-renewable energy sources** | *i. Share of renewable electricity in gross final electricity consumption (GFEC) of the region* | $\Delta RE/\Delta t \geq 0$ |
| | | *ii. Gas consumption for heating building sector* | $\Delta G_H/\Delta t \leq 0$ |
| | | *iii. Total petroleum consumption of city's vehicle fleet* | $\Delta P_{VF}/\Delta t \leq 0$ |
| | **b. Reducing the consumption rate of natural resources** | *i. Consumption of natural resources (i.e. fresh water, wood, metals, non-urbanized land, limestone and other extracted rock material for construction) in each i-th urban sector* | $\Delta NR_i/\Delta t \leq 0$ |
| **2. Output Flows** | **a. Reducing the quantity of waste produced and disposed** | *i. Total quantity of municipal waste produced per capita* | $\Delta W_{TOT}/\Delta t \leq 0$ |
| | | *ii. Share of municipal waste recycled* | $\Delta WR/\Delta t \geq 0$ |
| **3. Environmental Impact of Urban Sectors** | **a. Reducing the environmental impact of urban sectors** | *i. GHG emissions per capita for the commercial, industrial, domestic and transport sector* | $\Delta GHG_i/\Delta t \leq 0$ |
| | | *ii. Emissions of air pollutants (i.e. $SO_X$, $NO_X$, CO, $CH_4$, $NH_3$, CFCs, $PM_{10}$, $PM_{2,5}$ and Halons) per urban sector "i" (energy, industry, agriculture, waste management, transport and domestic)* | $\Delta AP_i/\Delta t \leq 0$ |
| | | *iii. Estimation of the polluting effect of different urban sectors on water compartments (i.e. natural flows, underground and superficial water bodies)* | $\Delta WP_i/\Delta t \leq 0$ |
| | | *iv. Emissions of soil pollutants (i.e. heavy metals and toxic substances) per urban sector "i" (waste, transport, agriculture and sewage system)* | $\Delta SP_i/\Delta t \leq 0$ |

**Tab.1: Identified Sustainable Development Indicators pertaining to the pillar "sustainable urban metabolism"**

## 2.2 INTELLIGENT AND KNOWLEDGE CITIES

With a clear and articulated description of what we mean by "cities pursing a state of sustainability" (fig. 3), the following research activity concentrated on the Intelligent and Knowledge City ideals. More specifically, the main focus was placed on the plans and programmes currently being implemented for the achievement of these two urban visions, generally labeled as Smart City initiatives (e.g. European Smart Cities, 2007). In sum, these programmes exploit state of the art Information and Communication Technologies (ICT) and the city's digital infrastructure for different purposes. The goal of ICPs is to pursue urban operational excellence through the improved management of the city's sectors and infrastructure (Deakin and Al Waer, 2011; Harrison et al., 2010), while KCPs are designed for improving territorial governance systems and for turning the city into an innovation hub that nurtures knowledge and creativity (Divir and Pasher, 2004; Ergazakis et al., 2004; Kominos, 2006).

Given the broad definition of Intelligent and Knowledge Cities, recognizing the initiatives that are truly contributing to the achievement of these two urban concepts is not as straightforward as it seems. Therefore, for the scope of this study, it was necessary to define a framework for establishing whether a particular urban program fulfills the definition of Intelligent or Knowledge City adopted in this research. In other words, the objective was to identify the features that differentiate ICPs and KCPs from each other and from traditional urban (re-)development projects. These features were sorted in four levels that are briefly discussed below (fig. 3).

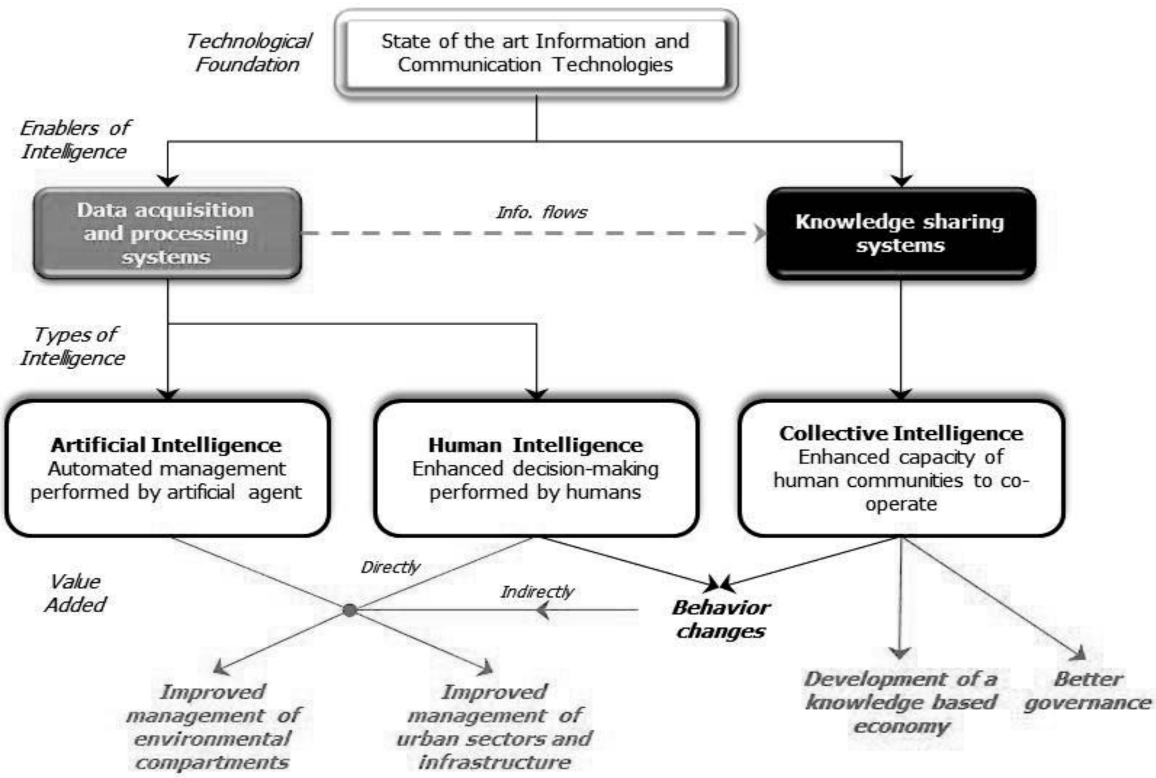


Fig. 3: A framework for identifying and characterizing Intelligent and Knowledge City Programmes (ICPs & KCPs)

Level 1: *Technological foundation*

The first feature that stands out for differentiating urban (re-)development projects from ICPs and KCPs refers to the means adopted for achieving the broad goal of improving urban systems. Generally speaking, the former focus more on the physical layout of the city and on the spatial organization of services and utilities. By contrast, the latter primarily exploit ICT to enhance the management of the different urban sectors and environmental compartments of the city.

Level 2: *Enablers of intelligence*

ICPs and KCPs introduce ICT within urban environments with the scope of providing them with three main systems: (i) data acquisition systems (i.e. data collecting and monitoring devices such as cameras and sensors that measure real world physical conditions and convert the resulting samples into digital numeric values that can be manipulated by a computer), (ii) Data processing systems (i.e. hardware and/or software processing units that format, re-format, translate or convert raw input data in a final form of output information), and (iii) Knowledge sharing systems (i.e. systems that exploit the city's digital infrastructure and ICT for creating virtual environments where online digital content and information is stored, shared and discussed).

Level 3: *Types of intelligence*

The technological means implemented by an ICP or KCP represent enablers of three types of intelligence: Artificial, Human and Collective (Kominos, 2006). Artificial intelligence refers to the ability of an artificial agent to study and monitor specific aspects of the environment and take actions that optimize the performance of the system (automated management). Human intelligence denotes the capacity of humans to use information in decision-making processes to solve problems or improve the functioning of a system. In this sense, we could state that ICPs allow human or artificial agents to transform complex managerial problems in more simple decision-making processes. Finally, collective intelligence refers to the capacity of human communities to co-operate in creation, innovation, invention through the exchange of knowledge.

Level 4: *Value added*

Data acquisition, data processing and knowledge sharing systems implemented by ICPs and KCPs are enablers of the three types of intelligence which drive different types of values to the city. The value added of ICPs and KCPs was sorted in the following five groups: (1) improved management of environmental compartments (i.e. aquatic, terrestrial and atmospheric), (2) improved management of urban sectors and infrastructure (i.e. transport, water, energy, waste, buildings, public administrations), (3) behavior changes, (4) development of a knowledge-based economy, and (5) better governance. While the first and last two groups belong to ICPs and KCPs respectively, the third one can belong to either programmes depending on the final goal: If a program aims at changing the conduct of humans (taken individually or as a collectivity) for optimization purposes, it will be considered an ICP, while if the final aim is to educate citizens towards more eco-responsible and sustainable lifestyles, the program belongs to the group of KCPs.

## 2.3 OVERVIEW OF THE ASSESSMENT FRAMEWORK

The working definitions and concepts developed throughout the first part of the study were combined together for the design of an assessment methodology having the final goal of systematically tracking down the contribution of ICPs and KCPs to urban sustainability. The framework consists of a table that connects the value added by an ICP or KCP to the indicators of the 'sustainabilizing city' previously defined (fig. 4). The procedure for using the assessment model is composed of three main steps:

1. characterize the ICP or KCP with the use of the framework previously illustrated;
2. assume possible relations between the value added by the program and the pre-defined parameters of the 'sustainabilizing city';
3. search for data that demonstrate which indicators of the assumed parameters are being affected, and to specify the direction of change.

The strength of the proposed methodology relies in its simplicity: it provides a clear picture of the speed at which an ICP or KCP is moving the city towards the achievement of urban sustainability in all its dimensions.

| | | | Parameters of Sustainabilizing Cities | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | | 2 | 3 | 4 | | | | | 5 | 6 | 7 | 8 | 9 | | | 10 |
| | | | a | b | a | a | a | b | c | d | e | a | a | a | a | a | b | c | a |
| Value Added by ICPs and KCPs | ICPs | **Improved mgmt. of env. compartments** | | | | | | | | | | | | | | | | | |
| | | • Aquatic | | | | | | | | | | | | | | | | | |
| | | • Atmospheric | | | | | | | | | | | | | | | | | |
| | | • Terrestrial | | | | | | | | | | | | | | | | | |
| | | **Improved mgmt. of urban sectors & infra.** | | | | | | | | | | | | | | | | | |
| | | • Buildings | | | | | | | | | | | | | | | | | |
| | | • Energy | | | | | | | | | | | | | | | | | |
| | | • Public administration | | | | | | | | | | | | | | | | | |
| | | • Transport | | | | | | | | | | | | | | | | | |
| | | • Waste | | | | | | | | | | | | | | | | | |
| | | • Water | | | | | | | | | | | | | | | | | |
| | KCPs | **Behavior changes** | | | | | | | | | | | | | | | | | |
| | | **Development of a Knowledge Based Ec.** | | | | | | | | | | | | | | | | | |
| | | **Better governance** | | | | | | | | | | | | | | | | | |

**Fig. 4: The Intelligent-Sustainable Assessment Table**

## 3 TOWARDS INTELLIGENTLY-SUSTAINABLE CITIES? DISCUSSING THE INTERPRETATIVE FRAMEWORK

Developing With the goal of providing an answer to the main research question tackled by this study, the article shows how the concept "to sustainabilize" is transposed to urban settlements, resulting in four fundamental pillars subdivided between the two sets "sustainable imperatives" and "contingent sustainability". While the definitions of a sustainable society, economy and environment cannot be universally defined, what is meant for a sustainable urban metabolism should be common to all cities. According to our definition, a city possesses a sustainable urban metabolism when all input flows (energy and resources) are in equilibrium with the regeneration rate of the relative source, when output flows are recycled or naturally absorbed by the city's ecosystem and when urban activities have a marginal impact on the environment. Preliminary conclusions (recommendations for directing future research efforts are finally provided) can be resumed in the following four points (fig. 5):

A. through improved management of urban sectors and infrastructure (with particular emphasis on the electricity grid), ICPs mainly contribute to the achievement of a **sustainable urban metabolism** (i.e. reduced consumption of non-renewable energy and natural resources, and reduced environmental impact of urban sub-systems), while KCPs support this goal by promoting behavior changes within the community and, in some cases, through the promotion of innovation-based activities.

B. Through improved urban safety and mobility, better governance systems and the development of a knowledge-based economy, ICPs and KCPs contribute to the achievement of a **sustainable society** (i.e. improved quality of life and attractiveness of the city).

C. Through improved management of urban sectors and infrastructure and the development of a knowledge-based economy, ICPs and KCPs contribute to the achievement of a **sustainable economy** (i.e. higher short- and long-term competitiveness).

D. Through the improved management of environmental compartments, ICPs are facilitators for the achievement of a **sustainable environment** (i.e. preservation of the three environmental compartments and biodiversity). However, the main contribution of ICPs to this pillar derives from the optimization of the city's infrastructure and services, which reduces the environmental impact of urban sectors by lowering the emissions of toxic substances and consumption of natural resources. KCPs also contribute to this goal by promoting behavior changes within the community which are more eco-compatible.

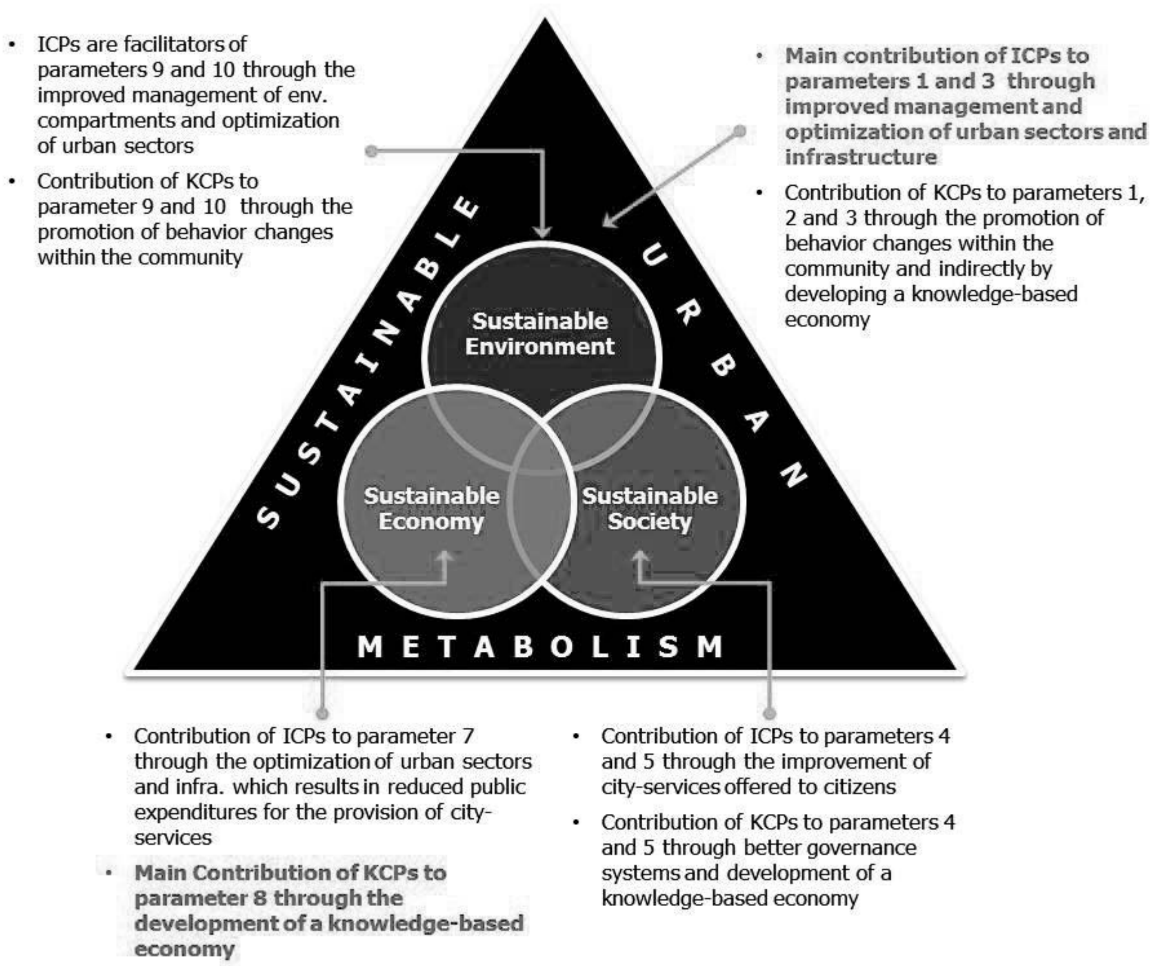


**Fig. 5: The contribution of ICPs and KCPs to the 4 pillars of sustainabilizing cities**

Even if ICPs and KCPs can potentially contribute to all pillars of the sustainabilizing city, the first point listed above is of particular relevance for two main reasons: (i) its importance within our definition of sustainable development, and (ii) the intrinsic limitations deriving from the application of the assessment methodology in this study.

Considering the first reason, recall the definition previously provided of "sustainable imperatives". One of the results reached by our research on urban sustainability was that the sine qua non requirement for cities to become sustainable is that their urban metabolisms progressively reduce their dependency on non-renewable energy, lower the consumption rates of natural resources and ecosystem services, reduce the quantity of wastes produced and decrease the environmental impact of all urban activities and sectors. The word "progressively" was evidenced to stress that succeeding in these goals is a process which requires the long-term commitment of the city, a clear vision and robust strategies approved by the main stakeholders of the system. In this context, the contribution of ICPs appeared critical. In fact, according to our research there are three main strategies for achieving a sustainable urban metabolism: (1) higher efficiency, (2) behavior changes (less energy and resource intensive lifestyles), and (3) Innovation. Being optimization of urban sectors and infrastructure the quintessence of these programmes, the role played by ICPs in sustainabilizing cities appeared evident: they embody the latest ICT technologies to leverage operational efficiency within the different sectors of the city. Moreover, both ICPs and KCPs came through as functional for incentivizing behavior changes within the community which are less energy and resource dependent. In this respect, their strength relies in showing the "carrot" (mainly in the form of savings deriving from a better use of resources) of adopting more sustainable lifestyles. Finally, in some specific cases, KCPs were observed to contribute to reducing the consumption levels of the city by stimulating innovation in the fields of energy efficiency.

Turning to the second reason that justified the importance of the first point, this derives from the limitations encountered while applying assessment methodologies like the one proposed in this paper. As previously argued, the SDIs pertaining to the "contingent sustainability" set cannot be universally defined. In fact, this research acknowledged that among the greatest difficulties in delineating the meaning of sustainability is the fact that defining what we mean by a "sustainable society and economy" is ultimately bound to political discourses. Politics is the art of protecting interests, and these interests cannot be aligned when negotiating on which elements of social and economic systems are to be sustained or developed and for how long (Parris & Kates, 2003). Surprisingly, this research observed that even with regards to the definition of a "sustainable environment" there are no universally accepted lines of thoughts, so even this pillar was considered as part of the Contingent Sustainability set. Therefore, in order to carry out the assessment of ICPs and KCPs in light of urban sustainability, this research provided a proposal of the features that a sustainable society, economy and environment should embody. It comes without saying that the conclusions drawn on the contribution of ICPs and KCPs to these three pillars are subject to the definitions provided. This brings to the conclusion that the role played by ICPs and KCPs in supporting cities achieve a sustainable society, economy and environment inevitably needs to be evaluated on site and with the adopted definition of these three pillars by the city.

## 4 CONCLUSIONS

In order to determine whether there is a robust connection between Sustainable and Intelligent Cities, a methodology for investigating the role of ICPs and KCPs in supporting cities become sustainable was developed. In this paper, we provide an illustration of the developed methodology and a summary of the main results achieved. The paper concludes with a discussion on the role of ICPs and KCPs within the current debates on sustainable development and future research opportunities.

Reflecting in general terms on the contribution of ICPs and KCPs to urban sustainability, this research noticed that a considerable number of these programmes deeply rely on the extent to which humans become "intelligent". In fact, both ICPs and KCPs are enablers of human and collective intelligence, which means that their implementation does not guarantee that citizens will change their behaviors as planned. While the effects of ICPs directly optimizing urban sectors and infrastructure (i.e. through automated management systems or by supporting urban managers take more efficient and effective decisions) are more quantifiable, the indirect contribution of programmes ultimately relying on the "good will" of citizens is hard to predict. In fact, most of these programmes dealing with human behavior are being implemented in the form of pilots, because they rely on the assumption that humans act rationally and that they are willing to change their consumption habits. Moreover, there is a certain limit to the extent to which ICPs and KCPs can enhance decision-making processes, given the fact that "management is both an art and a science". The basic principle is that, besides the obstacles faced by Intelligent and Knowledge Cities, becoming smart requires efforts, and not just in the form of investments in ICT and digital infrastructure.

A final point of concern arises in light of the prospects of a dramatic growth in urban populations and increasing consumption levels in emerging countries. These two trends seriously hamper the world's journey towards sustainability, and whether ICPs and KCPs will be able to accommodate these trends is a question that remains open to discussion. Furthermore, this research underlined that in order for ICPs and KCPs to successfully leverage sustainability, "optimization" of urban sectors and "behavior changes" need to be pursued in tandem. The main reason justifying this need is to reduce the probability that higher urban efficiency indirectly translates into increasing per capita consumption levels. In fact, it might well be the case that cities result less sustainable despite being more intelligent because of these three scenarios.

In conclusion, this contribution has demonstrated that urban intelligence and sustainability are strongly related, but it is incorrect to consider them as the two opposite sides of the same medal. At the present moment, ICPs and KCPs represent useful tools for supporting cities (especially the ones with significant infrastructure legacy) in their journey towards sustainability, but other actions are required for the achievement of this goal.

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## IMAGES SOURCES

Fig. 1, 2, 3, 4, 5: Our elaborations.

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Vittorio achieved his Bachelor in Science degree in Environmental Engineering at the University of Rome 'La Sapienza', specializing in the fields of Urban Planning and Ecological Spatial Planning. Successively, Vittorio obtained his Master in Science degree in Engineering and Policy Analysis at Delft University of Technology, where he focused on subjects of Systems Modeling and Policy Analysis of Multi-Actor Systems, and completed his final thesis on Sustainable and Intelligent Cities. Vittorio has participated to several research projects concerning land-use change, urban sprawl and polycentric development, sustainable and intelligent cities and is author of one book and more than 10 scientific articles in English. He now works in Accenture's Sustainability and Strategy Team based in Milan.

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TeMA

Journal of
Land Use, Mobility and Environment

TeMA 1 (2013) 87-94
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1513

Not reviewed paper

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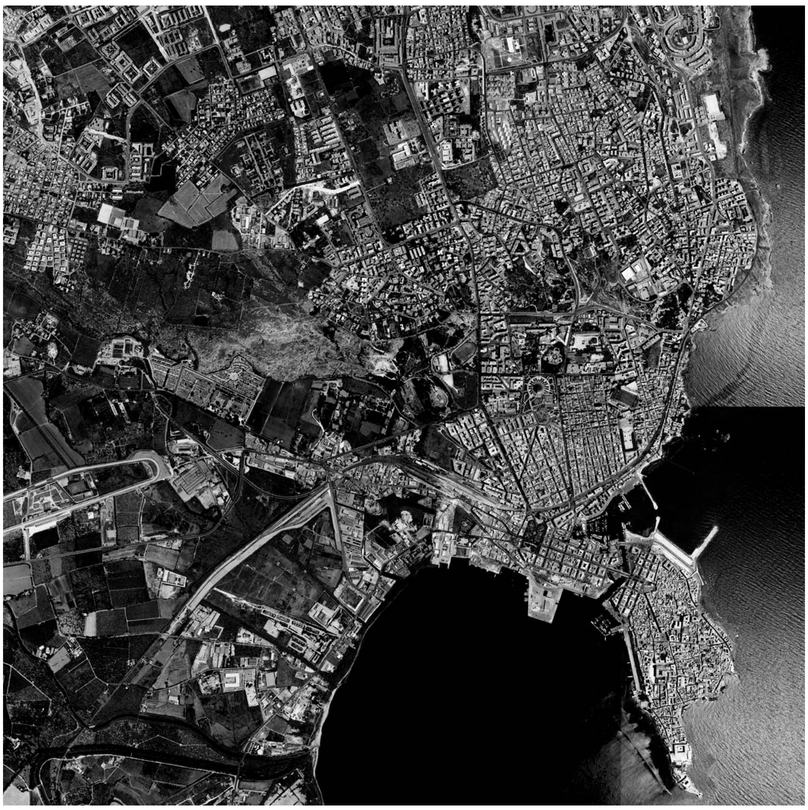

# SIRACUSA, SMART CITY EUROMEDITERRANEA

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ABSTRACT

About three years ago, the City of Siracusa has started a serious reflection about the crisis, about its model of development and its problems related to its territorial marginality. In this context, it lodged a service "Complex Programs and EU Policies" internal the Department of Public Works as the first embryo of the future Urban Center in Siracusa. The Smarter Cities Challenge program, sponsored by IBM, provides, for the years 2011-2012-2013 a selection through a call, a hundred cities around the world that offer a program of counseling on territorial issues, urban, social, exposed by the city in challenge. The program for 2012, selected Siracusa, the only Italian city in a hundred choices, with a theme that emphasizes the need to find methods (smart) to integrate the two systems, the industrial and the historical, cultural, into the overall Siracusa system territorial. The advent of smart policies also confirms the trend that characterized the most evolved from the most marginal realities in Europe. For the realities of the Euro-Mediterranean area, such as Siracusa, the winners model's urban policies originate from the most evolved and developed, where the economy is more structured and able to assume the active role of actors development and urban transformations. So, a universal language of transformations really exist? The same model development produces the same results everywhere, regardless the places and the people tribe? To promote smart Siracusa means, not only, economic innovation promotion, social inclusion and environmental sustainability, but also:
Siracusa intends to strengthen its image as innovation land and to evolve into a center of excellence for smart policies.

KEYWORDS:
Smart City; Innovation; Cultural Heritage; Information and Communication Technologies

# 1 SIRACUSA TERRITORIO SNODO

L'Amministrazione Comunale di Siracusa ha inaugurato, poco più di tre anni fa, una seria riflessione sul suo modello di sviluppo (accessibilità, vivibilità, e sostenibilità) e sulle problematiche territoriali legate alla sua marginalità geografica.
In tale contesto ha costituito, presso l'Assessorato Lavori Pubblici, il servizio "Programmi Complessi e Politiche Comunitarie" come primo embrione del costituendo Urban Center di Siracusa, previsto all'interno del Piano di Sviluppo Sostenibile, del Piano Strategico "Innova Siracusa 2020" e del Piano Integrato di Sviluppo Urbano (PISU).
Il servizio unifica, presso i suoi uffici, le attività di animazione, negoziazione e di programmazione delle azioni di trasformazione urbana legate, anche, alle politiche comunitarie a sostegno dello sviluppo delle zone in ritardo di sviluppo.
Partendo proprio dal Piano di Sviluppo Sostenibile (Ministero dell'Ambiente), proseguendo poi con il Programma SISTeMA e con Progetto di Territorio (Ministero Infrastrutture), come anche con il Piano Integrato di Sviluppo Urbano e del Piano Integrato di Sviluppo Territoriale (P.O. FESR 2007/2013) ed infine raccogliendo tutta la programmazione nel Piano Strategico (Regione Siciliana), il servizio ha reso continuativa l'azione di programmazione, articolandola nei suoi diversi aspetti sistemici ed istituzionali.
L'architettura del processo di programmazione si può genericamente riassumere in questo schema, dove le varie fasi sono scandite da precisi intenti di "rivitalizzazione" delle relazioni sociali ed urbane:
Programma SISTeMA e Progetto di Territorio, in particolare, hanno determinato una sostanziale maturazione dell'efficacia delle azioni e degli obiettivi, selezionando azioni e progetti con un'alta valenza di integrazione e sostenibilità, rendendo Siracusa città adeguata ad essere realmente "territorio snodo" per i Beni Culturali ed Ambientali nella Piattaforma Transnazionale Tirrenico-Ionica, come già formulato nel Quadro Strategico Nazionale[1].

| | | | | |
|---|---|---|---|---|
| PROGRAMMAZIONE | PIANO DI SVILUPPO SOSTENIBILE<br>Quadro e azioni di sviluppo | PROGETTO S.I.S.Te.M.A.<br>Relazione di area vasta | PROGETTO DI TERRITORIO<br>Innovazione ed infrastrutturazione territoriale | PIANO STRATEGICO<br>Innova Siracusa 2020 |
| CONDIVISIONE | URBAN CENTER<br>TAVOLO PER IL FUTURO DI SIRACUSA | | | |
| PROGETTAZIONE | PORTE E NODI DELLA CITTA'<br>Accessibilità e centralità | PARCO ARCHEOLOGICO NEAPOLIS<br>Beni culturali | EX CINTURA FERROVIARIA<br>Beni ambientali | WATERFRONT<br>Recupero della relazione con il mare |
| ATTUAZIONE | PIANI INTEGRATI<br>PIST Neapolis-Eloro<br>PISU Aretusa Contemporanea | PROGRAMMA OPERATIVO F..E.S.R. 2007/2013 | art.12 D.M. 83/2012 "CRESCI ITALIA"<br>Piano per le città | FONDI DI SVILUPPO URBANO<br>Partenariati Pubblico Privati |

**Fig. 1: Comune di SIracusa - Schema della Programmazione**

1 La proposta italiana di Quadro Strategico Nazionale per la politica regionale di sviluppo 2007-2013, messa a punto in versione definitiva a seguito della conclusione del negoziato con Bruxelles, è stata approvata dalla Commissione europea con decisione del 13 luglio 2007.

## 2 SIRACUSA SMART

La collettiva presa di coscienza del ruolo e del rango che la città potrebbe assumere nella complessiva competizione territoriale, avviene in occasione dell'esperienza avuta con la selezione della città nell'ambito dell'iniziativa IBM Smarter Cities Challenge. Il programma Smarter Cities Challenge, promosso da IBM, prevede, per gli anni 2011-2012-2013 la selezione, tramite bando, di cento città nel mondo a cui offrire un programma di consulenza relativamente a problematiche territoriali, urbane, sociali evidenziate dalle città nel challenge. Il programma, per il 2012, ha visto la selezione di Siracusa, unica città italiana delle cento scelte, con un tema che sottolinea la necessità di trovare metodologie (smart) per integrare i due sistemi, quello industriale e quello storico culturale, nel complessivo sistema territoriale di Siracusa.

Durante tutto il mese di giugno del 2012, un team di sei esperti IBM ha operato a Siracusa, congiuntamente al servizio Programmi Complessi e Politiche Comunitarie, incontrando i principali stakeholder della città, realizzando workshop e visitando i luoghi di interesse e le strutture urbanistiche rilevanti della città. Ciò ha evidenziato che esistono dei punti di forza, come:

- il patrimonio storico e culturale di Siracusa rappresenta una notevole eredità storica, un'importante risorsa di attrattività, caratterizzata da un patrimonio artistico, culturale ed architettonico noto ed apprezzato nel mondo;
- un'ottima protezione dell'ambiente naturale (es. il Parco Marino del Plemmirio) che può essere ulteriormente valorizzata;
- un grande entusiasmo, riscontrato durante le interviste con le associazioni, l'Amministrazione comunale ed i portatori di interesse, per la costruzione della Siracusa del futuro;
- un gruppo di professionisti altamente motivati che hanno lavorato in modo proattivo per lo sviluppo urbano di Siracusa;
- un ampio portafoglio di progetti ben delineati per lo sviluppo della città (zona portuale, Centri Commerciali Naturali, iniziative sul sistema delle infrastrutture);
- una produzione agricola di eccellenza riconosciuta (DOP e DOC).

Come, pure, ha evidenziato dei punti di debolezza, come:

- un limitato coordinamento e collaborazione fra tutti gli attori coinvolti, con i cittadini e con le circoscrizioni;
- la mancanza di un approccio (e di competenze) più ampio, rispetto a quello tecnico, nella valutazione dei progetti;
- la stratificazione della città in livelli, senza un piano di sviluppo armonico (il centro storico di Ortigia separato dal resto della città, come pure la città separata dal Polo Industriale);
- la mancanza di un piano solido ed integrato di mobilità e di accessibilità tra le varie centralità e per i luoghi di maggiore interesse della città;
- un approccio culturale ed una serie di comportamenti diffusi che inibiscono le iniziative di cambiamento e di sviluppo;
- la carenza nelle infrastrutture e nei servizi per le diverse categorie di turisti che si desidera attrarre;
- un polo industriale separato e non coinvolto nel piano di sviluppo della città.

Come risultato del lavoro è stato redatto un Report, a cura del team IBM, che ha individuato il percorso, schematicamente riprodotto qui sotto, verso una "Siracusa SmaRt".

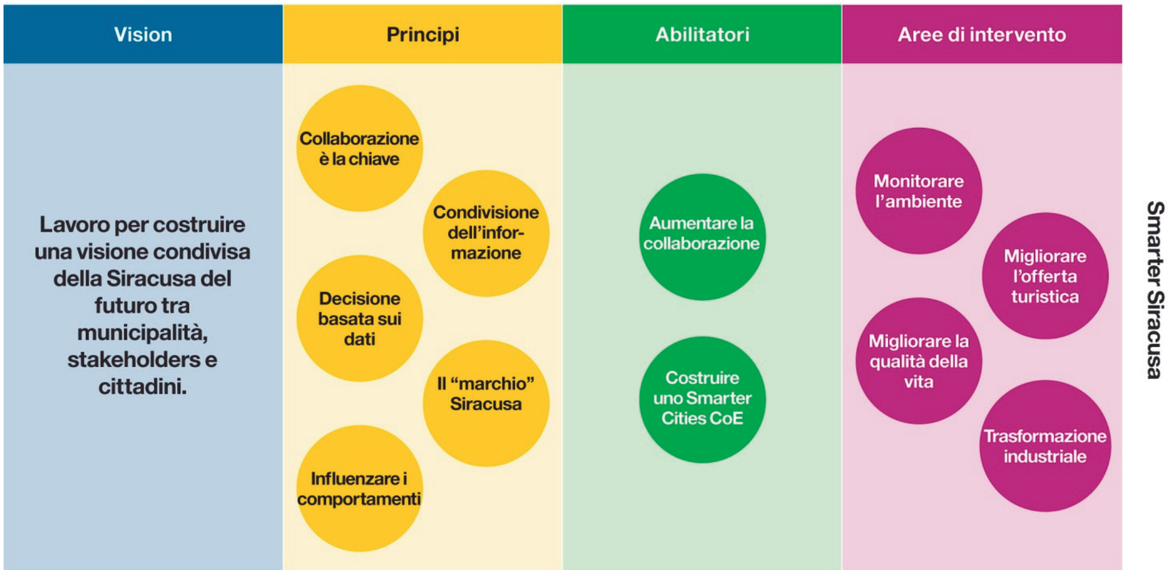


Fig. 2: Schema del Report "IBM –Smart CIties Challenge

Lo schema evidenzia la necessità di avere un'unica visione condivisa della città, delle problematiche e delle politiche, secondo cinque principi base, individuando due abilitatori adatti ad ottenere significativi risultati nelle quattro aree di intervento individuate.

La selezione di Siracusa all'interno di IBM Smarter Cities, ha prodotto una serie di effetti immediati:

- l'Assessorato LL.PP., tramite l'Ufficio Programmi Complessi e Politiche Comunitarie, ha organizzato numerosi incontri di condivisione dell'iniziativa con i principali stakehoder, oltre a numerosi incontri tecnici di approfondimento tematico, in collaborazione con la Fondazione IBM Italia e con l'assistenza tecnica del Piano Strategico, con la finalità di implementare il documento selezionato da IBM e strutturare, anche in chiave logistica, il periodo di lavoro con il Team IBM;
- viene istituzionalizzato il "Tavolo per il Futuro di Siracusa" che raccoglie ed applica il primo abilitatore "aumentare la collaborazione";
- la città (nel senso più generale dell'Amministrazione e dei suoi *Stakeholders*) ha compreso l'urgenza, anche alla luce della crisi economica, di un'evoluzione dei rapporti tra P.A., cittadini e forze economico-produttive, come pure del rapporto tra la città ed i suoi beni economici, culturali ed ambientali.

Da un punto di vista tecnico, vi è stato un prezioso e non ancora esaurito, momento di co-working, che ha prodotto numerosi interessanti approfondimenti tematici. I punti evidenziati nel documento realizzato dall'Amministrazione e selezionato in IBM Smarter Cities Challenge, che possiamo definire come i tre temi caratterizzanti la richiesta di assistenza tecnica sono:

- lo straordinario valore dei beni culturali ed ambientali di Siracusa
- la presenza, a nord, di un estesa area petrolchimica
- la posizione baricentrica di Siracusa nel Mediterraneo

Come evidenziato negli incontri tecnici, anche alla luce delle recenti esperienze di Agenda 21 e del Piano Strategico, Siracusa è una città che sconta una certa difficoltà ad aggregarsi in chiave sistemica, come anche a realizzare efficaci politiche di condivisione delle scelte. Non è casuale che le sue due nature economiche prevalenti, quello dei beni culturali e quello delle industrie, non siano, quasi mai, presenti in azioni integrate all'interno di attività di programmazione comune.

Partendo dall'assunto che una città intelligente è una città in grado di gestire in modo integrato tutte le informazioni disponibili, così da elaborarle e ridistribuirle sul territorio tradotte in servizi di qualità e in un migliore governo del territorio stesso e, considerando che la dicotomia ambiente/industria non si presta facilmente ad operazioni di condivisione di obiettivi, l'esperienza ha evidenziato che la capacità dell'industria di avviare efficaci attività di ricerca e di innovazione può, se correttamente stimolata, collaborare al fine di stimolare la creatività e l'innovazione nell'ambito turistico-culturale ed anche nell'ambito della valorizzazione e della tutela dei beni culturali.
Si pensi, ad esempio, alle attività di ricerca legate ai temi del restauro dei monumenti, alla tutela idrogeologica dell'ambiente, alla sicurezza dal rischio sismico ed ambientale, alla produzione di tecnologia per la produzione di energia da fonti rinnovabili, alle attività di riciclo e smaltimento dei rifiuti solidi urbani, alle tecnologie legate all'ICT per l'efficentamento dei servizi pubblici, ecc.
La discriminante, quindi, è l'interconnessione. Possiamo usare le tecnologie applicate alla mobilità anche per obiettivi di sicurezza, o creare una sinergia con i servizi al cittadino. Nella logica smart tutte le informazioni che già ci sono, tutta la tecnologia che già c'è, deve convergere: integriamola, elaboriamola e avremo una città più intelligente. Interconnessione significa che le informazioni, aggiornate con l'ausilio di tutte le componenti collettive della società, insieme alla tecnologia adeguata per elaborarle e per comunicarle adeguatamente al fine di implementare gli input utili alla generazione di processi innovativi di gestione dei beni, di sviluppo dell'economia e di implementazione della qualità della vita.
Promuovere Siracusa SmaRt implica, non solo, favorire l'innovazione economica, l'inclusione sociale e la sostenibilità ambientale, ma anche:

- promuovere l'innovazione nella tutela e valorizzazione dei BB.CC.AA.;
- incentivare la ricerca nell'ambito delle energie rinnovabili;
- rendere efficiente il sistema della logistica e dei flussi di merci, persone ed idee;
- promuovere la condivisione attiva delle scelte per favorire l'approccio sistemico alle sfide globali;
- connettere ed integrare le infrastrutture ed i servizi urbani grazie allo sviluppo di soluzioni intelligenti basate su ICT (information and communication technologies).

Questa visione implica l'implementazione di nuovi modelli di governance e nuove forme di relazione tra amministrazione pubblica, comunità collettive, imprese economico-industriali e cittadini. Come luogo, dove svolgere ed avviare simili politiche, è stato individuato l'Urban Center, un luogo fisico, promosso da un'insieme dinamico di animatori e di tecnici e con la collaborazione attiva delle organizzazioni collettive e delle istituzioni, dove incentivare processi di innovazione, anche e non solo con l'ausilio di sistemi di ICT. Con la sua concretizzazione l'Urban Center, nell'immediato, permetterà di istituzionalizzare i processi di condivisione, di sistematizzare la rilevazione ed il monitoraggio dei dati e, nel medio lungo termine, permettere la messa a sistema dei valori del territorio siracusano, in primis nell'ambito della tutela e valorizzazione dei suoi beni culturali ed ambientali, come anche, nel suo gravoso processo di riconversione da polo petrolchimico a polo energetico, nell'area industriale.
Alla rilevazione ed al processo di conoscenza, tramite i processi di condivisione, seguiranno dei momenti di co-working e di co-decisione per incentivare processi di creatività e di innovazione, principalmente, tra il sistema della cultura e quello dell'industria e della nuova tecnologia.

## 3 COERENZA CON L'AGENDA DIGITALE ITALIANA

Il processo avviato e gli obiettivi, individuati dall'Amministrazione di Siracusa, sono coerenti con quanto riportato dall' Agenzia per l'Italia Digitale nel documento: "Architettura per le comunità intelligenti: visione concettuale e raccomandazioni alla pubblica amministrazione", dove si afferma che: "*risulta pertanto* *evidente che, nell'architettura ICT di riferimento per la Smart City, il Sistema Pubblico di Connettività potrebbe essere visto come il nucleo di un livello di rete in grado di garantire lo scambio dei dati veicolati dai diversi dispositivi grazie alla capacità di integrazione di sistemi e di tecnologie di accesso di tipo differente (mobile, Wi-Fi, PLC, sistemi ottici, ecc.). La possibilità di far cooperare, attraverso lo scambio dei dati, le reti/servizi/sistemi esistenti rende il Sistema Pubblico di Connettività uno dei fattori indispensabili nella costruzione delle Smart City. Infatti, nei modelli di integrazione, il fattore comune è costituito proprio dalle infrastrutture di comunicazioni e di interoperabilità dotate, di volta in volta, di specifiche caratteristiche*". Ed ancora: "*Il ruolo dell'infrastruttura di trasporto Sistema Pubblico di Connettività nel prossimo futuro potrebbe comprendere i gateway per la raccolta delle informazioni provenienti dagli "Smart Citizen" e dei dati pubblici/privati provenienti da sistemi ICT e dai sensori presenti sul territorio. Ma non solo, visto che i sensori costituiscono un elemento irrinunciabile delle architetture delle Smart City, è lecito ipotizzare anche la disponibilità di servizi/sistemi standard di gestione per la configurazione ed il monitoraggio delle tipologie più comuni di sensori e/o attuatori che si prevede di impiegare*".

Il documento si conclude affermando che: "*Lo scenario delineato configura quindi il Sistema Pubblico di Connettività non più come un insieme di infrastrutture tecnologiche e di regole tecniche e servizi, per lo sviluppo, la condivisione, l'integrazione e la diffusione del patrimonio informativo ma come una più articolata infrastruttura in grado sia di raccogliere e distribuire sia di renderli immediatamente fruibili. In questa ipotesi il Sistema Pubblico di Connettività diventa un insieme di building block, più o meno complessi, con caratteristiche di immediata fruibilità (standardizzazione, interoperabilità e volendo anche pricing) che spostano il focus sulla costruzione dei servizi e delle applicazione richiesti dalle Smart City. In definitiva, Sistema Pubblico di Connettività con le caratteristiche ipotizzate, assume il ruolo fondamentale di 'catalizzatore' per lo sviluppo delle piattaforme e delle applicazioni nell'ottica di accrescere l'efficienza e la qualità della vita dei cittadini e soddisfare il desiderio di trasformazione delle città in città sostenibili*".

## 4 PROGETTO ITI SIRACUSA

Immediata ed indicativa conseguenza dell'esperienza IBM Smarter Cities Challenge è stata la redazione del progetto "Itinerari Turismo Industriale" (ITI Siracusa).

ITI è un progetto che pone, in chiave innovativa, l'esigenza di rivalutare il territorio, facendo convivere le sue diverse anime in termini di sostenibilità e di fruizione culturale.

Il progetto, predisposto con il supporto dell'Ufficio Progetti Complessi del Comune di Siracusa, in collaborazione con l'HUB di Siracusa e dello staff di IBM, risponde all'ultima delle sei raccomandazioni proposte dal team IBM, nell'ambito di *Smarter City Challenge*: "Collaborare per la trasformazione industriale: Costruire Insieme".

All'iniziativa hanno già espresso la loro adesione Confindustria Siracusa, LIPU, Legambiente, Università di Catania, Italia Nostra, FAI, Comitato Parchi, Associazione Koinè.

Obiettivo di ITI è creare un prodotto non convenzionale e trasferibile sul tema del il turismo industriale. Un mix di attraversamenti (in treno, bici), visite (in loco), incontri ed esperienze virtuali (App – anticipata da una piattaforma tecnologica wiki) contribuiscono a forzare il ricongiungimento sistemico delle due anime divise di Siracusa: il Polo Petrolchimico e la vocazione storica, archeologica, monumentale, paesaggistica di Siracusa che, tra l'altro, aspira a diventare capitale Europea della cultura 2019 ed è già patrimonio UNESCO dell'umanità.

L'azione si dispiega in 5 step:

1. L’animazione territoriale
2. La costruzione di una visione condivisa
3. Il prodotto turistico
4. L'innovazione tecnologica
5. La valorizzazione (comunicazione, marketing, trasferibilità)

Il primo passo è l’animazione territoriale volta ad accrescere la consapevolezza della storia industriale del territorio siracusano ed a dipanare la dialettica in cui è sprofondata la città (tra chi è pro e chi è contro); l’obiettivo è quello di costruire una rete di attori locali per favorire una visione partecipata sul presente e sul futuro del polo industriale. Una piattaforma tecnologica (wiki) consentirà a chi interessato di aggiungere dati, proposte. ITI prevede di costruire 4 itinerari:

1) col treno, 50 minuti di struggenti contraddizioni, dalle ciminiere in fiamme alla riserva naturale Saline di Priolo, per poi connettersi alla pista ciclabile, con itinerari trekking e bike-sharing;
2) Le vie dell'energia, col coinvolgimento degli stabilimenti petroliferi, della centrale solare termica Archimede, di grandi impianti fotovoltaici;
3) Il percorso natura, con enti che già operano nell'area per la fruizione della Riserva Naturale Saline di Priolo;
4) Itinerario archeologico con visite guidate ai due siti di Megara Iblea e Thapsos. Con l'ausilio dell’augmented reality si potrà osservare passato, presente e futuro dei luoghi.

Il progetto promuove la cultura del turismo industriale. L’area industriale siracusana circonda siti archeologici di straordinaria importanza non valorizzati (Penisola Tapsos, Megara Iblea) ed una zona protetta, La Riserva Naturale Saline di Priolo.
Riconnettere e ricontestualizzare l’area industriale di Siracusa nello spazio (il territorio) e nel tempo (il passato, il futuro) aprirà la strada ad un’esperienza pilota che potrà essere replicata e *customizzata* in altre aree di petrolchimico ed in tante delle altre zone industriali che, al contempo, nutrono e uccidono i rispettivi territori.

## 5 POLITICHE SMART, APPROCCIO INNOVATIVO O SOLTANTO UN NEOLOGISMO?

Ritengo sia superfluo sottolineare la positività di quanto è avvenuto a Siracusa con l’esperienza *IBM Smarter Cities Challenge*. Per realtà come quella di Siracusa gli impatti e le influenze, generate dalle politiche concertative e di condivisione, sono certamente importanti e determinano un momento rilevante di presa di coscienza aggregativa.
Anche nell’avvento delle politiche *smart* si conferma il trend che distingue le realtà più evolute da quelle più marginali d’Europa. Anche per le realtà dell’area Euro-mediterranea, come quella di Siracusa, i modelli “vincenti” delle politiche urbane traggono origine dalle realtà più evolute e sviluppate, dove il tessuto economico è maggiormente strutturato e capace di assumere il ruolo attivo di attori dello sviluppo e delle trasformazioni urbane. Ciò è, storicamente, sempre avvenuto. Ogni attività innovativa nel campo delle politiche urbane, infatti, ha trovato, spesso, come promotori i territori più dinamici del centro Europa e degli Stati Uniti. Il modello di diffusione delle innovazioni, infatti, procede spesso dalle aree centrali verso quelle marginali in una sorta di trasmissione centro-periferia.

Esiste, quindi, un linguaggio universale delle trasformazioni? Ossia, un medesimo modello di sviluppo produce ovunque gli stessi risultati, indipendentemente dalla genìa dei luoghi e delle genti? In questi processi di globalizzazione dei linguaggi dello sviluppo, la singolarità e la tipicità degli ambiti locali e dei macro-ambiti, viene spesso sacrificata e non valorizzata. Una sorta di assenza di identità che rischia di rendere impersonale e generica ogni iniziativa di sviluppo e di trasformazione urbana.
Come per altre definizioni ed altre terminologie nelle politiche urbane (come Sviluppo Sostenibile, contro urbanizzazione, città diffusa, ecc.), anche il concetto *smart* appare soprattutto come un neologismo che, come tutti i neologismi, ha la capacità di generare rinnovato interesse e di evocare immagini, pensieri, sentimenti, aspettative, servendosi non solo di sintassi, punteggiatura, enfasi, inflessioni e paralinguaggi vocali, ma della capacità innovativa propria, appunto, dei neologismi.
Inoltre, la genesi economicista di tali approcci e di tali concetti, rende molto ardua la loro effettiva applicazione territoriale. Teoricamente sono nozioni che funzionano molto bene, illuminano le menti ed evocano approcci innovativi, ma, spesso, a livello applicativo risultano freddi, distaccati, cinici, privi di capacità di generare realmente momenti di partecipazione e condivisione.
L'invasione degli aspetti economici ha reso necessariamente sacrificabili le politiche sociali, come pure quelle culturali, in una sorta di distinzione tra "progetti freddi" e "progetti caldi", tra progetti, cioè, che creano redditività e progetti che la consumano[2].
Il rischio di non dare adeguata consequenzialità ad un efficace approccio teorico appare sempre inadeguato, anche se, sono convinto, che nella gestione dello sviluppo e delle trasformazioni territoriali non si può evitare di assumersi una discreta dose di rischi.

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## FONTE DELLEIMMAGINI

Fig. 1: Comune di Siracusa – Ufficio Programmi Complessi e Politiche Comunitarie

Fig. 2: IBM – Report "Smarter Siracusa"

## PROFILO DELL'AUTORE

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2 I progetti selezionati dai mediatori bancari nel programma JESSICA, ad esempio, sono esclusivamente i progetti ad alta redditività.

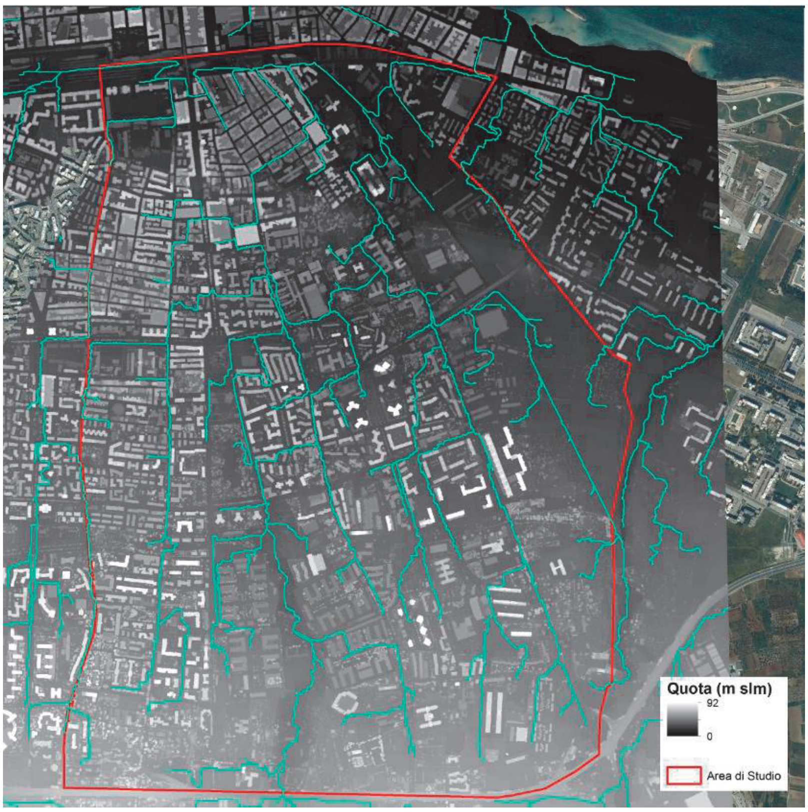
# TeMA

Journal of
Land Use, Mobility and Environment

TeMA 1 (2013) 95-111
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1418

review paper received 30 January 2013, accepted 08 April 2013

www.tema.unina.it




# VERDE URBANO E PROCESSI AMBIENTALI:

## PER UNA PROGETTAZIONE DI PAESAGGIO MULTIFUNZIONALE

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ABSTRACT

Urbanisation phenomena, associated with soil sealing, can lead to an increase in surface runoff, environmental pollution and ecosystems degradation with risks to human health and economic losses by floods. Then, new urban development strategies and land management models are essential. The European Union Water Framework Directive (2000) requires Member States to draw up efficient measures to ensure sustainable use of water resources. Several Best Management Practices (BMPs) were developed at this aim. BMPs are usually multifunctional structures (e.g. wetland and green roofs) that can provide suitable Habitat for species and bring to the maintenance of biodiversity, allow climate regulation by evaporation and adsorption of solar radiation together with aesthetic/amenity, recreational and educational benefits, enhancing the urban quality of life and social interaction.

However, especially in Italy, the full integration of BMPs in territorial planning and urban (re-) design is not fully realized yet. The control of water quality and quantity has often been realized by isolated and localized interventions (e.g. detention/infiltration basins) without a "smart" and systemic project based on a holistic environmental sustainability concept.

Through an application of a synthetic index for urban permeability assessment (RIE Index), this paper presents a systemic approach to urban green planning to reduce surface runoff in a pilot area of Bari city, increasing soil permeability and reducing hydraulic risk. This green and sustainable stormwater management approach would be able to furnish environmental benefits and services to the citizens, enhancing quality of life in urban contexts.

KEYWORDS:
BMPs, multifunctional landscape, urban planning

## 1 INTRODUZIONE

La crescita della popolazione urbana e il dilatarsi della città sono fenomeni ormai ragguardevoli e non ancora destinati a terminare o rallentare (U.N., 2009). Le conseguenti problematiche spingono con sempre maggiore impellenza alla ricerca della sostenibilità ambientale delle politiche urbane e il suolo come una risorsa non rinnovabile. Questo significa gestire il territorio tenendo presente (quindi mitigando/evitando) gli impatti dello sviluppo urbano, quali l'emissione di gas clima-alteranti, il mantenimento/incremento della biodiversità, l'impermeabilizzazione di vaste superfici e le relative conseguenze sul dissesto idrogeologico e la qualità delle acque (Akbari e Konopacki, 2006; Fistola, 2011; Getter e Rowe, 2006; La Rocca, 2011; Murgante et al., 2011; Pelorosso et al. 2012).

Anche da questo deriva l'approccio *smart*, prendendo a prestito ed estendendo il concetto di *smart cities*, che, mutuato dall'*Information e Communication Technology*, è ormai adattato o adattabile ad ogni cosa riguardi la possibilità di una migliore qualità della "performance" urbana. "Smart" non è aggettivo della sola infrastrutturazione tecnologica, ma soprattutto, strumento strategico di attenzione, integrazione, uso sapiente, valorizzazione e tutela delle risorse, rapportato alle azioni antropiche su di esse. Insomma, il fin troppo abusato anglismo nasconde (spacciandola per moderna) l'antica tradizione di ingegno, equilibrio e multifunzionalità che sono i valori fondanti della costruzione del paesaggio e delle città italiane (Leone, 2009). È questo il vero approccio alla sostenibilità e alla mitigazione degli impatti. Infatti, il cambiamento dell'uso del suolo ed, in particolare, l'urbanizzazione associata alla rimozione del suolo agrario o naturale altera vari fattori dell'assetto naturale, in una sinergia tutta negativa in termini di impatti ambientali:

1) Mutano le caratteristiche emissive delle superfici rispetto alla radiazione solare e, quindi, si genera quel particolare microclima noto come isola di calore urbano, a sua volta responsabile di enormi consumi energetici ed emissioni di gas-serra (Akbari e Menon, 2009).

2) Il sistema urbano costituisce barriera alla diffusione di pollini, semi e alla stessa macrofauna, con conseguenze sulla biodiversità (Gobattoni et al. 2011), che può essere mitigata solo attraverso un sistema di *greening* integrato, ovvero da "una rete ecologica continua e diffusa di unità ecosistemiche che sappiano interagire con un sistema complesso, integrando le esigenze della natura e dell'uomo" (Pelorosso et al., 2012).

3) È alterato il sistema idrologico con incremento dei volumi e dei picchi di deflusso superficiale delle acque (Ahiablame et al., 2012; Barbosa et al., 2012; Pelorosso et al., 2009; Leone, 2011). Ne consegue il rilascio (in forma diffusa) di inquinanti presenti sul territorio, sia urbano (residui organici e delle emissioni di autoveicoli) che rurali (nutrienti e pesticidi), che possono essere trasportati ai corpi idrici attraverso il deflusso (Barbosa et al., 2012).

In merito a quest'ultimo punto, il conseguente degrado degli ecosistemi acquatici e terrestri, associato al rischio per la salute umana, alla diminuzione della qualità della vita, nonché, alle perdite economiche causate dagli eventi di piena, spingono a preferire l'approccio sistemico allo sviluppo urbano, basato sulla sostenibilità ambientale (Villareal et al., 2004; Fioretti et al., 2010; Gerundo et al., 2010).

La direttiva quadro sulle acque 2000/60/CE (European Union Water Framework Directive, 2000) ha recepito queste esigenze, richiedendo agli stati membri di approntare misure per prevenire il deterioramento quali-quantitativo delle acque, migliorarne lo stato e, infine, assicurare un utilizzo sostenibile della risorsa idrica. Questi obiettivi sono stati perseguiti dalla comunità scientifica attraverso lo sviluppo di modelli di simulazione, monitoraggi ambientali e studio di azioni e pratiche, sia in ambiti rurali (e.g. Turpin et al., 2005; Ripa et al., 2006; Leone et al., 2008) sia in ambiti urbani (e.g. Mitchell, 2005; Ellis and Revitt, 2008; Sholz and Kazemi Yadzi, 2009), per la riduzione del deflusso superficiale e delle fonti diffuse di inquinamento e la valutazione del carico massimo di inquinanti accettabile dei corpi idrici riceventi.

Anche in risposta a queste esigenze, si sono sviluppate una serie di misure e tecniche per il controllo degli inquinanti e dello scorrimento superficiale intese ad una gestione sostenibile delle acque meteoriche urbane. Queste misure e tecniche hanno assunto varie definizioni in funzione dell'obiettivo e dei paesi in cui sono state sviluppate ed adottate; tra le più comuni troviamo: Best Management Practices (BMPs), Low Impact Development (LID), Water Sensitive Urban Design (WSUD), Sustainable Urban Drainage Systems (SUDS), Innovative Stormwater Management (Villareal et al., 2004; Barbosa et al., 2012).

In questo lavoro si farà riferimento all'acronimo "BMP" anche per continuità con la terminologia adottata nella letteratura riferita alle pratiche di gestione territoriale e paesaggistica extra-urbana (Ripa et al., 2006; Leone, 2011). In aggiunta ai sopra citati scopi delle BMPs, alcune di esse (es: verde pensile, bacini di detenzione/ritenzione, zone umide) possono svolgere anche una funzione ecologica (habitat per specie animali e vegetali); di termoregolazione (attraverso l'evaporazione e l'assorbimento della radiazione solare incidente); estetica (come fattori di qualificazione urbana); di promozione del capitale sociale e delle interazioni (Dahlenburg and Birtles, 2012). Esempi di BMPs urbane possono essere ritrovati in diverse pubblicazioni e manuali (esempio: CIRIA, 2007; Akbari, 2009).

Uno dei casi italiani più organici dal punto di vista della gestione sostenibile delle acque meteoriche urbane e la sua integrazione nella pianificazione territoriale è quello del Comune di Bolzano (vedi sito web[1]), che ha messo a punto uno specifico algoritmo: l'indice di Riduzione dell'Impatto Edilizio (RIE), allo scopo di regolamentare l'attività edilizia alle nuove esigenze di risparmio energetico e minor impatto sul sistema idrologico urbano.

Dato questo contesto, il presente lavoro presenta un'esperienza, attraverso un caso di studio generalizzabile, sul come costruire scenari di greening, sulla base di un insieme integrato di BMPs, che hanno poi altri effetti positivi sulla qualità dell'ambiente urbano.

Il piano dell'infrastruttura verde della città parte dall'armatura minima indispensabile basata sulle sue funzionalità multiple: idrologica, climatica, di incremento della biodiversità e igienico-fruitiva, secondo gli standard urbanistici. A questa si sovrappone l'analisi, più complessa, del contributo che il verde urbano può dare alla costruzione della città, nel senso di stimolo e promozione delle relazioni umane. Ne scaturisce una progettazione per gradi, per ogni componente delle suddette funzionalità: a partire da quella idrologica, necessariamente più strutturata, perché richiede precisi elementi quantitativi, circa il quanto aumentare la permeabilità del territorio e dove questa operazione é più efficace per attenuare del rischio idraulico. Successivamente, e progressivamente, si inseriscono le necessità delle altre funzioni, per arrivare a un sistema che ha i presupposti per divenire complesso e, quindi, robusto e sostenibile. Infine, il sistema progettato va verificato nella sua ultima e "più elevata" funzione: quella di componente della rete ecologica.

Il progetto delle aree verdi, quindi, si basa su precisi processi territoriali, la cui prima fase, a titolo di sperimentazione, è stata applicata al caso di studio riportato nel presente articolo, significativo per l'interesse generale dei risultati e la riproducibilità della metodologia proposta.

## 2 AREA DI STUDIO

### 2.1 L'ASSETTO TERRITORIALE

L'area di studio presa in considerazione è la parte urbanizzata del comune di Bari (fig. 1, circa 655 ha) la cui rete di drenaggio delle acque meteoriche periodicamente entra in crisi, provocando anche l'inquinamento del tratto di mare prospiciente la città.

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1 http://www.comune.bolzano.it/urb_context02.jsp?ID_LINK=512&id_context=4663&page=10

Essa ha una particolare conformazione morfologica, con la convergenza di numerosi solchi torrentizi di origine carsica (le lame) che dalle colline interne (altopiano delle Murge) sfociano nel mare Adriatico attraversando tutta la città. La lame sono corsi d'acqua tipici delle zone semi-aride: le portate sono effimere, spesso nulle, ma, in occasione dei rari episodi di piena, possono avere effetti catastrofici, anche perché i lunghi (anche decine di anni) periodi di alveo secco attenuano fortemente la percezione del rischio. Il caso di Bari è significativo in tal senso: tra fine '800 e inizi '900 la città ha avuto uno sviluppo edilizio impetuoso, che l'ha portata ben oltre i confini della città medievale e del borgo ottocentesco. Inevitabilmente, sono nati i conflitti con l'assetto naturale del territorio, manifestatisi attraverso i catastrofici eventi alluvionali del 1905, 1915 e 1926  a seguito dei quali si è provveduto ad opere di grande lungimiranza ed efficacia (Puglisi et al. 1991). Infatti, in seguito all'evento alluvionale del 1926, sono state progettate e realizzate imponenti opere di presidio idraulico (incremento della capacità degli alvei e canali deviatori che impongono ai torrenti un corso differente da quello naturale), ma, contemporaneamente, si è rimboschita buona parte dei bacini idrografici (bosco di Mercadante[2]), per aumentarne la permeabilità (Borri et al., 2002).

Nonostante alcuni interventi scriteriati e l'ulteriore, impetuosa espansione della città del dopoguerra, questo sistema di difesa ha retto bene ed è stato messo alla prova da eventi particolarmente intensi, che altrove hanno causato gravi danni e morti (clamorosa l'alluvione dell'ottobre 2005: vedi Mossa, 2007).

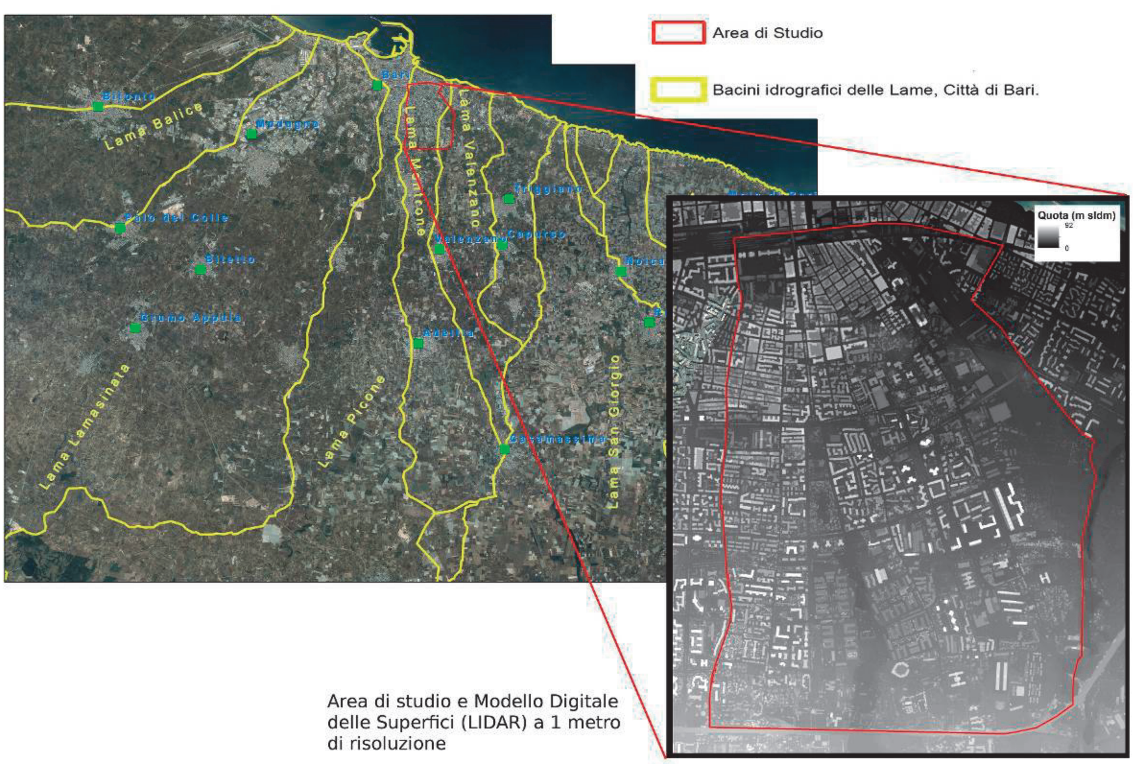


**Fig. 1: Bacini idrografici delle Lame della Città di Bari ed area di studio con il DSM ad alta risoluzione**

2 Questo bosco è un ottimo esempio di multifunzionalità. Piantato a puro scopo idraulico meno di 80 anni fa, è luogo di scampagnate e tempo libero per i cittadini, ma è anche una fondamentale componente delle rete ecologica, tanto da vedere la presenza del lupo, giunto sin qui dall'Appennino abruzzese.

## 2.2 L'AMBITO URBANO

Il tessuto edilizio è caratterizzato da tre principali tipologie: edifici a corte, edifici in linea e a torre. I primi sono presenti nei quartieri (ormai storici) di espansione della città verificatasi tra il 1813 (anno di fondazione del borgo razionalista) e i primi del '900.

La corte era generalmente destinata a verde: orti e giardini privati, alcuni dei quali sopravvissuti (fig. 2).

Nei quartieri di più recente realizzazione il tessuto edilizio si dirada e si passa a edifici in linea o a torre, i cui spazi di pertinenza sono per lo più adibiti a parcheggio. Questa tipologia è stata poi ripresa nella stragrande maggioranza dei casi di demolizione/ricostruzione delle coorti, allorquando, negli anni '60 e '70 del secolo scorso, i palazzetti ottocenteschi sono stati sostituiti con edifici a torre e le coorti chiuse per realizzare il retrobottega dei locali commerciali. La conseguenza è la totale impermeabilizzazione di tutto il tessuto urbano storico, cosa che, a scala regionale, non ha influenzato significativamente l'idrologia, ma che ha messo in crisi la rete di smaltimento delle acque meteoriche. A sua volta, questo è causa di danni, rischio per l'incolumità delle persone e problemi per la qualità delle acque. Eclatante è il caso del collettore finale più importante, sito in via Matteotti (fig. 5), le cui esondazioni, trattandosi di sistema fognario a tipologia "mista", provocano l'inquinamento di ampi tratti di costa, compresa la più affollata spiaggia libera cittadina[3]. Essa, per altro, drena quasi tutto il bacino di Lama Montrone (detta anche Fitta, di superficie ben 56 km$^2$) e vi coincide nel suo tratto finale e alla sua foce.

In questo contesto, destinato per altro a peggiorare con i cambiamenti climatici in atto, il classico intervento strutturale è ovviamente insufficiente e va integrato, ricalcando la felice tradizione dell'intervento integrato, come ha dimostrato la sistemazione successiva all'alluvione del 1926: sistemazione idraulica strutturale, unita a maggiore permeabilità del territorio. Questo schema oggi va riprodotto e coniugato a scala di drenaggio urbano, con le opportune strategie di greening e riqualificazione naturalistica di ben precise zone. Il tutto allo scopo di ridurre il carico idrologico sulla rete drenante, attraverso l'aumento delle superfici permeabili, la ritenzione, la detenzione e l'infiltrazione delle acque meteoriche.

**Fig. 2: Un esempio di cortile, oggi sopravvissuto, tipico della città ottocentesca**

[3] Libera e popolare, quindi battezzata "Pane e pomodoro".

# 3 MATERIALI E METODI

Per perseguire gli obiettivi prefissati dal presente lavoro, è stata dapprima valutata la permeabilità territoriale, attraverso un indicatore sintetico del processo in esame. Successivamente, sono state ipotizzate diverse strategie di riqualificazione, scelte tra quelle più funzionali e calzanti le specificità territoriali e sulla base del reticolo idrografico derivato, in ambiente GIS, da un modello digitale delle superfici ad elevata risoluzione.

## 3.1 L'INDICATORE DI PERMEABILITÀ URBANA

Come indicatore della permeabilità del territorio urbano è stato scelto quello noto con l'acronimo RIE (Riduzione di Impatto Edilizio), che ha lo scopo di mitigare gli impatti idrologici del contesto in cui i nuovi edifici si inseriscono, stimolando la creazione di superfici permeabili, che presentano i ben noti vantaggi.
La procedura di calcolo del RIE è stata messa a punto nell'ambito della pianificazione urbanistica del Comune di Bolzano. In tal modo, l'Ente pubblico regolamenta l'attività edilizia, perseguendo la maggiore permeabilità dei suoli ed il risparmio energetico. Il metodo si basa sulla valutazione analitica dell'indice numerico RIE, il quale scaturisce da un apposito algoritmo di calcolo, applicato al lotto oggetto di trasformazione urbanistica prima e dopo il progetto. Esso varia tra 0 e 10, ed è crescente al crescere della qualità ambientale. A valori tendenti a "0", corrispondono siti con superfici completamente o in larga parte impermeabilizzate (per esempio parcheggio asfaltato scuro), prive cioè di spazi verdi e con effetti negativi sulla regimazione delle acque meteoriche e sui fattori climatici influenti il microclima urbano (isola di calore). Valori prossimi a "10" sono invece legati a superfici verdi, naturali o seminaturali, evapotraspiranti e quasi prive di spazi impermeabili, che offrono le massime prestazioni in termini di regimazione idrica e controllo del microclima. Le aree urbanizzate sono caratterizzate da RIE intermedi, in relazione alla tipologia di residenze esistenti, alla dotazione di verde urbano ed alle attività produttive presenti.
Il calcolo dell'indice RIE consente di attribuire alle diverse categorie di copertura del territorio (l'assetto progettato) un peso comparabile con la situazione precedente il progetto.
La relazione è la seguente:

$$RIE = \frac{\sum_{i=1}^{n} Sv_i * \frac{1}{\psi_i} + Se}{\sum_{i=1}^{n} Sv_i + \sum_{j=1}^{m} Si_j * \psi_i}$$

In cui:
RIE = Indice di Riduzione dell'Impatto Edilizio.
Svi= i-esima superficie permeabile, impermeabile o con copertura verde.
Sij= j-esima superficie permeabile, impermeabile o senza copertura verde.
Ψi= Coefficiente di deflusso sull'i-esima superficie.
Se= Superfici equivalenti relative alle alberature.

Il coefficiente di deflusso varia a seconda della tipologia di superficie considerata e rappresenta il rapporto tra l'acqua piovana affluita e quella che invece viene captata in un dato intervallo temporale. Tale indice varia da 0 a 1. Una superficie asfaltata ha un indice di deflusso pari a 0,85-0,90. A coefficiente tendente a valori prossimi a 0 corrispondono superfici dai connotati naturali, per le quali è elevata la quantità di acqua trattenuta dal suolo e che percola verso le falde.

Il calcolo dell'indice RIE complessivo dell'area di studio è stato effettuato valutando le diverse tipologie di superficie secondo le linee guida della metodologia elaborate dal comune di Bolzano. Utilizzando i dati cartografici del SIT (Sistema Informativo Territoriale) della Regione Puglia, quali la carta dell'uso del suolo, la Carta Tecnica Regionale (entrambe a scala 1:5000) e le ortofoto a colori dell'anno 2010, sono state identificate in ambiente GIS (ArcGIS ver.10) le diverse coperture e tipologie di pavimentazione ed a ciascuna superficie è stato associato il relativo coefficiente di deflusso. I Coefficienti di deflusso delle categorie di superfici prese a riferimento sono stati reperiti dal sito web del Comune di Bolzano. Il riassetto paesaggistico dell'area in esame è stato quindi valutato in termini numerici, attraverso la determinazione delle diverse tipologie di superficie attinenti alla situazione di fatto ($RIE_0$) e a quella di progetto ($RIE_p$).

## 3.2 LE STRATEGIE DI RIQUALIFICAZIONE

Per valutare le BMPs più efficaci in termini di aumento del valore RIE, sono stati considerate quattro tipologie di intervento:

A) edifici e cortili con tetti verdi;

B) parcheggi permeabili;

C) greening delle aree adibite a servizi pubblici;

D) greening dei vuoti urbani.

### 3.2.1 TETTI VERDI

Il verde pensile trova buone applicazioni nella città storica, per la sua particolare morfologia a corte e, infatti, proprio i cortili occupati dai magazzini dei locali commerciali consentono lo sviluppo di questa tecnica, sui solai di copertura dei locali stessi. Per altro, i tetti verdi sono il sistema più adatto, pur con tutte le intuibili difficoltà pratiche, per la città consolidata, la cui elevata densità offre poche possibilità di applicazione di altre BMPs. Essi, oltre a rappresentare delle ottime superfici permeabili, consentono risparmio energetico per il riscaldamento invernale ed il condizionamento estivo, miglioramento del clima urbano, incremento della biodiversità, filtro per le polveri e maggiore possibilità di fruire di spazi altrimenti inutilizzati.

Un ulteriore aspetto qualificante del verde pensile è rappresentato dalla possibilità di un integrazione con pannelli solari al fine di produrre un effetto sinergico positivo delle due tecnologie sull'ambiente ed un aumento della resa dei pannelli fotovoltaici (vedi Sun-RootTM System[4] e Oberndorfer et al., 2007).

Le linee guida per l'applicazione dell'indice RIE la tipologia d'uso in questione definiscono un coefficiente di deflusso che tiene conto dello spessore e della stratificazione. Lo spessore del tetto verde ipotizzato in questo studio è 20 cm, con coefficiente di deflusso pari a 0,3.

### 3.2.2 PARCHEGGI PERMEABILI

Gli interventi previsti con questa tecnica prevedono la sostituzione dell'attuale pavimentazione con asfalto permeabile e la disconnessione, dove possibile, di tutte le aree impermeabili con delle aiuole drenanti. Mentre i parcheggi tradizionali presentano superfici sostanzialmente impermeabili (coefficiente di deflusso circa 0,9), per quelli drenanti il coefficiente di deflusso scende a 0,5.

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[4] http://www.greenrooftechnology.com/_blog/green-roof-blog/post/The_Sun_Root_Living_Roof_System_ Green_Roofs_embrace_Renewable_Solar_Energy/

### 3.2.3 GREENING NELLE AREE ADIBITE A SERVIZI PUBBLICI

In questo caso si sono considerati i grandi spazi pubblici: aree adibite ad attività sportive, insediamenti dei grandi impianti di servizi pubblici e insediamenti ospedalieri. Le norme, riportate nelle linee guida del Comune di Bolzano, per le tipologie d'uso in questione definiscono degli indici fittizi che tengono conto della eterogeneità delle tipologie di coperture di questo caso. Tramite foto-interpretazione è stata definita la composizione media delle aree in questione, cosa che consente di attribuire ad ogni superficie complessa un coefficiente di deflusso medio ponderato.

Nelle aree con infrastrutture sportive si può intervenire sui parcheggi e sugli spazi a margine dei campi sportivi. In tal modo, si può ridurre sensibilmente il coefficiente di deflusso (da 0,50 a 0,35).

Sui grandi spazi pubblici si interviene sempre sui parcheggi e poi si incrementano le aree verdi, cosa che consente di ridurre il coefficiente di deflusso da 0,70 a 0,45. Stessa scelta per gli insediamenti ospedalieri, dove il coefficiente di deflusso scende da 0,60 a 0,40.

### 3.2.4 GREENING DEI VUOTI URBANI

Gli interventi proposti propongono una "nuova funzione" alle aree classificabili come "vuoti urbani" ed "incolto", valutandone i benefici in termini di permeabilità. Per definire la possibilità che questi spazi possano essere realmente sede di BMPs, occorre effettuare alcune valutazioni: la dimensione pubblica o privata dell'area; la posizione nel centro urbano; la presenza di altri elementi focali nelle vicinanze dell'area (aree verdi, strutture pubbliche etc.); l'accessibilità ecc. In genere si tratta di aree con vegetazione spontanea, già abbastanza permeabili. Di conseguenza, in questi casi i margini di miglioramento idrologico non sono sensibili come negli altri casi e prevale l'aspetto della riqualificazione a scopo fruitivo. Ciò non esclude, però, la possibilità di utilizzo dei vuoti urbani per altre BMPs, nel caso ci sia vocazione per aree di invaso temporaneo e infiltrazione delle acque di pioggia.

## 3.3 INDIVIDUAZIONE DELLE AREE CRITICHE E IPOTESI DI UTILIZZO DELLE BMPS

Ogni intervento illustrato al paragrafo precedente è stato adattato alle specificità territoriali, tenendo in conto le diversità dell'ambiente urbano, le potenzialità e la realizzabilità degli interventi stessi. Per fare questo, è stato definito il reticolo idrografico a scala urbana, ricavato dal Modello Digitale delle Superfici (MDS, risoluzione 0,8 m) dell'area di studio, mediante l'utilizzo delle applicazioni idrologiche del software ARCGIS ver. 10 (ESRI, 2010). Il MDS, ottenuto mediante un rilievo con tecnologia LIDAR (Light Detection and Ranging), rappresenta in forma digitale le quote del terreno, del tetto degli edifici, della chioma degli alberi, delle infrastrutture ecc. Tramite il comando "fill" il MDS è stato corretto per eliminare eventuali errori e dati mancanti. Successivamente, tramite i comandi "Flow direction" e "Flow accumulation", sono state derivate sia le direzioni, sia l'accumulo dei flussi. Il raster così ottenuto è stato riclassificato e vettorializzato in modo da ottenere il reticolo idrografico a scala urbana distinto per quantità di acqua accumulabile e rami aventi un ordine gerarchico crescente.

Questa suddivisione ha permesso di individuare le aree del reticolo a maggior rischio di allagamento.

Il territorio analizzato è stato quindi suddiviso in tre sub-zone, in funzione della presenza e tipologia della rete fognaria pluviale. Per ciascuna area, considerando la localizzazione delle aree critiche, sono stati ipotizzate differenti applicazioni delle BMPs. Esse sono state definite sulla base della potenzialità nel ridurre il carico sulla rete di drenaggio urbano, tenendo conto della vocazione delle zone e delle potenzialità di trasformazione. Questo significa aumentare la permeabilità nelle aree più critiche, che ricadono soprattutto nella zona più orientale della città compatta, che poi è la stessa dove scorre, prima dello sbocco in mare, il collettore finale della rete fognaria, su via Matteotti.

Le aree di intervento sono state localizzate mediante foto-interpretazione, sovrapponendo il reticolo idrografico con l'ortofoto. Non sono stati considerati gli interventi di riqualificazione tramite tetti verdi perché tale tipo di intervento non dipende strettamente dal reticolo idrografico.

## 4 RISULTATI E DISCUSSIONE

In questa prima fase dello studio, per avere una guida progettuale oggettiva, si è ricorsi all'algoritmo RIE. Nell'area di studio, attualmente, esso è pari a 2,4, valore da incrementare, considerando, ad esempio, che il minimo richiesto dal Comune di Bolzano per le nuove lottizzazioni è 4. Tale incremento può essere effettuato attraverso una progettazione mirata del verde urbano e l'introduzione di opportune BMPs.
Per una valutazione in termini di efficienza delle varie strategie, si è costruito il grafico di fig. 3, dove sono riportati i risultati dell'applicazione delle diverse BMPs previste, in termini di RIE ed in funzione della superficie soggetta ad intervento. In tal modo è ben chiara la selezione degli interventi più efficaci, in termini di incidenza quantitativa sul RIE e quindi sull'aumento della permeabilità del territorio.
Emerge da tale elaborazione che i tetti verdi della città compatta sono la BMP più efficace, a parità di superficie coinvolta. Essi hanno poi il vantaggio di non avere limitazioni di superficie, a differenza delle altre BMPs, dati i modesti spazi a disposizione nella città consolidata. Segue la tecnica di incremento della permeabilità nelle aree a parcheggio.
Questi risultati hanno notevole importanza per il supporto alle decisioni, perché evidenziano chiaramente le differenze di efficienza delle BMPs. È dimostrato il valore strategico dell'incremento del verde nella città consolidata, la più compatta e la più impermeabile. Certamente un inserimento di questo genere non è facile, ma una politica di incentivo in tal senso appare indispensabile, per i vantaggi che se ne possono ottenere e per l'evidenza dei risultati mostrata nel grafico di fig. 3. Non bisogna poi dimenticare la necessità di attrezzare le città al cambiamento climatico, per il quale la politica dei tetti verdi è fondamentale (Crane & Landis, 2010).

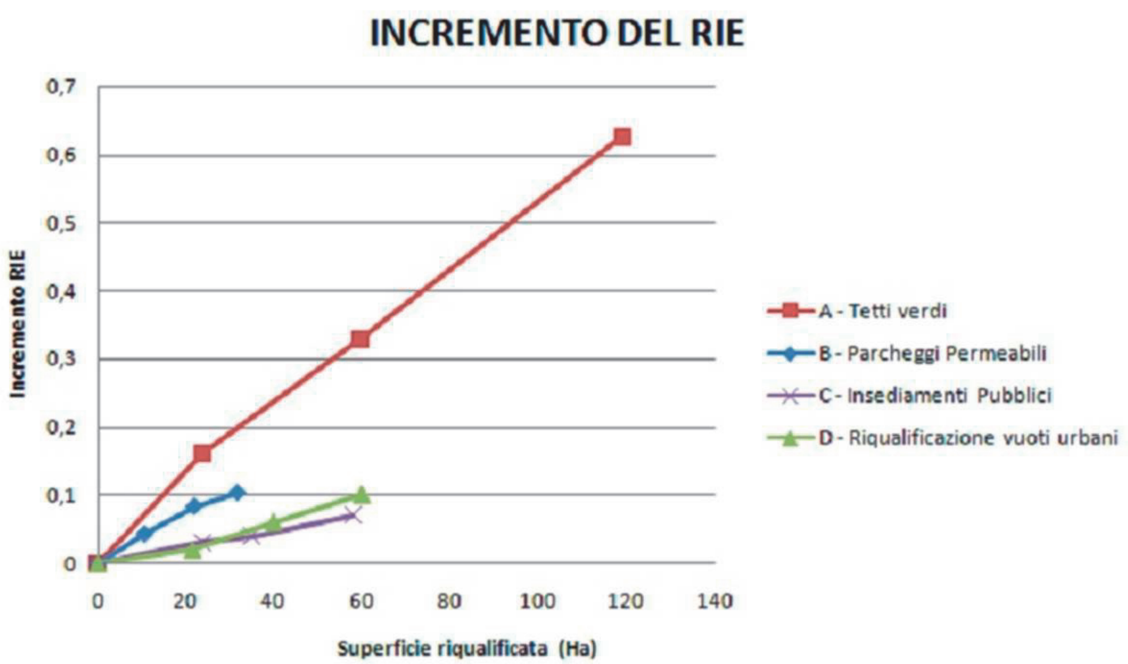


**Fig. 3: Strategie di intervento (BMPs) ed incremento del RIE**

Altro importante risultato ottenuto con il presente studio deriva dall'analisi dei percorsi delle acque di ruscellamento, che consente di individuare molto chiaramente le specificità e le diverse vocazioni dell'assetto territoriale urbano rispetto alle BMPs. Attraverso la tecnica GIS, e grazie all'elevata risoluzione del MDS, è possibile una ricostruzione molto realistica del reticolo idrografico urbano, che non risente solo dell'altimetria, ma anche dei percorsi delle strade, degli ostacoli costituiti dagli edifici ecc. (vedi fig. 4).

**Fig. 4: Reticolo idrografico e ortofoto di una porzione dell'area di studio. Linee gialle, arancioni e rosse rappresentano rispettivamente flussi di portata maggiore**

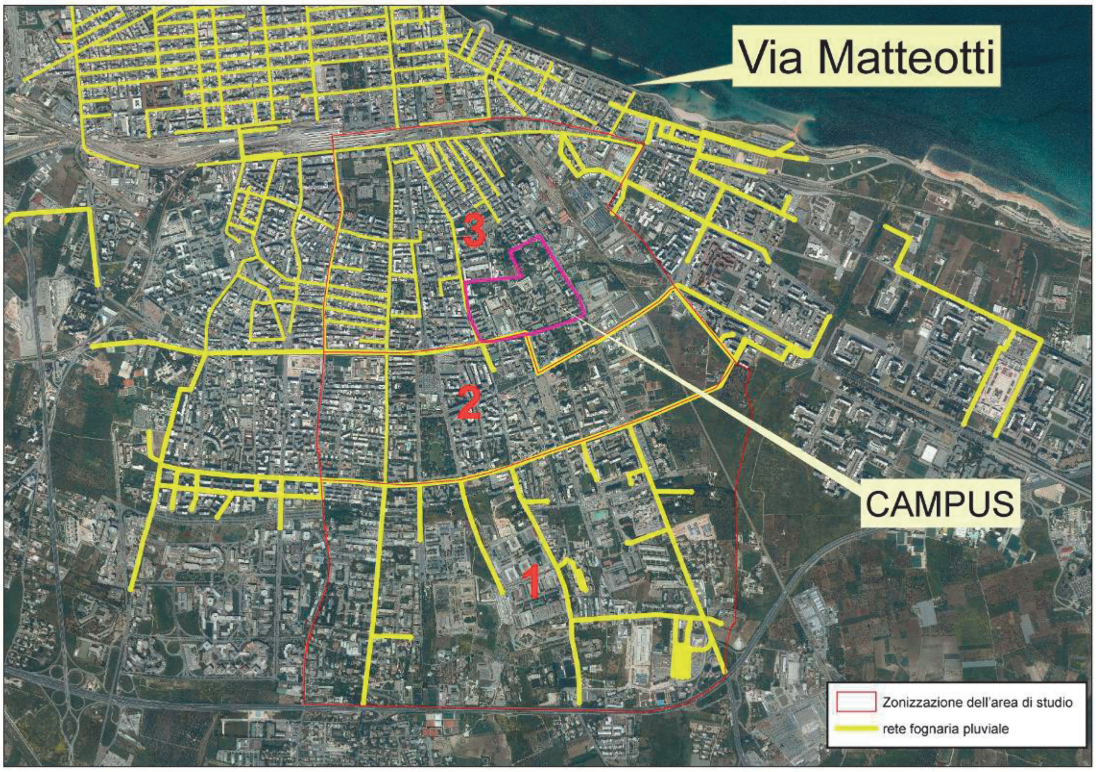


**Fig. 5 :Zonizzazione dell'area di studio e rete fognaria pluviale**

Dall'analisi eseguita si deduce che il ramo del reticolo in cui converge una quantità maggiore di acqua è situato nel tratto a sud-est della città. Tale ramo attraversa il Campus Universitario e giunge al mare passando dai quartieri San Pasquale e Madonnella, dove il deflusso alimenta la condotta fognaria di via Matteotti.

Le tre sub-zone in cui è stata suddivisa l'analisi effettuata (fig. 5) ricalcano i principali ambiti paesaggistici del sistema urbano barese: la città storica; la periferia della seconda metà del '900; il suburbio. Quest'ultimo (individuato come "zona 1", perché a monte dal punto di vista idrologico) è caratterizzato da un tessuto urbano non denso, con lembi di territorio agricolo (Fig. 6a). In questa zona è buona la disponibilità di spazio, cosa che consente di collocare:

a) due zone umide, con funzione di accumulo e laminazione delle acque, che poi è un'ottima occasione anche per la loro depurazione. Una di esse è ubicata a monte della zona 1, con funzione di disconnessione e accumulo delle acque provenienti dalle campagne, che si incanalano nella rete di drenaggio naturale, incrementando notevolmente il rischio di allagamento.

b) tre bacini di ritenzione/detenzione.

c) cunette erbose per l'aumento dell'infiltrazione ai lati di alcune strade più larghe, tipiche del relativamente recente Quartiere Poggiofranco.

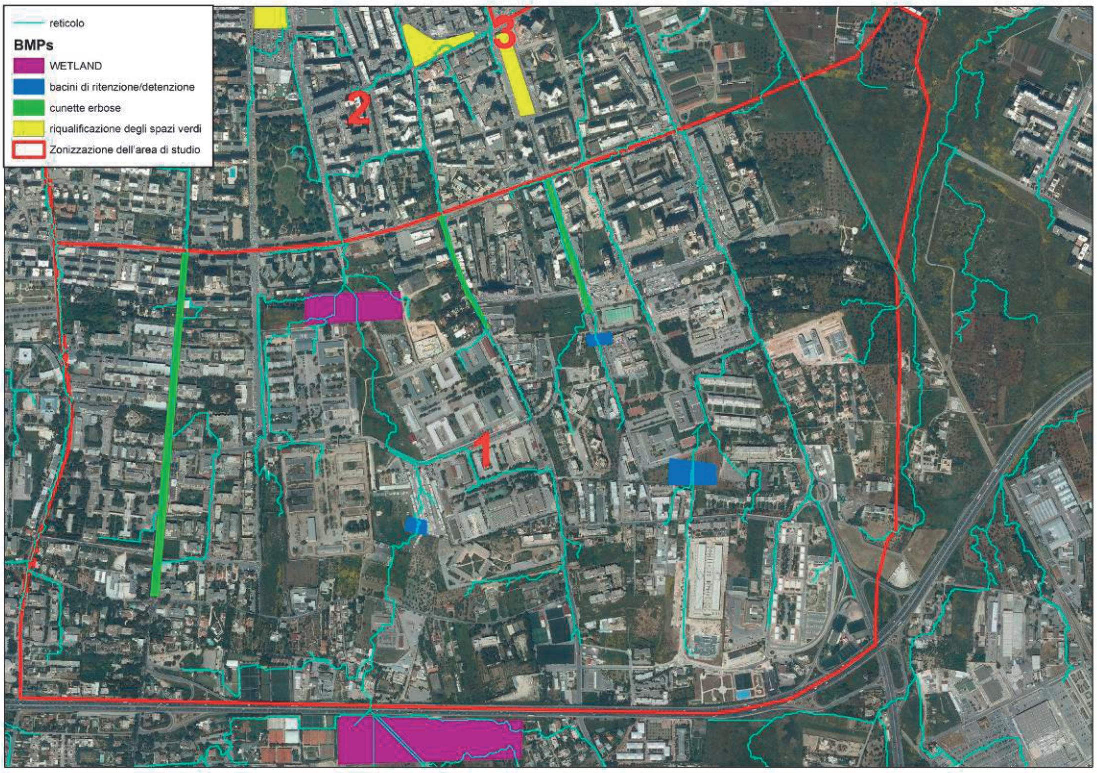


**Fig. 6°: Zona 1 e BMPs proposte**

Nella zona 2 (Fig. 6b) il tessuto urbano si densifica, quindi la strategia di greening è incentrata sulla riqualificazione degli spazi verdi, delle aree pubbliche e dei parcheggi. Inoltre, due bacini di ritenzione sono stati inoltre proposti. Tali impluvi dovrebbero accumulare l'acqua in corrispondenza di eventi importanti e, una volta cessato l'evento, convogliarla alla rete di drenaggio o renderla disponibile per il riutilizzo, a seconda delle necessità.

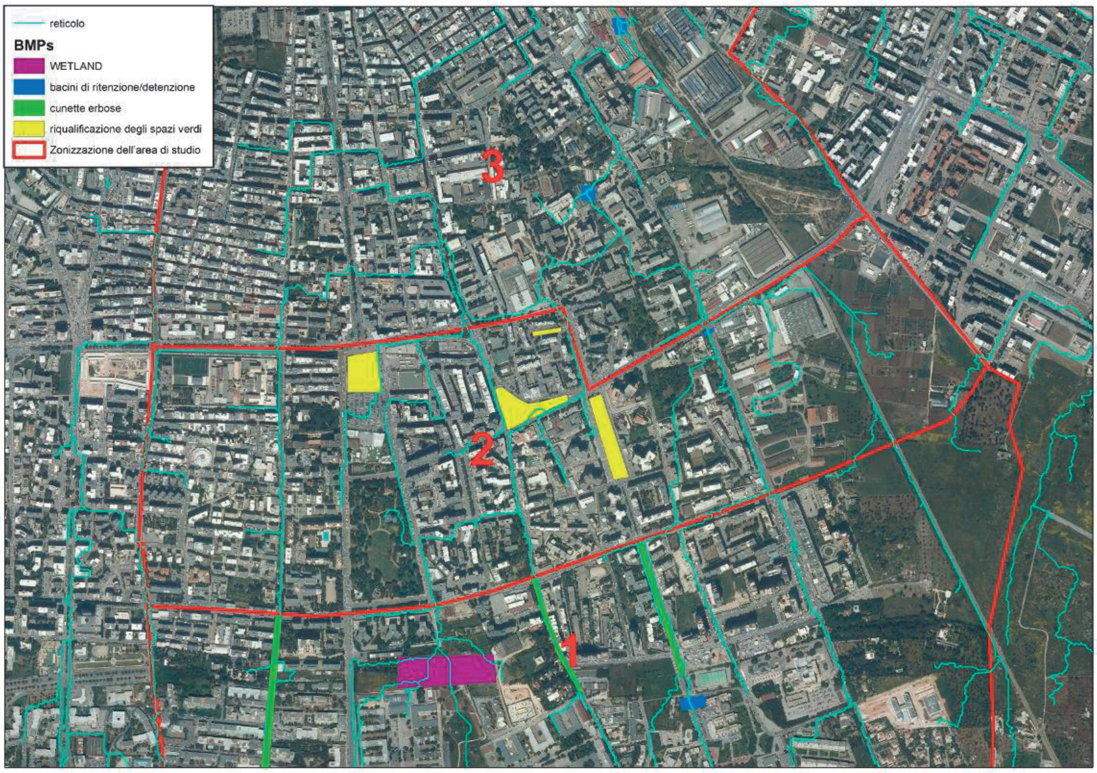


**Fig. 6b: Zona 2 e BMPs proposte**


**Fig. 6c: Zona 3 e BMPs proposte**

Per quanto riguarda la zona 3 (Fig. 6c), la città storica, i margini progettuali di BMPs sono fortemente limitati, per ovvi motivi di spazio. Il greening quindi si deve limitare ai tetti verdi e soprattutto a quello dei cortili, coperti con solai all'altezza del primo piano degli edifici per realizzare locali commerciali. Per altro, la destinazione a verde e orti dei cortili fa parte della tradizione d'uso ottocentesca (vedi fig. 2), da reinterpretare in chiave contemporanea.

Importanti occasioni di intervento sono poi offerte dall'imminente spostamento della ferrovia, che attraversa tutta la città, immediatamente a monte della zona 3. In questa area esiste un compluvio naturale molto importante, perché grande fattore di carico idrologico sulla fogna principale di via Matteotti, essendo a ridosso di questo collettore (vedi fig. 5). Qui è fondamentale prevedere una zona umida, con bacino di detenzione-ritenzione.

Le analisi eseguite per il calcolo dell'Indice RIE e il confronto dei risultati ottenuti dalle singole strategie hanno permesso di stabilire che, date le caratteristiche dell'area di studio, l'intervento più efficace per l'aumento dell'Indice RIE è la riqualificazione degli edifici con tetti verdi. Buoni risultati si potrebbero avere, inoltre, con la riqualificazione di grandi aree adibite a parcheggio mediante l'utilizzo di pavimentazioni permeabili.

Questo risultato è comprensibile considerando che il tetto verde permette di trasformare una superficie totalmente impermeabile in una superficie verde con buone capacità di infiltrazione. L'inserimento di tetti verdi, quindi, è un intervento che, se applicato in maniera diffusa sul territorio, migliora di molto la condizione complessiva in termini di deflusso superficiale e con ricadute positive potenziali anche sulla qualità di vita urbana in generale. La scelta di dove incentivare maggiormente la riqualificazione dipende da diversi fattori, uno dei quali è la difficoltà nelle aree densamente urbanizzate di intervenire con BMPs che occupano superfici al suolo. In tali casi il tetto verde rimane l'unica possibilità di riduzione dei deflussi. Per quanto riguarda l'area di studio, le zone più vocate all'utilizzo di questa tecnologia sono le zone 1 e 2. La tessitura particolarmente densa dell'edificato di tali aree infatti consente di utilizzare pochi interventi diffusi di altro tipo come cunette erbose o utilizzo di pavimentazione permeabile.

La riqualificazione dei vuoti urbani non genera un incremento sostanziale dell'indice RIE totale. Tuttavia, la riqualificazione delle aree degradate si pone come una buona strategia per il miglioramento dell'area di studio, poiché genera un complessivo miglioramento della qualità urbana. Il riuso delle aree dismesse e dei cosidetti "vuoti urbani" consente non solo di restituire porzioni significative del territorio urbanizzato, ma di farle concorrere alla realizzazione di nodi ambientali (veri e propri gangli ecologici), che concorrono alla realizzazione della più articolata rete ecologica e ambientale urbana. Favorire la mixità funzionale, il riuso di aree preziose che spesso si trovano nel cuore dei tessuti urbani non solo rompe i recinti e le barriere che rendevano questi luoghi anche fisicamente separati dalla città, ma consente il recupero di parte del deficit pregresso di dotazioni sociali che caratterizza le città italiane, nonché di dotazioni infrastrutturali e di mobilità pubblica.

Le strategie di intervento proposte in questo caso studio, anche se progettate sulla base di una analisi strettamente idrologica per la mitigazione del run-off urbano, hanno molteplici esternalità positive[5], svolgendo una funzione ecologica (sono corridoi e habitat per specie animali e vegetali), di termoregolazione del clima cittadino (attraverso l'evapotraspirazione e l'ombreggiamento da parte delle piante), estetica (riqualificazione ambientale dei vuoti urbani e delle corti), ricreativa e sociale (verde urbano visto come luogo di incontro), culturale e didattica (promuovendo la sensibilità ambientale dei cittadini) nonché

[5] Tali esternalità possono altresì essere considerate ecosystem services, cioè benefici che gli esseri umani possono ottenere dagli ambienti semi-naturali (Millennium Ecosystem Managment, 2005) e, quindi, anche dalle aree verdi urbane (per una trattazione completa degli urban ecosystem services vedi Lundy e Wade, 2011).

psicologica ed umorale dei fruitori (contribuendo al benessere psicofisico). Nel momento storico attuale, dove i conflitti tra uomo e natura si fanno sempre più evidenti e dove la conservazione delle risorse naturali (acqua, suolo, aria) necessita, ormai sempre più inderogabilmente, di identificare un efficace piano di azioni, la progettazione e la gestione del verde urbano multifunzionale, come quello descritto in questo lavoro, è essenziale per conseguire lo sviluppo durevole delle città. Questi sono i principi ispiratori della Carta di Aalborg (1994), della Convenzione Europea del Paesaggio (2000) e della Strategia Territoriale Europea (Gomez et al., 2011).

Con la ricerca illustrata in questo articolo si intendono sperimentare assetti territoriali che attuano i principi di sostenibilità ambientale attraverso l'uso del suolo, con la prevenzione dei problemi, che evitano o, quanto meno, rendono meno impattanti, provvisori e costosi gli interventi strutturali. Lo studio è quindi indirizzato alla riscoperta della tradizione della multifunzionalità del paesaggio, che è uno dei pilastri della sostenibilità ambientale, ma anche dell'economia, perché supera la logica (anche questa ormai insostenibile) secondo la quale i problemi si risolvono investendo tanti soldi in grandi opere, le quali, solo per essere grandi e costose, hanno la bacchetta magica della soluzione. In tal senso, il caso di studio proposto ha riproducibilità generale.

## 5 CONCLUSIONI

Il presente lavoro presenta un'esperienza, attraverso un caso di studio generalizzabile anche ad altre realtà, su come costruire scenari di *greening* finalizzati all'aumento della permeabilità del suolo, attraverso un insieme integrato di BMPs multifunzionali. Le proposte di intervento riportate in questo lavoro per la Città di Bari, rappresentano un primo passo verso la definizione delle BMPs urbane più efficaci per la riduzione del run-off urbano e l'identificazione delle aree più vocate ad una riqualificazione ambientale. L'algoritmo RIE per la sua semplice formulazione e la manualistica a disposizione, ha dimostrato di essere un valido strumento per una rapida valutazione e comparazione di BMPs; la sua applicazione ad altri casi studio potrà stimolare la diffusione della gestione sostenibile delle acque meteoriche urbane anche nella realtà italiana. Ulteriori studi saranno comunque necessari per definire strategie progettuali che massimizzino l'efficacia delle BMPs, ad esempio attraverso l'uso di modelli di simulazione del runoff ed analisi dei costi-benefici delle possibili combinazioni di BMPs.

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## FONTE DELLE IMMAGINI

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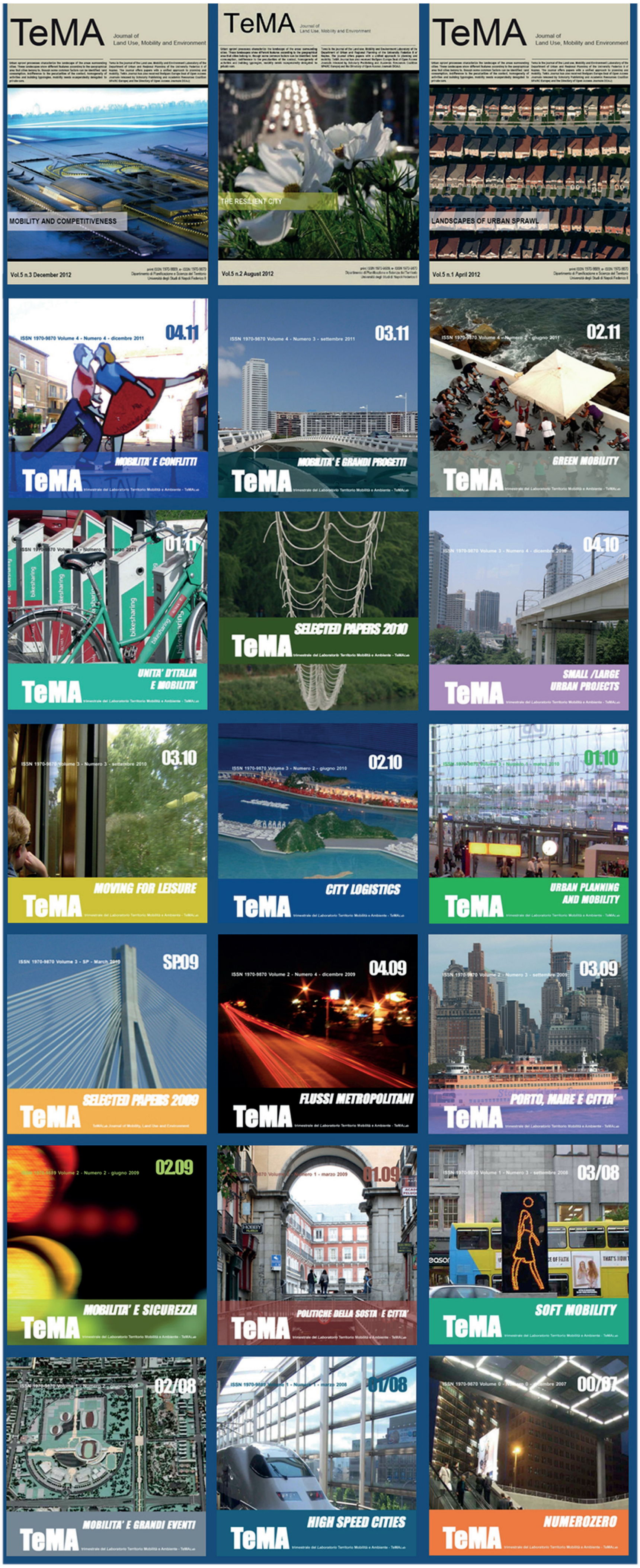


*Mobility and Competitiveness*

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TeMA

Journal of
Land Use, Mobility and Environment

TeMA 1 (2013) 113-140
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1502



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# REVIEWS PAGES

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The Reviews Pages keeps the readers up-to-date on developments in five reports: web, books, urban practices, law, news and events. Each report deals with the specific subject proposed in the TeMA issue. These reviews are specialist in nature but contain enough introductory material to make the main points intelligible to a non-specialist. The reader will not only be able to distinguish important developments and trends but will also find a sufficient number of references to the original literature, web and other resources .

# 01

SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR THE CITY

## REVIEW PAGES: WEB RESOURCES

**LAURA RUSSO**
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In this number
### SMART CITY AT URBAN SCALE

Everybody talks about sustainability, energy efficiency and innovation, lately. Struggling against the current financial, energy and social crisis, we are now considering the real importance of building a new type of city, capable of preserving the global urban future. In this context, several solutions have been proposed, and the so-called *smart city* concept seems to be the most successful one. A concise definition of *smart city* is hard to find since the idea has a broad application and the label *smart city* has been extensively used, yet we can think to a place where the physical world merges with the digital one, through active and creative participation of human capital. The main goal that the *smart city* project aims to achieve is to promote a sustainable development taking advantage of information and communications technology (ICT) to supply energy more effectively, increase efficiencies, reduce costs, and enhance quality of life, bringing large benefits to the population. Many cities, in Europe and around the world, have already taken up the challenge of becoming smart and they are working together, sharing information and best practices, supporting each other.The deep interest in the *smart city* approach has generated plenty of debate and discussion, and the web bears witness. Among a wide range of websites related to the *smart city* concept, it was chosen to point out some of them, each of which refers to a different scale/location of cities concerning the *smart city* process (European governments, Amsterdam local authority, megacities global network).
The European Union's website is the first one signalized; it explores the Smart City and Communities (SCC) European Innovation Partnership (EIP), that aims to integrate different themes, such as energy, transport and communication, at European level.The Amsterdam Smart City website shows the effort made by local authorities to ensure the interaction between citizens and government about the projects planned for the city; Amsterdam has becoming one of the main examples of smart city in Europe.
In the end, the C40 website presents the growth and mission of «a network of the world's megacities taking action to reduce greenhouse gas emissions. With a unique set of assets, the C40 works with participating cities to address climate risks and impacts locally and globally».

## SMART CITIES AND COMMUNITIES

http://www.eu-smartcities.eu

On 10 July 2012, the European Commission launched the Smart Cities and Communities European Innovation Partnership (EIP). The partnership proposes to pool resources to support the demonstration of energy, transport and information and communication technologies (ICT) in urban areas. The energy, transport and ICT industries are invited to work together with cities to combine their technologies to address cities' needs. This will enable innovative, integrated and efficient technologies to roll out and enter the market more easily, while placing cities at the center of innovation (European Commission).

The Smart City Stakeholder Platform represents the core of the EIP; its objective is to promote the diffusion of technological solutions by practitioners. «To achieve its goal, the Smart City Stakeholder Platform will set up five groups: three thematic expert Working Groups (energy supply networks; energy efficiency in buildings; mobility and transport) and two horizontal Working Groups (Finance and Roadmap)».

An accurate explanation of each group is provided in the website of the EIP under the heading of *Working Groups*, together with the latest solution proposal, the next meeting scheduled, the members and documents available. The applications to join the Working Groups have been closed and the first meeting already took place, but any member of the platform, not just the Working Groups members, can propose technologies for the Working Groups to consider.

In the website *Home*, visitors are invited to join the Stakeholder Platform or submit a solution proposal by completing two different, but equally simple, forms. In addition, there are the *Highlights* section where the most important information is presented, and the *Smart City News* section, which contains the latest news about the project. In the bottom part of the *Home*, the *City Profiles* section includes a list of cities across Europe that promote smart city initiatives; each city profile gives information about climate, population, density, morphology and other characteristics that distinguish the city itself, allowing users to find smart city solutions suitable to their own city.

The most interesting part of the site is that dedicated to the innovation solution proposals that have been submitted by members; each proposal is described in details, providing information about the appropriate city context where it can be tested, energy supplied or savings expected, potential expected benefits, and more. Every member of the platform can publicly comment or ask for more information, as well as privately contact the author. From May 2012 to January 2013, thirty nine solution proposals have been submitted and they constitute a valuable set of information freely available to anyone. The Stakeholder Platform goal of promoting the wide diffusion of ideas and best practices does not seem to be far.

## AMSTERDAM SMART CITY (ASC)

http://www.amsterdamsmartcity.com

In 2009, Amsterdam Smart City (ASC) inaugurated a new promising future for the Metropolitan Area, thanks to the collaboration between Amsterdam Innovation Motor, grid manager Liander and local authorities.

ASC aims to create new cooperation bringing partners together in order to facilitate sustainable progress and to implement climate and energy projects. «The ultimate goal of all activities is to contribute positively towards achieving CO2 emission targets, as well as aiding the economic development of the Amsterdam Metropolitan Area. In doing so, the quality of life will improve for everyone».

Several meaningful achievements have been reached since Amsterdam Smart City was born: 36 new technologies were tested; 6 partners meetings, 4 knowledge sessions, 60 presentations and 40 guided tours were organized; 132 companies joined the platform; 2422 users visited the website monthly. But most important of all, Amsterdam has rising in the ranking of the leading smart cities in Europe, working successfully. The key to this success is making the Metropolitan Area an urban living lab, giving the chance to partners for testing innovative products, services, technologies and approaches in a practical environment: for example, with the project *ship to grid* «almost 200 shore power stations were installed allowing ships to connect to green energy instead of relying on polluting on board diesel generators for their power supply», and thanks to the project *Geunzenveld-Sustainable Neighborhood,* «more that 500 homes were provided with new smart meters and some of them with an additional energy feedback display that should enable the residents to become more aware of their energy use».

Amsterdam Smart City website provides detailed information about the ASC partnership, which focuses of 5 themes (living, working, mobility, public facilities and open data) including 32 projects, implemented mostly in 3 areas in the Amsterdam Metropolitan Region (Nieuw West, Zuidoost and Ijburg); *themes*, *areas* and *projects* are the main sections of ASC website, that allow visitors to explore the new smart dimension of the city. By clicking on a single theme, or area, the related projects appear in the right part of the web page and a brief description of the theme/area is provided. On each project's page, you can find a detailed explanation with the monitoring of the project's phases and also the lists of partners and useful contacts concerning it; in some cases, a concise and straightforward video helps to better understand the project.

Additional site sections, such as *News*, *Knowledge Center* and *Partners*, provide extra information: *News* informs you of upcoming events, such as the World Smart Capital Partner Meeting or the inauguration of a new ASC project; the *Knowledge Center* contains documents, links, reports and more, about smart city's world, which can be useful to deepen understand this new idea of city; in the *Partners* section, however, the many organizations involved in ASC are listed, divided into 4 groups (Founding partners, Strategic partners, Project partners and Network partners).

## C40 CITIES – CLIMATE LEADERSHIP GROUP

http://www.live.c40cities.org

The Climate Leadership Group was founded in October 2005, when the Mayor of London promoted a meeting for further action on reducing carbon emissions. The group, originally called C20, in 2006 has grown to 40 cities, and thus the name C40 was born. New York City Mayor M. R. Bloomberg is the present Chair of the C40 and before him, London and Toronto Mayors held the position. C40 mayors take part in rotation in the Steering Committee, leading the network and guiding its work. «C40 Cities are working to reduce greenhouse gas emissions significantly and provide proven models that other cities and national governments can adopt». The city is considered the key to ending climate change; in fact, the sum of local actions has the power to change the future, having immediate impacts and effects. The C40 network helps cities in three different ways: it provides direct assistance to its cities in the choice and monitoring of climate actions; it promotes peer-to-peer exchange of experiences and knowledge; it offers a research and communications service to C40 cities, by finding and spreading the most successful activities.

The C40 website is fundamental for the group because it represents its public face, and gives everyone information relating to the C40 and its initiatives. It is divided into 7 sections: *About, C40 Cities, Why cities?, Take action, Blog, Events* and *Media & Research.* The section *About* includes a description of the group and its mission, its history and leadership (chairperson, Steering Committee and Executive Team), with a video that sums it up. If you want to know how many and which cities are part of the C40 network, the section *C40 Cities* gives you all the information about it. Today, there are 58 affiliated cities, representing 18% of the global GDP and around 9% of global population. You can browse through cities by choosing from a list; every city has its own page with an overview ($CO_2$ emissions and target, carbon emissions and city data), news and case studies. The way a single city can effectively contribute in reducing greenhouse gas emissions is explained in the section *Why Cities?*, where a infographic content informs you about the current potential of cities, that working together can help to build a better urban future. Cities are made of people, which means that each of us, by acting in a different way, can make a difference: this is the message of the section *Take Action*, where citizens are invited to «spread the word about the C40 mission» and follow the recommendation contained in the «11 easy ways to cut your carbon and help your city» list.

The *Blog* includes posts subscribed almost on a daily basis, concerning the C40 group and, more generally, the commitment to reduce greenhouse gas emissions. The sections *Events* and *Media & Research* end the website and provide information about the upcoming events and the press releases, as well as news, reports and additional case studies. The website is full of information of interest and it is well worth a look.

**IMAGE SOURCES**

The images are from: www.ricercasit.it/mastersmartcity/; www.eu-smartcities.eu; www.amsterdamsmartcity.com; www. carbon-based-ghg.blogspot.it

# 02

## SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR THE CITY

## REVIEW PAGES: BOOKS

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In this number

### THE SMART FUTURE OF THE CITIES

The concept of smart city is of great importance in relation to the tricky period we are passing through: the urban population growth (by 2020 the urban population will outgrow the rural population and the trend will continue until 2050), the worldwide economic crisis and the energy saving issue are some of the huge questions that have become important both from the perspective of environmental sustainability and progressive transformation of the economic development model and of behaviors.

Building resilient and intelligent cities is getting more and more a need in order to absorb disturbance and to ensure a better quality of life; although a lot of studies and researches have been carried on about the smart issue, we can provide neither a clear definition, nor conceive exactly this concept within the urban dimension. Nowadays smart is often a "trend" to which adhere, to attract considerable economic investment, and most cities claiming to be smart don't offer any evidence to support such proclamations (Hollands, 2008). Therefore it would be appropriate engaging the smart issue with a holistic approach in order to integrate and coordinate the several main elements that form a smart city: governance, mobility, participation, energy, economy, environment and living. The joining element among all these ones might be the ICT (Information, Communication and Technology), but actually is the community. Technology should be considered as a support to create a smart city, and not as the key factor, because it is people that use technology allowing in this way the cities to evolve and to become smarter: <urbanizing technologies, making them actually useful to the new urban needs> (Sassen, 2011).

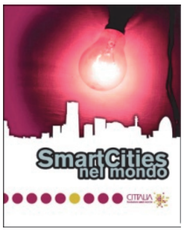
According to this perspective and in order to underline the concept that smart cities should be able to deal with the challenges that are getting on in terms of competitiveness, sustainability and social cohesion, this section proposes three documents related to the experiences of those cities that can be defined smart: the first proposal is a research project focused on a smart city ranking; the second one describes the smart best practices; the third one aims at supporting Italian government to create a smart Country.


**Title: Smart Cities-Ranking of European medium sized cities**
Author/editor:AA VV
Publisher: Centre of Regional Science, Wien University of Technology
Download: http://www.smart-cities.eu/download/smart_cities_final_report.pdf
Publication year: 2007
ISBN code: n.d.

In 2007 the collaboration among the Wien University of Technology, the University of Ljubljana and the Delft University of Technology allowed to conduct a research project related to the medium sized cities development perspective. Infact because of radical economic and technological changes, cities are facing growing competition and especially in Europe competitiveness and sustainable urban development are two challenges that are contented concurrently. In this perspective the medium sized cities should detect <their strengths and chances for positioning and ensure and extend comparative advantages in certain key resources> against both other cities of the same level and larger metropolises. Furthermore most urban studies has been concentrated up to now on these great metropolises dismissing the medium sized cities. Basing on these assumptions this research project is concentrated on the Smart European Cities Ranking, depending on an extended group of indicators, for the medium-sized cities. The Smart European Cities Ranking approach has been developed according to the following objectives:

- transparent ranking of a selected group of cities;
- elaboration and illustration of specific characteristics and profiles of every city;
- the encouraging of benchmarking between selected cities;
- identification of strengths and weaknesses for strategic discussion and policy advice.

This Ranking approach considers the six main elements characterizing a smart city, according to literature: economy, people, governance, mobility, environment and living. All the characteristics are defined by 31 factors identified in several workshops and which in turn, each one of the factors are described by a certain number of indicators (74 in all). The indicators have been obtained from public and free available data, in the period 2001-2007. Most of indicators (65%) are defined at the local level, while the remaining ones (35%) are derived from data on the national level in order to provide additional information not only about the endowment of cities but also about the perception and assessment of specific developments. Since the indicators are defined in different ways they have both different levels of values and different ranges, which are not allowed to be merged in any form. Therefore, these indicators have been standardized by a z-transformation resulting in a distribution with an average value 0 and a standard deviation of 1. In the final ranking Scandinavian cities and Benelux and Austria cities are ranked in the top group, while cities ranked lowest are mainly in the new EU member states. The ranking results are illustrated by maps, tables, and graphs on the website of the project, and the online database allows to the comparative strengths and weaknesses on the level of characteristics and factors of the 70 cities. The Smart Ranking approach is an easy way for benchmarking and identifying strengths and weaknesses and <its utility will increase the more clear/similar are the criteria for the selection of cities and the more valid and reliable are corresponding indicators>. In author's opinion the real smart cities will be able to use this ranking approach as a tool both to benchmark with other cities and to learn from the better performing cities in order to enhance their territorial capital and setting up strategic policies.

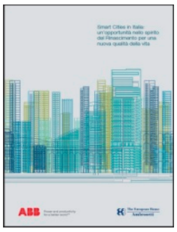



**Title: Smart Cities nel mondo**
Author/ editor: AA VV
Publisher: CITTALIA-Fondazione ANCI Ricerche
Download: http://www.cittalia.it/images/file/SmartCities_paper(1).pdf
Publication year: 2012
ISBN code: 978-0-8213-7766-6

Cittalia, the publisher of this publication, is a research center of Italian Towns and Municipalities whose goal is supporting local administrations in the challenges of urban and economic transformation; recently it is promoting several initiatives aimed at sustaining the local development processes in smart innovation. "World Smart Cities" is a report related to some of the most significant experiences in Europe and in the rest of the world and it provides an important contribution of ideas and suggestions to inspire the creation of similar initiatives in our Country. All the study cases are observed through the lens of the projects that cities have already implemented and that will be achieved in the near future; the description of each city starts both from its social and territorial characteristics and strengths of the policy realized in order to understand better the operating context. Therefore the report aims at underlining the added value of technological innovation for the sustainable development of urban contexts involved. The ICT (Information, Communication and Technology) is infact the common thread of all the experiences and represents the key to start an innovation digital process in the local policies.

Amsterdam and Seattle put the energy saving and efficiency as central themes of their political agendas in order to achieve mobility, working and public space projects, in this Flamish town, and to involve the local community in the planning process, in that American city. Both the towns want to achieve two main objectives: improving awareness of energy consumption with private citizens and promoting a greater consciousness of the impact of the individual on the quality of the urban environment. The independence from fuel fossil is the straight of Reykiavik where electricity is completely produced by renewable sources. The use of renewable energy, although facilitated by the availability of natural sources being in the territory, it can't be made without research, development and innovation processes, on which the city of Reykjavík has strongly focused.

Innovation technology has been used as catalyst for urban redevelopment in Paredes, Tallin and Monterrey; their goal is to attract capital and foreign investment in order to increase the urban competitiveness and to improve the quality of life. Mobility, environment, public health and other public services are the main axes of the growth strategies implemented in Cutiriba, Hlesinki, Portalnd and Houston; in these cities the ICT has been used to improve the dialogue between citizens and local administrations. This is the objective of Aahrus and Gent too, that have been realizing a digital revolution aimed at encouraging the participation of the local community. Especially Gent chose the crowdsourcing in order to put private subject services on the global market and to allow a better cooperation between private and public sectors. The reading of these experiences allows to understand two main elements: medium size cities can be drivers of development too, through targeted interventions; innovation technology represents an important prerequisite, but it is not completely sufficient; ICT is a way to improve the quality of life and to overcome the sustainability challenge, but the critical factor is the community. How can a city be smart if its citizens aren't smart too as well?



**Title: Smart Cities in Italia: un'opportunità nello spirito del Rinascimento per una nuova qualità della vita**
Author/editor: AA.VV.
Publisher: ABB e The European House-Ambrosetti
Download:http://www.abb.it/cawp/db0003db002698/bc72c938b3add52ac1257a53002fd811.aspx
Publication year: 2012
ISBN code: n.d.

ABB and the European House-Ambrosetti supported the draft of this report about the development of smart city in Italy, in order to define a virtuous and strategic growing path for our Country. Within the report there is a definition both of smart city and smart Country, in accordance with the aim of the same report: the smart city represents an <urban model able to guarantee a high quality of life and personal/social growth of individuals and business, while optimizing resources and sustainability> and a smart Country is <a forced choice that combines competitiveness of the Italian system and citizens wellness>. Our government should consider the "smart opportunity" as the first step to define a new systematic approach to the growth of the Country, considering all cultural identities, dimensions, vocation and peculiarities of Italian cities.
Seven proposals have been defined to create the optimal conditions for the smart development of Italy; these suggestions are the results both of the surveys referring to the stakeholders and to three studies processed for the report and they can be read in relation to the hypothesized effects on the Country:

- actions to participate successfully in international competition (proposals 5 and 6);
- actions to close the gap with the main Countries of international reference (proposals 3 and 4);
- actions to create competitive advantages (proposals 2 and 7);
- a proposal which is the cornerstone of the entire plan (proposal 1).

The report has been developed to answer three main questions related to the smart issue: what should Italy do to become more smart? What does smart mean? How smart is Italy and how much it will be in the future? Actually the real question is: how much will it cost to Italy the option not to choose, not to invest, not to engage a challenge that is approaching, despite any decision? The answer has been determined through studying data elaborated by Fondazione EnergyLab: Italy has to invest three percentage points of GDP each year from now until 2030. Nevertheless a smarter Country is worth up to ten points in GDP annually, without considering some aspects neither considered and nor quantified in the report, in terms of international competitiveness and image, social cohesion, innovation and livability. In order to achieve all these economical and social goals, the first action that should be implemented is disseminating the new smart culture; a survey on a representative sample of Italian population showed that four out of five Italian citizens have never heard of smart city, only the youngest and more educated segment of the population (25-34 years old and graduated) knows this subject. Instead everyone should feel the need to be part of a smart city, in order to build a real smart Country. Therefore this step related to the communication will has to be aimed at two aspects: the acculturation of the population on the smart cities and the public engagement to involve effectively the citizens.

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# 03

SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR THE CITY

## REVIEW PAGES: LAWS

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## THE DIGITAL AGENDA: TOWARDS AN UNIFIED EUROPEAN REGULATORY SYSTEM FOR THE CONSTRUCTION OF SMART AND SUSTAINABLE CITIES

The relationships between the elements of the territorial system and the technological innovation system are well-established in scientific literature and also the possible effects related to the use of new technologies on urban organization and structure have already been widely predicted (Beguinot Cardarelli 1992, Gargiulo 1995). This awareness at theoretical level influences the policies adopted by the European Union over the last twenty years. In 1987 the discussion about the foundation of a single European market of telematic services was launched by the "Green Paper on the convergence of the telecommunications, media and information technology sectors and the implications for regulation - Towards an approach for the information society" (COM(97)623). At the moment, the most recent European documents oriented to the development of an European Information Society are the Lisbon Agenda in 2000, the i2010 strategy (COM(2005)0229) and the Europe2020 strategy (COM(2010)2020).

Also the impact of advanced communication technology in re-launching the role of cities and regions from local to global scale, already stated in the 1990s, is now confirmed by the European Commission which defines that: "in today's technological environment, any structural change must necessarily include a strong dose of digitisation. Europe's companies cannot remain competitive, nor can public services remain first-class, if they do not make extensive use of information and communication technology (ICT)" (Galderisi Gargiulo 1997, European Union 2012).

The above considerations show how both theories and EU policies for the construction of what today are called "smart cities", have been introduced years before the same definition of the "smart" concept. The debate turns on again when techniques within the business environment starts to be adopted to the study of cities, that is when many device companies associated with new technologies realized that expanding its scope from the building to the whole urban system would increase the market for such devices. Today, both Europe and Italy have not yet developed a regulatory system for the construction and the management of smart city. This is because the "smart city" concept is still undefined and has a multidisciplinary nature. Until now both the European and the Italian Parliament have issued lows that affect different aspects of a smart city: energy saving, digital networks, sustainable mobility. The step that now they are trying to put forward is to build up a unified regulatory system within which defining specific legislation in the different areas of interest. The objectives they seek to achieve in the short term, concern essentially the creation of a single digital market and the overcome of the digital divide that still affects a lot of Member States.

Based on these considerations, the structure that will be given to the Laws' Review Pages of TeMA vol 6, is the following:

- the first issue concern how the statutory provisions take into account the territory wiring;
- the second issue will be based on the examination of the European and Italian laws related to energy saving with specific reference to the building scale;
- the third number will offer some reflections on the need to adopt a holistic approach to the issue of smart city that is to integrate digital networks and energy saving to a knowledgment and social capital who knows how to operate, in order to allow an effective improvement of the quality of life.


DIGITAL AGENDA FOR EUROPE: THE KEY ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT)

The Digital Agenda for Europe (DAE) (COM(2010) 245), lunched in May 2010, is the new ten-year planning document that takes the place of the European eGovernment Action Plan 2011-2015. It is the first of seven flagship initiatives of the Europe 2020 Strategy (COM(2010)2020), set out to define the key enabling role that the use of Information and Communication Technologies (ICT) will have to play if Europe wants to generate smart, sustainable and inclusive growth in Europe.
The objective of this Agenda is to chart a course to maximize the social and economic potential of ICT, spuring innovation, economic growth and improvements in daily life for both citizens and businesses in order to provide Europeans with a better quality of life through, for example, better health care, safer and more efficient transport solutions, cleaner environment, new media opportunities and easier access to public services and cultural content. Two are the challenges that Europe is to overcome with the DAE for the next decade:

- overcome the barriers that hinder the Member States in the adoption of ICT, such as: lack of interoperability, lack of investment in networks and lack of digital literacy and skills; insufficient research and innovation efforts and so on;
- stimulate demand and encourage investment in the development of infrastructure networks and in the promotion of digital contents and services.

For these reasons, the Digital Agenda proposes 101 actions, grouped around seven "pillars":

1. achieving the digital single market through opening up legal access to online content and by simplifying copyright clearance and management and cross-border licensing;
2. enhancing interoperability and standards of devices, applications, data repositories, services and networks.;
3. consolidating online trust and security by presenting measures on network and information security and the fight against cyber attacks.;
4. promoting competitively priced fast and ultra fast Internet access for all;
5. investing in research and innovation by encouraging private investment and doubling public expenditure to develop ICTs.;
6. enhancing digital literacy, skills and inclusion through the European Social Fund and by promoting e-accessibility in particular when the Member States apply the Audiovisual Media Services Directive;
7. leveraging smart use of technology for society exploiting the potential offered by the use of ICTs in the several areas such as: climate change, through partnerships with emitting sectors; digitization of content, through European; intelligent transport systems, by applying the proposed Directive.

The Implementation of the actions described is coordinated by a group of Commissioners, the current commissioner is Neelie Kroes, the Vice-President of the European Commission. The Commissioners are responsible for ensuring that the principles of the agenda are recognized and implemented by all Member States. It's up to the Member States to adopt the digital agenda at national level.
On 18 December 2012, with the Communication COM(2012) 784 "Digital Agenda for Europe - driving European growth digitally", has been drown up a "to-do list" which sets up seven new digital priorities for

2013-2014. The Commission's top digital priority for 2013 is finalising a new and stable broadband regulatory environment. The remaining priorities concern: the adoption of measures to avoid one million ICT jobs going unfilled by 2015 because of lack of skilled personnel; the deliveration of EU cyber-security Directive; the update of EU Copyright Framework; the acceleration of cloud computing through public sector buying power; the development of new electronics industrial strategy to increase Europe's attractiveness for investment in design and production as well as growing its global market share.

Progress on implementing the Digital Agenda will be charted in the annual Digital Agenda Scoreboard. The last Scoreboard has been published in June 2012, reporting on the progress of those actions between June 2011 and May 2012 and assessing overall impact on the basis of 13 key performance targets. In particular, report underlines that "the progress towards achieving key performance targets is mildly positive, though some areas for concern should be noted, which can be partially attributed to the negative economic climate in which the strategy is being deployed. Regular internet usage is rising steadily, especially among disadvantaged groups. Fewer and fewer citizens have never used the internet. Similarly, online buying continues to increase, although the pace of growth in cross-border eCommerce is very slow. Importantly, high-speed broadband shows the first signs of taking off, including super-fast connections above 100 Mbps. Finally, the market share of LED lighting is expanding swiftly." (EU 2012).

## DIGITAL AGENDA FOR ITALY: THE MODERNIZATION OF THE RELATIONSHIP BETWEEN GOVERNMENT, CITIZENS AND BUSINESSES

The Digital Agenda for Italy (ADI) has been launched the 1st March 2012 by the Decree Law named "Semplifica Italia". The statutory provisions concerned with the Digital Agenda for Italy are within the item n. 47 of the D.L. 5/2012, named "Agenda Digitale Italiana", according to which " under the directions of the Digital Agenda, the Government is pursuing the goal of the modernization of the relationship between government, citizens and businesses, through coordinated actions aimed at encouraging the development of the demand and the supply of innovative digital services, at enhancing the broadband connectivity, at encouraging citizens and businesses to use digital services and at promoting the growth of industrial capacity adequated to support the development of innovative products and services". On December 18th, 2012 the D.L. 179/2012 "Further urgent measures for the country's growth" has been turned into the low n.221/2012, named "provvedimento Crescita 2.0", in which there are the measures for the concrete application of the ADI.

The goals that the Italian government aims to achieve are 3:

- encourage public funding to eliminate the digital divide by 2013;
- encourage the digitization of the relationships with the local administration and the communications between public offices;
- promote the development of smart cities, where government and technology come together to improve the quality of life of citizens. In this regard two announcements have already been issued: one for the northern Regions, for which have been allocated 665.5 million euro, and one for the central and southern Regions, of about 240 million euro.

To implement these goals a "Commissioners group" has been instituted. The task of this group was to establish, between the beginning of March and the end of June 2012, a series of regulations (decrees "Digitalia" package) that constitute, together with the operational projects, the strategy of the Italian Digital Agenda.

The Commissioners group is divided into six working groups which correspond to the six strategic areas: Infrastructure and Security; eCommerce, eGovernment Open Data, Computer Literacy - Digital Skills, Research and Innovation, Smart Cities and Communities. The task of carrying out the objectives set by the Commissioners group and of monitoring the implementation of plans of ICT in public administrations will be performed by the "Agenzia per l'Italia digitale", as stated in the D.L. n.147/2012, named "Decreto Sviluppo".

To make a complete and exhaustive list of the projects and of the plans contained in the Digital Agenda is practically impossible: on the one hand because it is a large amount of proposals and guidelines that affect several subjects, and secondly because the whole Agenda is still at a preliminary stage, with no clear and definitive measures of implementation.

Summarizing and simplifying, we can say that Italian Digital Agenda follows the seven pillars developed by the European Commission, adapting and directing them towards the real needs of Italy. The following innovations will be provided:

1. digital identity and innovative services for citizens: identity card, electronic health card and national services card (to access to the online services of public administration) starting from 2013; civil registry unified database, roads archive and certified e-mail for companies;
2. digital administration: allow to automate the range of organizational and procedural tasks of the services provided by public administrations. In particular, it has been stated that the public administrations has to execute all the services by Internet starting from 2014;
3. services and innovations to promote the digital education: electronic certificates and folders in the University starting from 2013-2014 period, digital textbooks starting from the academic year 2014/2015;
4. digital health measures: electronic health folders, electronic prescriptions;
5. broadband and ultra-broadband: the Agenda expects to complete broadband coverage (at least 2 Megabit) by 2013 and to improve the "ultra-wideband"[1]. For this reason two main plans have been issued: the first one named "National Broadband Plan",in the approval phase, for which have been allocated 150 million euro; the second one is the "National Plan for ultra-wideband" concentrated in the south of the country to which almost 600 million euro are assigned to;
6. electronic money and digital invoicing starting from 2014;
7. digital justice: notifications by electronic means, changes to the bankruptcy law to proceed electronically.

Every year, the Government will submit to Parliament a current report on the implementation of the Italian Digital Agenda.

The following are some considerations on the possible effects that the application of the measures contained in the Agendas presented above would entail.

The full implementation of Digital Agenda for Europe would increase European GDP by 5%, or 1500€ per person, over the next eight years. In terms of jobs, up to one million digital jobs risk going unfilled by 2015 without pan-European action while 1.2 million jobs could be created through infrastructure construction. This would rise to 3.8 million new jobs throughout the economy in the long term.

In Italy initiatives for approximately € 2.5 billion have been allocated; this investment is expected to produce 4.3 billion euro and up to 54.000 permanent employees. This strategy will allow the growth rate of national GDP of nearly a quarter of a point (0.24%); in this way it's possible not only to amortize the investment, but also to self-financing over time the public investment made through normal taxation.

In addition, the digitization of many services would dramatically decrease government spending and fraud against the State. For example, the electronic prescriptions, which should have started already in September 2012 as stated by the ex health Minister Renato Balduzzi, could save about € 7 million per year.

These measures will allow Italy to overcome the crisis and to compete in the global scenario.

The report "doing business 2012" by the World Bank, notes that Italy reveals a lower contribution of long-term ICT capital to GDP growth by investing in ICT only 2 per cent of its gross domestic product (that is, 10% of total investment), compared with 3.5% in the U.S. (which accounts for 25% of total investment). A reading of the Digital Agenda Scoreboard 2012 shows also the significant gap between the Italian and the other European Union countries.

An overview reveals that Italy has the following values below the European average:

- the population that has never used the internet (the 39% of the population declare that they have never used the internet), preceded only by Romania, Bulgaria, Greece, Cyprus and Portugal;

- the percentage of individuals using the internet regularly, that is one of the lower of the European States;
- the use of internet, such as searching for information, online banking, eCommerce, online purchases: books, magazine,/e-learning material.

The indicators in line with the European average mainly concern aspects regarding the infrastructure (eg, fixed and mobile broadband penetration). These results demonstrate that besides to continuing to invest in infrastructure it is now necessary to focus on strategic issues related to the increase in digital literacy skills and inclusion.

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## NOTES

[1] "broadband" refers to the connection system that allows to send information at a rate that varies from 2 to 20 Mbps (megabits per second). The "ultra-broadband" travels instead at a major rate: from 30 to 100 Mbps

# 04

## SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR THE CITY

## REVIEW PAGES: URBAN PRACTICES

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In this number

## SMART CITIES: THREE INTERNATIONAL CASE STUDIES

Larger cities of today are facing immense problems in terms of development, inclusion, housing transport, climate, infrastructure, security and many more. The current economic crisis is making it even harder for cities and their citizens, neighbourhoods and businesses to achieve their goals and many cities are in a state of decline (Pallagst et al.,2009). At the same time the cities themselves represent a promise for a brighter future: a vision of freedom, creativity, opportunity and prosperity (Schaffers et. al, 2012). They are the engine of economic growth , productivity and competitiveness. In this context the concept of "Smart City" has attracted considerable attention over the past few years. The European Union (EU), in particular, has devoted constant efforts to define a strategy for achieving urban growth in a "smarter" and more sustainable way. Other international institutions also believe that "Smart Cities" represent an effective response to today's needs which have become crucial thanks to the rapid, pressing trends seen throughout the world. According to Caragliu et al. (2009) a city can be defined as "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". Cities around the world are currently developing strategies toward becoming "Smart Cities". In this paper three international case studies have been presented:

– Amsterdam (the Netherlands)
– Masdar City (United Arab Emirates)
– Curitiba (Brazil)

The case studies aim to analyze the currently emerging strategies, policies and technological opportunities offered by this new emerging approach to smart and sustainable growing. With different strategies and different solutions, the case studies analyzed have shown how a forward thinking approach, an innovative usage of green and ICT technologies and new forms of citizen's empowerment can be successful factors to tackle social, economic and environmental issues that cities are currently facing and pave the way to a smarter and greener environment.

## THE STUDY CASE OF AMSTERDAM

As the commercial capital of the Netherlands and one of the top financial centres in Europe, Amsterdam is considered an alpha world city in the global economic system. The city strives to become one of the "greenest," most sustainable cities in Europe while continuing to attract businesses and maintain economic growth. Over the past four years, the city has successfully managed to become a leading European Smart City.

Cooperation, smart technologies and behavioural changes are the key ingredients of "Amsterdam Smart City"(ASC), an ambitious strategy aimed to fuel sustainable economic growth and a higher quality of life, in combination with an efficient use of natural resources. The Amsterdam Smart City Project ties in with the New Amsterdam Climate Plan which aims to ensure that all the city's organisations are climate-neutral and to reduce CO2 emissions by 40% by 2025 (compared with 1990).

Amsterdam Smart City started in 2009 as a collaboration project between Amsterdam Innovation Motor and the grid operator Liander, in close collaboration with the municipality of Amsterdam. Using a collective approach by bringing partners together and setting up local projects, ASC has grown into a broad platform. Today, the project involves over 70 different partners, and Amsterdam has become known as a Smart City all over the world. In a Smart City perspective, Amsterdam's main challenge is to save energy to reduce CO2 emissions. To do this, Amsterdam Smart City has, during these years, introduced and tested a vast amount of projects, divided into five areas: Living, Working, Mobility, Public Facilities and Open Data.

Under the label "Living" Amsterdam Smart City has initiated a variety of projects which aim to raise awareness among residents about their energy use and behaviour. Indeed, with over 400000 households, Amsterdam is the largest city in the Netherlands; together these households are responsible for approximately one third of the total CO2 emissions in city. By applying smart and energy-saving technologies, the City intends to greatly reduce CO2 emissions and energy consumption. A successful example of this strategy is the West Orange Projects that aims to better inform residents about their energy consumption through a wireless energy display connected to the digital gas and electricity meters. In this project more than 400 homes were equipped with a smart energy management system which allows to view the power consumption of any electrical appliance and the overall consumption of the entire house. This system has fostered an energy and emissions saving by up to 14 percent for each home and is now going to be applied on a large scale. A similar initiative has been realized in 500 other dwellings within the project Geuzenveld that provided the gradual replacement of the old energy meters with new displays containing information and suggestions helpful to residential energy consumption. Even many local companies have been involved in energy saving projects. During the Smart Challenge, for example, eleven local companies competed with each other in saving the largest amount of energy.

"Working" is an area where Amsterdam Smart City has initiated a lot of projects. In the densely populated Netherlands, commuting is very common. To create a more sustainable environment, Amsterdam needed to tackle the many daily trips made by car. A first attempt was made by creating drop-in work places in areas where there were often traffic jams, but due to many factors this was not successful. Today, a very successful project with drop-in offices within 5 minutes biking everywhere in Amsterdam is creating flexibility and reducing car-traffic within the city.

An example of a "Mobility" project is the Moet je Watt, where special electrical battery chargers have been relocated all over the city. What makes this project special is that the charging stations, apart from providing easy use services to electrical vehicles, also prevent over-charging, creating less energy waste. WeGo is another example of "Mobility" project aimed to reduce car ownership, congestion and pollution by stimulating car sharing. It consist in a new sustainable platform that allows neighbours and friends to safely rent their cars to each other. WeGo provides the insurance and technology to make sure every transaction is safe, convenient and easy.

"Public Facilities" includes projects such as Smart School and the Utrechtsestraat Climate Street. Smart School is a project where children in primary schools learn about saving energy, while their school competes with other schools in energy efficiency. The Utrechtsestraat Climate Street is another public space project where a city street works as an incubator and testing place for new climate friendly innovations and experiments.

"Open Data" programme consists in a number of separate activities, all required to stimulate the development of open access to publicly-available data. Key concerns include the decryption of data, the creation of sample applications and the organisation of a location platform for the data. According to ASC strategy access to share open data will fuel the information society: publicly-available data can be used and combined to provide citizens with new insights and the chance to make decisions based upon actual facts and figures.

## THE STUDY CASE OF MASDAR CITY

Masdar City is a planned city of 640 hectares designed by British architectural firm Foster and Partners. Initiated in 2006, it will rely entirely on solar energy and other renewable energy sources, with a sustainable, zero-carbon, zero-waste ecology and will be a car free city. It will consume 75 per cent less energy than any traditional city of the same size.

Creating an entirely new city exclusively based on renewable energy sources and the latest technologies is considered a major challenge in the strategic plan Abu Dhabi Economic Vision 2030. As a clean-tech cluster and test-bed of renewable energy and sustainable technologies, Masdar City will not only help diversify the Emirate's economic base by providing a home to a new industry, but will also provide an environment where new technologies can pave the way to a smart green environment.

Today only a small part of the city is completed while construction is still ongoing. At full build-out by 2020, the city is expected to have 40,000 residents. Furthermore 60,000 workers are expected to commute to the city to work in hundreds of companies in the energy and clean technology that will settle there.

The Master-plan of city, financed by the Abu Dhabi Future Energy Company, meets in particular the criteria of urban sustainability: in addition to a particular attention to the buildings orientation (with regards to the sun and prevailing winds), the city has been designed to facilitate integration between work and leisure. A mix of land-uses has been designed in order to minimize the need to travel. Other key features of the city design are the high density of the blocks combined with a relatively low height of the buildings, which will reach a maximum of 5 floors, attention and care for the construction of public spaces, thus encouraging collective life and social relationships. The City, therefore, is an entirely pedestrian area with narrow streets, shaded walkways and a series of routes that encourage walking.

Sustainable urban development and high quality of life are the main concerns of the master-plan. To achieve these objectives, great importance has been given to the role of new technologies. These technologies have been applied in a variety of projects, divided into four main areas: energy management, water management, transport and supply chain, waste management.

In the area of energy management, several smart and energy-efficient techniques have been applied and stringent building efficiency guidelines have been set in areas such as insulation, low-energy lighting specifications, the percentage of glazing (i.e., windows), optimising natural light, and installing smart appliances, smart metres, smart building management systems, an integrated distribution management system, and a citywide energy management system that interacts to manage the electrical load on the grid – all along the system, from the utility to the consumer.

The City also aims to reduce water consumption by 40 per cent (compared with a "traditional" UAE city). To reach this objective the city is using a broad array of water-use reduction technologies and systems. Highly efficient fittings, fixtures and appliances, smart water metres that inform consumers of their consumption, and smart metres to identify leakage across the system are already in use. Furthermore treated wastewater is 100 per cent recycled to be used in landscaping. Indeed, through a variety of strategies, including highly efficient micro-irrigation, landscaping design that minimises plant evapotranspiration, and low-water-use and indigenous plants and trees, the city has achieved a 60 per cent reduction in water usage per square metre.

Transport is also another essential element for a city that aspires to be carbon neutral. For this reason, a public transportation system consisting of electric buses, electric cars and other vehicles powered by clean energy will carry out the transport service within the city, while a light rail will ensure the connection to the Abu Dhabi city centre. Masdar City is also experimenting with new sustainable transport solutions, such as the Personal Rapid Transit (PRT) and the Freight Rapid Transit (FRT). These vehicles that serve as taxis, but with electric traction systems and automated guideway transit, operating on a network of specially built guide ways and characterized by a single cabin to offer more privacy and comfort.

The Masdar City solid waste strategy seeks to minimise waste to landfill and maximise the resource potential of waste material by reuse, recycling and composting. The waste will be treated in the Resource Recovery Centre (RRC) of Masdar city: part of recyclables will be used for the construction of the city itself.

## THE STUDY CASE OF CURITIBA

Curitiba, the capital of the Brazilian state of Parana, is a city that has been able in the course of nearly three decades to radically transform its face. Hailed as one of the world's first Smart Cities, Curitiba has linked flood control, environmental quality, transportation and economic development through a systemic approach.

With a population of nearly 2,700,000 inhabitants, the city faced during the last century a process of rapid urbanization, due to the emergence of new industrial activities which produced as a result a massive migration flow from the countryside to the city. Population growth has led to a drastic acceleration of the urbanization process, with the typical consequences known to modern megalopolis: poverty, unemployment, insecurity, traffic congestion, pollution. Problems that the city is facing using a mosaic of popular and creative solutions.

Today, Curitiba is the ecological capital of Brazil, with its 51 square meters of green area per inhabitant and an income per capita that almost doubles the average Brazilian income per capita.

The process of change that led the city to achieve these results can be traced to 1971,when the architect Jaime Lerner became the new Mayor of the City. Lerner previously was the head of the Institute for Research and Urban Planning of Curitiba (IPPUC), which was established in the previous years as a centre of excellence in the region. Immediately after his election, Lerner launched a new development strategy focusing on three main areas: mobility and traffic; environment and planning; health, social services and education.

**A typical Curitiba's "tube station"**

The transportation network in Curitiba is a well planned and practical network that has been mimicked throughout the world. It is a system that limits the amount of car use and promotes sustainable modes of travel. The system integrates public transit with biking and walking, moving people efficiently and quickly while creating a pleasant atmosphere for travelling. The transportation network effectively serves the rapidly growing population while limiting the amount of urban sprawl. It is based on a fleet of buses which run on dedicated lanes. This way, not experiencing delays due to traffic of private vehicles, buses travel times are equal to those of the underground, which also caters for the same volume of people, but at one eighth of the costs. New innovative buses, locally produced by Volvo, have been designed with particular attention to energy consumption: in 2012 Volvo Buses has received its largest hybrid bus order to date. Indeed the city of Curitiba has ordered 60 buses that generate up to 35 per cent less fuel consumption. Efficiency is also due to the design of functional bus stops: the so-called "tube stations" consist of cylinders of steel and glass elevated above the street level with platforms parallel to the floor of the bus, these stations are wheelchair accessible, covered and safe. Since 2010 passengers benefit from automatic, contactless payment systems based on RFID technologies which allow them to purchase tickets by using their mobile phone. This system also provides passengers with better information about transit schedules and delays. New smart solution and well-planned bus transit system has helped to significantly decrease the dependence of residents on driving, resulting in lower carbon emissions. About 85 per cent of Curitiba's population uses the bus transit system.

The results in the field of mobility are strongly related to the introduction of innovation in the field of planning. Planning has encouraged the spread of services and trade in the entire area of the city, contrasting zoning practices. Each district has a "Road of citizenship" for public offices and decentralized administration. The height of the buildings is inversely proportional to the distance from the public transport.

Curitiba has also promoted a smart waste management system and public awareness on waste separation and recycling. About the 95 per cent of the population benefits of a municipal waste collection system. One of the most popular solutions to achieve this result is the Green Exchange Program, based on social inclusion and the benefits that both the people and the environment derive from it.

It was born with the need to limit the pollution and the deterioration of the city, especially in the poorest neighborhoods, and create jobs at the same time. Families who bring materials to recycling centers in return receive basic necessities such as bags of groceries and transit passes. There is also a program aimed at children in which recyclable waste is exchanged with school equipment, toys and books. Through this approach to the issue of waste management, the city has come to recycle 70 per cent of materials. The money acquired from the sale of materials is reinvested in the city, through programs of social utility or maintenance of the collection system. In addition, this guarantees the collection of waste even in areas where it is more difficult to organize a traditional system of collection.

An effort equally relevant is geared towards social integration, with particular attention to health care and education services. The low-income families are supported by several centres, located near schools, offering meals and educational activities to children and adolescents. These learning activities promote access to the labour market, also facilitated by the relief tax dedicated to companies willing to provide training. The Integration Program for Children and Adolescents helps creating social capital, teaching care for the public good, gardening techniques, energy savings, health promotion.

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## IMAGE SOURCES

The image shown in page 129 is from http://amsterdamsmartcity.com; the image shown in page 131 is from http://masdarcity.ae; the image shown in page 132 is from www.ascuoladaglialberi.net

# 05

## SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR THE CITY

## REVIEW PAGES: NEWS AND EVENTS

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In this number

### THE FUTURE AND DEVELOPMENT OF THE SMART SOLUTIONS

In the last years, it was necessary to focus policies and funds of European development, national and local through the improvement of living conditions in urban areas. Because of the high concentration of people that lives and works in these urban areas and it brought to the formation of numerous economic, social and environmental problems. In order to solve these problems, it was necessary to apply new models of smarter development, based primarily on a better understanding of the events influencing the evolution of the territory. Then the introduction of the concept of smart city, which engages the adoption of solutions involving the largest number of people and sectors, so as to increase the livability and local competitiveness. The start of urban development based on an integrated approach requiring a good knowledge of social and economic events that govern the evolution of the city.
The goal is to limit the negative effects of human activity, by reducing the use of non-renewable natural resources and the optimization of production and management processes. In addition to the objective of environmental sustainability for the future development of urban areas, there is also that of social sustainability. In fact, through the use of new technological solutions wants to promote the active participation of individual citizens in the decision making process of planning and management of services and territory. Then to generate the use of smart solutions is to facilitate the processes of social inclusion and the achievement of economic and environmental sustainability. To reach these objectives, the European authorities in collaboration with the European states and local authorities have started some multi-years programs for the development of these intelligent solutions.
In particular, the model of smart city that is proposed in Europe, with the application of these projects, is that of a city, that in the near future, will be equipped with the technologies of information and communication, to able to maximize the efficiency and guarantee a greater competitiveness, reducing the use of the natural resources. For example, the Strategic Plan for the European Energy Technologies (SET Plan) defines the smart cities, predisposing solutions for a 40% reduction of greenhouse gas emissions by 2020, through the use and production of energy from renewable sources. The interventions planned must regard the improvement of the quality of buildings, the installation of local energy networks and the systems of transport.

An essential element for the development of smart cities of the future is the development of digital networks, which can be considered a new category of public works. The greater use of these digital networks allows to obtain and interchange a large numbers of data and information, in a short time. In fact, the spread of these digital networks, will further allow the livability of the cities, providing a large and more immediate knowledge of the environmental and social factors that regarding the cities. Allowing a faster sharing and implementation of the choices for the city government and in general for urban areas. Finally the positive effects that can be generated by this new digital age will be able to provide and support a substantial rapprochement of the human to environment.

Among the sectors interested by the study and the development of new smart solutions, there is that of energy. To reduce and optimize the using, there is a necessity to implement innovative solutions, more effective and efficient, to able to meet the power needs of small and large users and manufacturers. Considerable importance is the application of smart solutions related to the energy sector in urban areas, where there are many solutions already developed successfully.

To provide to the public authorities and private investors the right knowledge and tools on intervention strategies, the sources of European funding and the possibility of a mixed public-private involvement, are organized events such as the Smart City Event. It takes place in Amsterdam, and now at the third edition and is considered one of the main European events in the industry.

To this event takes part numerous technology companies, industrial experts, the city already smart and energy producers and distributors that participate and show their projects already implemented successfully. Smart City Event is an opportunity for all that want to take example from experiences already consolidated, so to can evaluate which solutions and strategies are most appropriate to their need and the local context of origin.

In 2012, the previous edition, took part over 350 companies and organizations from all over the world, for the year 2013 are expected to more than 50 prominent international speakers.

The European Commission in 2007, to encourage the development and diffusion of technologies with low carbon use, in line with the international targets for reducing the pollution, drew up the Strategic Energy Technology Plan (COM (2007) 723). So the plan for the energy sector explains the new policies community strategic planning, the modalities of execution, the economic resources to use and the international cooperation. Fits into this logic the start in 2012 of the Smart Cities Stakeholder Platform that consists in a public platform for the exchange of information, where they can actively participate in the technical developers and local authorities of the European cities that adhere to the platform, and worked in the development of projects on Smart Cities. The work of platform is divided into two areas. In the first are developed the strategies for future development and in the second technological solutions can be adopted. Then the first area is divided into two subgroups: the first deals with the finance group and the other to define the roadmap. While the second area is divided into three subgroups of technical work, which respectively face the energy efficiency and buildings, the energy networks of power and the mobility and transport. Over the virtual sharing of information, annually is organized a workshop, this year at second edition. The workshop will be an opportunity for local authorities and all stakeholders involved in various ways in the development of intelligent solutions to meet and discuss on how direct the development of the European urban landscape in the coming decades and for present the results of groups of work and projects already started. This event allows the administrations to bring the requirements of the citizens and the problems found in the implementation of smart solutions in the cityscape. And the companies that operate in this sector to be able to illustrate the most recent elaborate smart solutions for the application in the urban contexts.

An important peculiarity for the development of future smart city is that on the use of Information and Communication Technology. The ICT is an essential tool to collect, manage and use in fast, effective and efficient high volume of data and information main to the management and governance of social, economic and environmental future of the city. So to be able the future challenges of development, will be necessary that businesses and governments find a appropriate technological solutions, able to adapt to individual needs, so that they can gather and store these large amounts of data within Big Data. In addition to collecting and archiving is also important to the development of software that are able to manage and draw the right information from these data. In fact, the right use of this information collected in the databases will can improve the existing services and develop for new citizen.
The use of ICT has led to the development of a new business sector, with the creation of many businesses and jobs. So since this is an industry that is constantly changing, it is important to take part to appropriate training events. One of the upcoming events in the program is smart to Future Cites, to be held in London, where more than 80 case studies will be presented at an international level developed with the collaboration between the government and the main international companies in Information and Communication Technology. Therefore will discuss the business models that can actually promote the development of smart cities and the creation of new economic activities that can foster the implementation of integrated solutions for the energy, transport, retail and of health care. It will also be possible for companies and institutions interested to have of direct meetings with the experts of field, in order to obtain specific advice for the implementation of their smart projects.

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| | SMART MOBILITY MANAGEMENT EVENT<br>Where: Brussels - Belgium<br>When: 30 May 2013 |
| | SMART CITY EVENT 2013<br>Where: Amsterdam - Nederland<br>When: 29-30 May 2013 |
| | SMART CITIES ANNUAL CONFERENCE<br>Where: Budapest - Hungary<br>WHEN: 5-6 June 2013 |
| | SMART TO FUTURE CITIES EUROPE 2013<br>Where: London – United Kingdom<br>When: 11-12 June 2013 |

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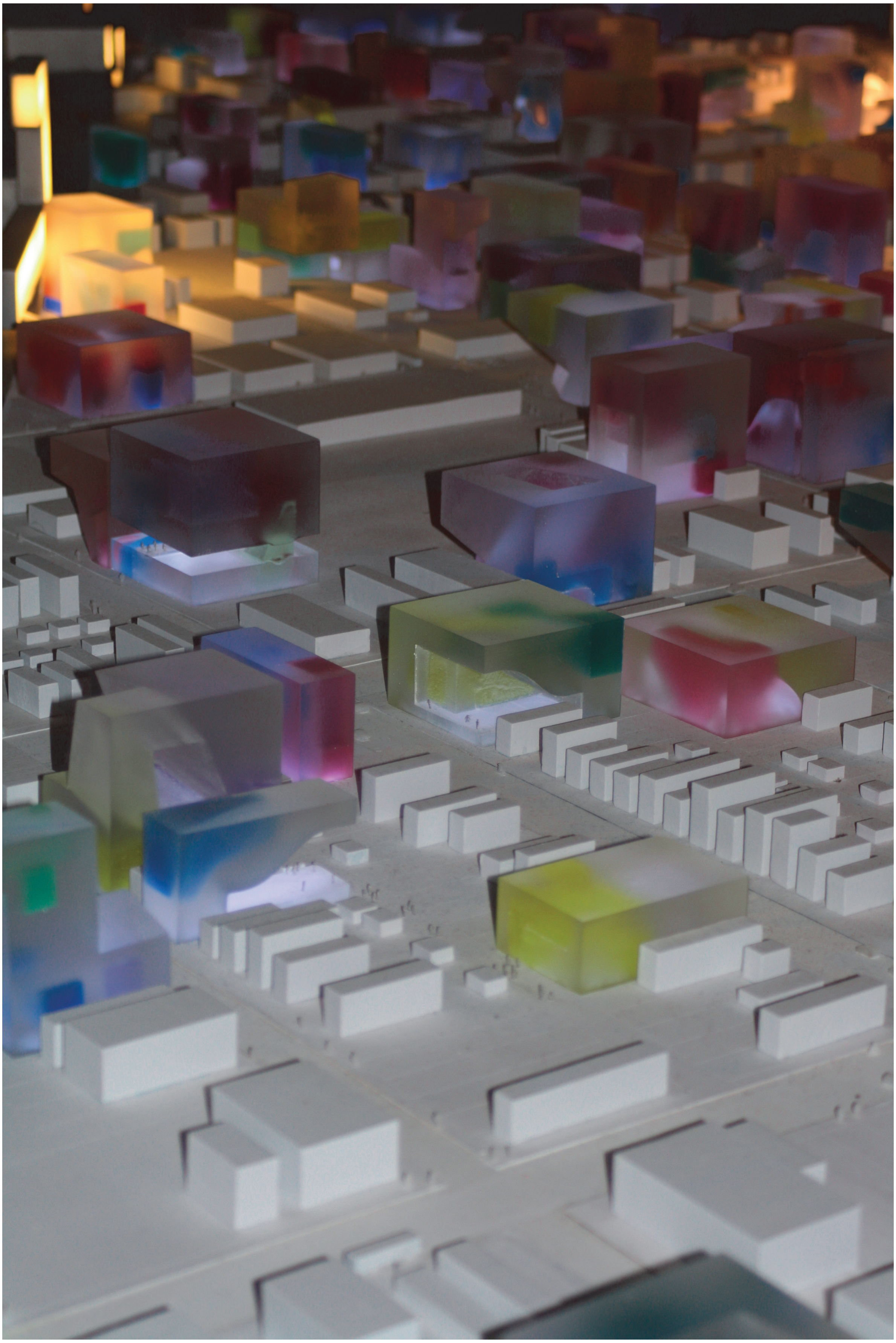
TeMA Journal of Land Use, Mobility and Environment

# SMART CITIES:

## RESEARCHES, PROJECTS AND GOOD PRACTICES FOR BUILDINGS

2 (2013)



Giusepe Mazzeo, Mediateca TeMA*Lab* 2012

TeMA

Journal of
Land Use, Mobility and Environment

TeMA 2 (2013) 143-144
print ISSN 1970-9889, e-ISSN 1970-9870
DOI: 10.6092/1970-9870/1829



# EDITORIAL PREFACE:

# SMART CITY: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR BUILDINGS

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During the last decades the concept of Smart Cities arose, according to which information and communications technologies might improve the functioning of cities, enhancing their efficiency, improving their competitiveness (Harrison, 2010). Within this general framework, the specific application of ICT in buildings is rapidly advancing in applications, with the aim of creating a more sustainable and resilient built environment, an in particular for the managing of resources and energy. In fact energy use in cities has attracted significant research in recent years.

The world's energy demand is mainly characterized by urban demand and two thirds of the world's total energy consumption of 7908 Mtoe and 70% of the CO2 emissions are attributable to cities. Covering only 2% of the world's surface, cities are responsible for about 75% of the world's consumption of resources (Pacione, 2009). In cities the building stock (domestic and commercial buildings) accounts for 61% of total energy consumption.

The theme of resource management and more specifically of energy saving is growing attention in research and in urban planning practice. In literature is growing the number of studies focusing on strategies and measure finalized at energy saving and in the practice field, energy savings require the development and usage of energy-efficient appliances and retrofitting of the existing building stock. Neverthless, where energy is concerned, the neighbourhood or city cannot be considered simply as an aggregation of buildings, and emphasis is need for more systemic, multi-scale and transverse approaches to deal with the intrinsic complexity of the urban fabric (Bourdic and Salat, 2012).

Within this framework this number propose a focus on ideas, projects and good practices aimed at develop building stocks within the city capable of an effective interaction with urban context, capable of reducing energy consumption, optimizing the use of space, minimizing impacts on natural resources, assuring the safety of inhabitants, also through an efficient use of available technologies.

In the Focus section the issue proposes two articles. The first article by Francesco Domenico Moccia describes a particular application of urban planning at the municipal level within the Campania Region. The Agropoli plan, which is part of the wider system of actions taken by the City to achieve the objectives on the environment posed by the European Union with the Directive "Climate Energy 20-20-20", provides a series of actions aimed at containing the uses energy through measures to rationalize, do not waste and reduce the use of non-renewable resources. The second article by Arto Emerik Nuorkivi and Anna-Maija Ahonen is about the experience of a Pilot training of urban planners in five EU countries such Finland, Germany, Hungary, Spain and the United Kingdom to understand the basics of renewable energy sources (RES) and energy efficiency (EE) that has been carried out during 2011-2012 under co-financing of Intelligent Energy Europe.

In the LUME section this issue collects an article by Lina I. Shbeeb and Wael H. Awad on the walkability of school surroundings and its impact on pedestrian behavior, with an application in Jordan. The study looks into pedestrian environment in schools' vicinity. Seventeen schools were selected and 231 students were followed from school to home. Results showed that 15% of observed subjects were involved in conflicts. Average walking time is 17 minutes; almost half of this time is spent either by walking on street or crossing. Females are involved in less conflict and they spend less time in traffic. Drivers give priority to pedestrian in one-thirds of all observed crossing with preference to males.

The second article of the section LUME is by Alì Soltani, Davoud Karimzadeh and is titled "The Spatio-Temporal Modeling of Urban Growth Using Remote Sensing and Intelligent Algorithms, Case of Mahabad in Iran. The article aims at modeling and simulating the complex patterns of land use change by utilizing remote sensing and artificial intelligence techniques in the fast growing city of Mahabad, north-west of Iran which encountered with several environmental subsequences.

The article by Rosa Anna La Rocca starts from the consideration that the diffusion of new communication technologies (ICTs) is significantly changing the urban supply system of tourist services giving rise to new ways of enjoying the city and proposes some reflections about tourist dimension of smart city.

The article by Alessandro Bove, Carlo Ghiraldelli focuses on the relationship between new technologies and urban space, that has become, especially with the introduction of the concept of smart city, the key in the definition of management options in the city itself.

The article by Houshmand E. Masoumi studies the effects of neighborhood-level land use characteristics on urban travel behavior of Iranian cities in a microscopic scale. In this study the role of socio-economic factors is also studies and compared to that of urban form. Two case-study neighborhoods in west of Tehran are selected and considered, first of which is a centralized and compact neighborhood and the other is a sprawled and centerless one.

Finally the article by Grazia Brunetta and Valeria Baglione focuses on the epistemological dimension of the concept of resilience in spatial planning., and its purpose is to understand the extent of innovation in planning practices and urban governance. In particular, the first part of the paper provides a review of the theoretical framework of resilience and the second analyzes the Transition Towns movement, with particular reference to the role of stakeholders.

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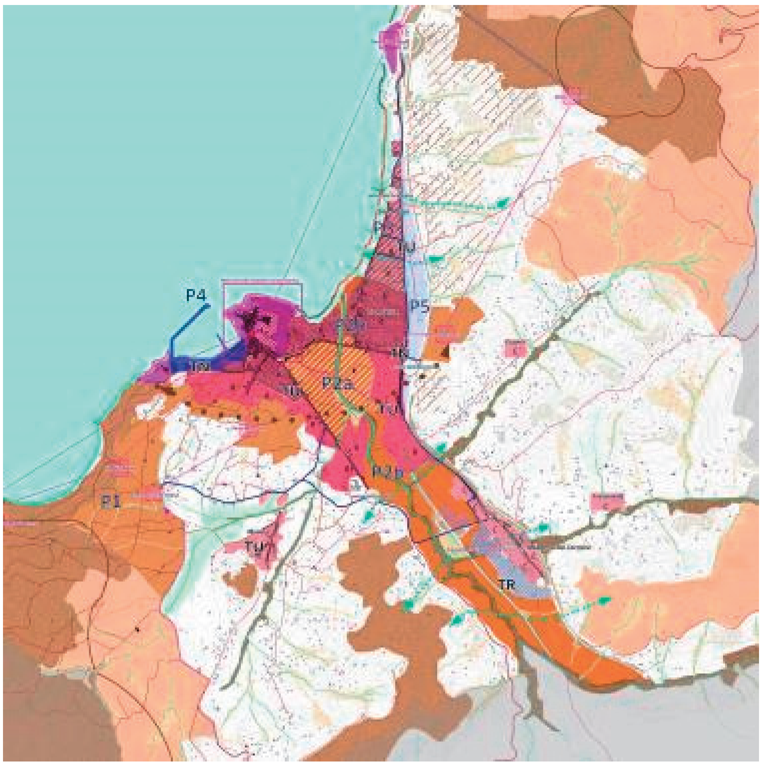
TeMA
Journal of
Land Use, Mobility and Environment

TeMA 2 (2013) 145-157
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1761

review paper received 16February 2013, accepted 28June 2013

www.tema.unina.it




# RESOURCES AND ENERGY MANAGEMENT: THE CASE OF THE AGROPOLI URBAN PLAN

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ABSTRACT

The issue of the resources management, of the energy-environment retrofitting framed in strategies to mitigate and adapt to climate change, aimed at energy saving, energy generating from alternative sources, metabolism and natural resources is one of the central topics the City Urban Planning of the City of Agropoli, currently approved by Resolution of the City Council no. 110 of 18.04.2013.

The plan is part of the wider system of actions taken by the Municipality to achieve the objectives on the environment posed by the European Union with the Directive "EP seals climate change package 20-20-20". In particular the planning tool provides a series of actions aimed at containing the energy consumption through measures to rationalize, do not waste and reduce the use of non-renewable resources, by promoting "best practices" from the management of public assets, the use of innovative technologies in all sectors and activities; the diffusion of renewable energy production, with care to avoid impacts and interference with the historical landscape, including the promotion of programs and interventions of public management. The different strategic projects will take care of specific actions also for the experimental use of innovative technologies.

The article proposes, within the framework of strategies and actions at the European level for small municipalities, the example of the City of Agropoli drawing conclusions and reflections on the issue of energy saving relative to the housing stock.

KEYWORDS:
Resource management; energy saving; small municipality

## 1 RESOURCE MANAGEMENT AND URBAN PLANNING

Environmental sustainability and climate change concerns have been a fundamental source of new ideas and approaches in urban planning over the last years. In fact here is increasing interest in the academic literature regarding municipal level action for sustainable development and to address climate change (Moccia, 2009).

In the 1990s the more comprehensive approach of Local Agenda 21 (LA21) received most of the attention, while local climate policy has gained much attention during the 2000s. This evolution brings a trend away from comprehensive sustainability initiatives towards energy-focused and sector-based initiatives focusing on reducing the emissions of greenhouse gases. This shift flanks a companion shift from preservation of natural assets to the reform of the city fabric where greenhouse gas emission concentrate and is moving the majority of the world population (Droege, 2008).

Recently, sustainable development is increasingly being used to guide urban planning. However, its implementation is not immediately apparent, because there has been no general agreement on how the concept should be translated into practice (Berke and Conroy, 2000; Jepson, 2001). According to the literature, resource management is a key factor for Sustainable Development, where RM refers to the conscious handling of natural resources, energy and materials and the utilization of infrastructure and technology to meet human needs; including extraction, transformation, consumption or use and disposal of resources. Hence, RM includes natural resources and manmade products (Agudelo - Veraa *et al.*, 2011).

One of the spreading concepts in the last year regards the urban metabolism concept, aims for improved resources management by closing urban cycles, applying innovative technologies and harvesting urban resources. In practice, good principles and processes stated in literature must meet aims of local communities and their political representatives in the decision making arena.

In the specific field of energy resources, in the last years the approval of the European climate change package gave a further pressure to ensure that the EU will achieve its climate targets: a 20% reduction in greenhouse gas emissions, a 20% improvement in energy efficiency, and a 20% share for renewables in the EU energy mix. At the local level of small municipality civic associations are campaigning according these general principles, strongly requiring adapting the urban planning tools with the aims of defining and putting into practice the general resources management and energy savings goals, sometimes obtaining to be heard by Majors and City Councils. Cities can lead in the reduction of CO2 emissions and the fight against climate change. Within cities, buildings are the largest energy-consuming sector, and offer the largest cost-effective opportunity for savings. Relative to almost all other investments, energy efficiency retrofit – installing newer energy efficiency technologies in older buildings –reduces emissions and improves energy security. However, considerable intensification in the delivery of ambitious whole-building energy efficiency upgrade programmes is needed.Integrated urban strategies provide the means to tackle the various challenges faced by cities. These strategies must link together the social, environmental and economic policy dimensions, connect the various levels of responsible governance, and involve the key stakeholders in the implementation of an energy efficiency policy for each municipal building stock (Owen Lewis *et al.*, 2012). Cities are ideally placed to drive action on sustainability through local action plans.

A further step is to link sustainability action plans in the general city planning process and tools. In his way, the urban form is designed according to ecological principles searching for solutions of the built environment able to assure the higher grade of resilience, the most saving of natural resources and the best metabolism of the cycles of nutrients (Moccia 2011). These objectives may regard both the new development as well as the already built up areas, some of whom are targeted by redevelopment programs while all the other are to be upgraded and retrofitted to reach the ecological standards.

This paper will describe the study case of the PUC (Piano Urbanistico Comunale) plan of Agropoli, a small Municipality in the South of Italy, focusing on the aspects of energy saving and natural resources management, in the general frame of sustainable urban planning.

## 2 AN EXPERIENCE IN THE SOUTH OF ITALY: THE AGROPOLI PLAN

### 2.1 THE CONTEXT

Agropoli is a small municipality located in the Cilento area of the province of Salerno, Campania, Italy, with a population of 21.251 inhabitants (Source: Istat 2011). It is an important coastal town, near the western Cilento, Vallo di Diano and AlburnumsNational Park, on the Tyrrhenian Sea at the southern end of the Gulf of Salerno and south of the Sele plain.

The urbanized land isthe 25% of the municipal area, which is higher of the regional value, equal to 7.5% (source: Regional land use), and the provincial value, equal to 4.5%, but it should be noted that in the provincial and regional data,the rural settlement spread is not calculated.

It is to underline the significant impact of the urbanized area in suburban areas almost equal in percentage terms to the urban (9.14% versus 9.43%), from which it derives considerable land consumption in rural areas. The evolutionary trend over 5 decades complaint a process of settlement of the territory, with an uncontrolled expansion of urban areas. The building development has been tremendous and progressive in the time period from 1960 to 2000 invading almost totally Testene area, the coastal area of San Felice and San Marco, and the valley of Fuonti area. The comparison over the past five years highlights in general, a significant increase in the urbanized area (+3.44%) with an average of 0.58% annually, or more than 18 ha/year (188,000 square meters) and an equally significant increase of abandonment (+2.91%). The built a total increase of about 470 manufactured from 2005 to 2011 going from 8060 to about 8530. The speedy development is fuelled by two main attraction: the first is the clustering of services of whom the surrounding municipalities are lacking, the second is the beach where people all over Campania Region, and most from the Naples metropolitan area, love to swim spending there his summer vacation.

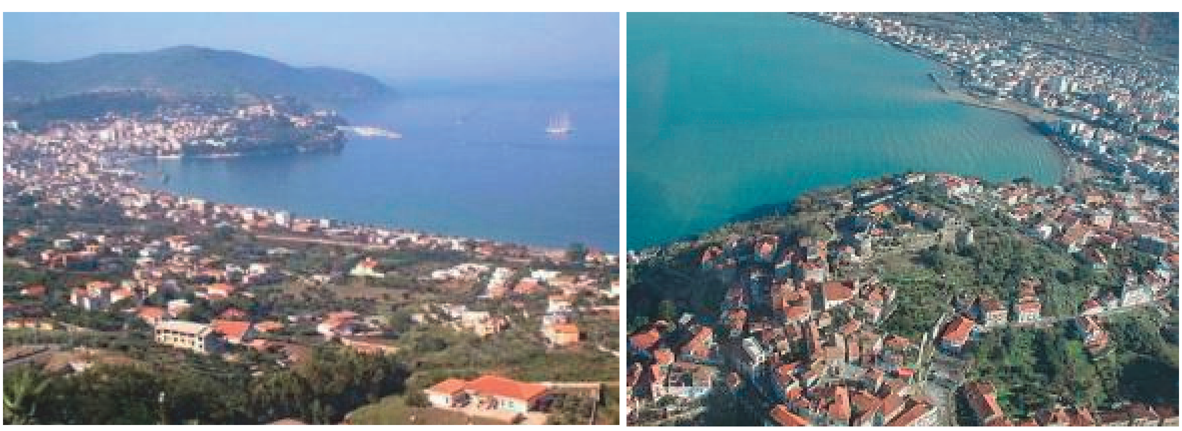

**Fig. 1: Views of the Agropoli Municipality**

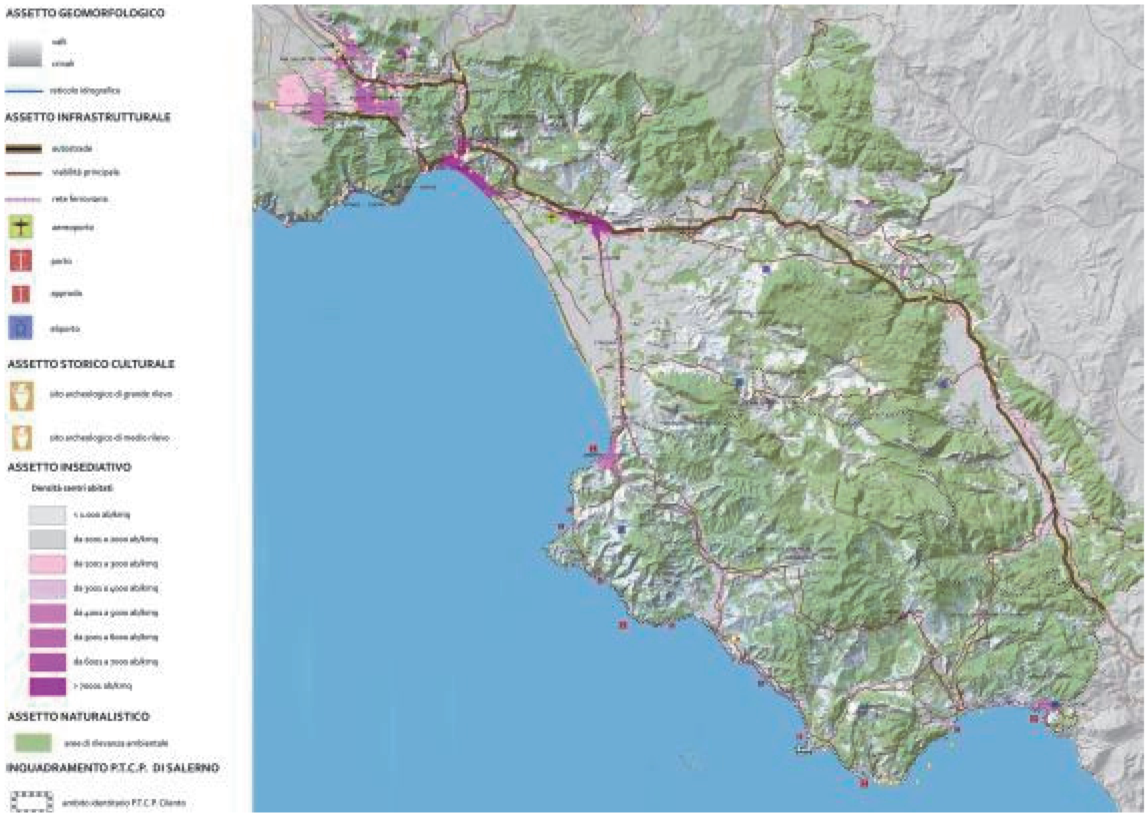


Fig. 2: Territorial framework

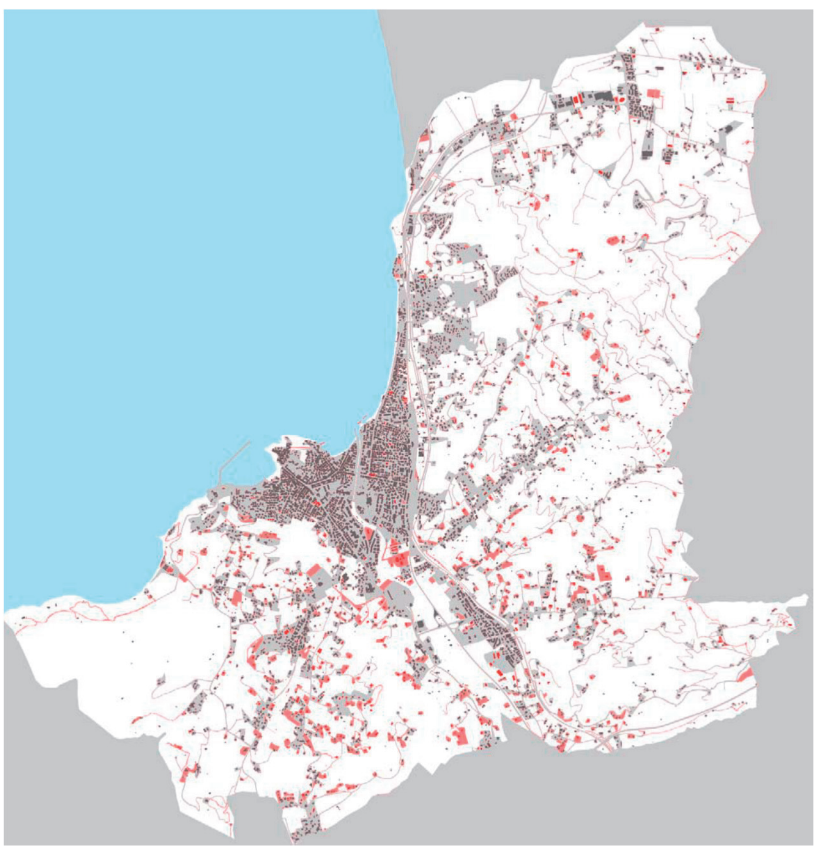

Fig. 3: The new settlements from 2005 to 2011 (in red)

## 2.2 THE RM APPROACH, STRATEGIES AND ACTIONS

The resource management approach guides the plan definition and implementation (Comune di Agropoli, 2012; Comune di Agropoli, 2013). In particular the plan defines some "regulation policies", which are referred to specific planning issues directly connected to the sustainable resources and energy:

- the issue of ecological and landscape redevelopment and mitigation of environmental degradation processes, in particular with regard to the modifications of the rural space;
- the issue of the re-use of urban building and infrastructure heritage, in order both to preserve the identity of places and to counteract the waste of land and other in responding to the demand for housing, social housing and services;
- the issue of urban redevelopment, for the reorganization of the building stock in consistent morphological patterns in relations with the public space;
- the issue of retrofitting energy-environment, framed in mitigation strategies and adaptation to climate change, aimed at saving energy, generation of energy from alternative sources, metabolism of substance and natural resources;
- the issue of "green infrastructure" inside the urban fabric to increase permeability, depuration of areal pollution, greenery; develop ecological corridors for the preservation of biodiversity and fight heat island; with the system equipment for solid waste management, water management, sustainable energy distribution.

Based on the assumptions outlined above the PUC defines a strategic framework organized in three general objectives:

- Ob1: Protection and improvement of the ecological matrix,
- Ob2: Reorganization and strengthening of infrastructure systems,
- Ob3: Urban and landscape rehabilitation for the improvement of the social and touristic fruition.

The strategies related to the first general objective (Ob1) have a distinctly priority, as Agropoli is located in the Cilento National Park, that has been declared UNESCO world heritage. According to this, the Plan defines to locatenew urban settlementsin already developed areas (brownfield sites): here more than elsewhere is valid the principle of "do not touch the untouched" and morenot detract from the general care agricultural and forestry soils.

In detail the actions related to the objective 1 can be summarized as follows:

- Strengthening of the main nodes of the ecological system, through the active conservation and restoring of the habitats and natural resources involved, facilitating the process of naturalization in areas abandoned by agriculture.
- Protection of ecological connections for the landscaping functionality, for the preservation of eco systemic identity and integrity.
- Maintenance and restoration the bio-permeability of soils and hydrogeological balances, through thecontainment and the control of development in rural areas, expansion of traditional farming methods, and integrated control of water management, with particular attention to the recovery of the metabolism of the cycles of natural resources.
- Limiting the consumption of soil, water and other primary resources for non-agricultural uses and activitiesby monitoring and regulation measures of settlements and infrastructure, to be oriented toreuse and recovery of the discarded, abandoned or underutilized building stock.
- Containment, mitigation and prevention of environmental risks, with measures of "adaptation" toglobal change and in particular with measures and interventions to prevent and combat the erosion of the coast and to promote thebeach nourishment; measures to protect against the noise

and electromagnetic risks; control and monitoring of production activities with greatest impact, with particular attention to thosein urban areas and in vulnerable areas; measures to reduce water consumption and control over pollution by discharges.

- Containment of energy use through measures to rationalize, do not waste and decrease the use of non-renewable resources, by promoting: the spread of "best practices" fromthe management of public assets, the use of innovative technologies in all sectors and activities, thedissemination of renewable energy production, with care to avoid impacts and interference with thehistorical, landscape, including the promotion of programs and management of public interventions. The different strategic projects will take care to define specific actions also experimentalthe use of innovative technologies in order to promote and implement the objectives defined before.

The second objective (Ob2) converges into a set of actions to strengthen the role andAgropoli position not only to respond to the local demand, but also to the one intercepted on a regional scale, based on the exploitation of natural and culturalresources. The actions that are directed connected to the issue of resource management and energy saving related to the second objective can be summarized as follows:

- Activation of coordinated measures at the inter municipality scale to contain soil andprimary resources consumption in manufacturing facilities; promote economies of urbanization and improvenetwork efficiency in the integration of activities and services designed to enhance the manufacturing activities, avoiding interference with agricultural activities and the river band still intact, in order tofoster relationships of supply chain processes and the provision of common services.
- Organization, characterization and qualification of complex integrated settlementfor production, trading and services through the relocation ofactivities with significant environmental impact.
- Construction of additional new and diversified accommodation as part of interventionsoriented to the re-composition of urban edge, the qualification of underdeveloped anddegraded areas, including the redevelopment of complex manufacturing operations of discontinued operations in mixed-use areas (residential-tourist-commercial).

More articulated is the set of actions related to the third objective (Ob3), which focuses onthe need of a strong urban transformation of the lately built areas,that differ from the local tradition building models and are characterized by low value, scarcesafety, noenergy performanceand poorly equipped and infrastructured, in order to raise the overall quality of the settlement andits attractiveness,through the urban restructuring and building restoration.The actions that are directed connected to the issue of resource management and energy saving related to the third objective can be defined as the activating processes of urban regeneration in the consolidated city and in strongdegradedareas, through the redesign of the not built areas, the reconstruction of margins in urban fringe areas, with the definition of criteria of transformation inrelation to the types of building, to the materials and their characteristics, to the weaknesses and opportunities. These actions can be articulated into three main classes:

- *decongesting,* through the rationalization of the road sections and areas for motorized and pedestrian mobility, the provision of parking and green areas, standard services, the rehabilitation of buildings of historical value; incentives for thereplacement of buildings which alter the plant or the skyline;
- *completing*the building fabric, through the redistribution of settlement density with building interventions through concentration construction, functional diversification, conversion of use and replacement, with particular reference to tourism services; environmental and functional qualification of building fabric (energy saving); enhancement of green and open spaces, also aimed at the rainwatersustainable management (Moccia and Coppola, 2009).

- *allocating*the services in urban areas that are poorly served, through the improvement and strengthening of accessibility and connectivity with more central urban areas (pedestrian and cycling pathways network), the equally distribution of standard, the consolidation of residential uses with the functional adaptation and the improvement of the quality of the buildings.

Within the same objective the plan defines other actions that are aimed at the protection and enhancement of open landscapes that surround the city and its branches, withreference to

- open spaces: active conservation of agricultural areas relatively intact, with the maintenance and consolidation oftraditional agricultural activities, strengthening the necessary infrastructure and the provision of services toagricultural production;
- landscape redesign of agricultural areas more densely urbanized, with innovative interventions likelyto improve their operation and environmental performance, in view of new balances and better conditionsenvironmental safety,
- reuse in rural areas that have been strongly and irreversibly transformed, even encouraging the provision of tourist facilities.

For the specific issue of the component atmosphere and climate change, energy and energy saving,electromagnetic pollution, noise pollution, water pollution, the plan defines specific goals:

- to contribute to the objectives of the Kyoto Protocol to reduce emissions of greenhouse gases
- to increase forest biomass and increaseconsequently the capability of fixing carbon (carbonsink)
- to improve air quality: reduce emissions ofpollutants into the atmosphere from sources and diffuse linear, eventhough recourse to the use of renewable energy sources
- to contain and prevent electromagnetic pollution
- to contain and prevent noise pollution in the environmentexternal
- to contain light pollution and consumptionenergy from outdoor lighting to protect public and privateenvironment.

**Fig. 4: view of the Agropoli Selva**

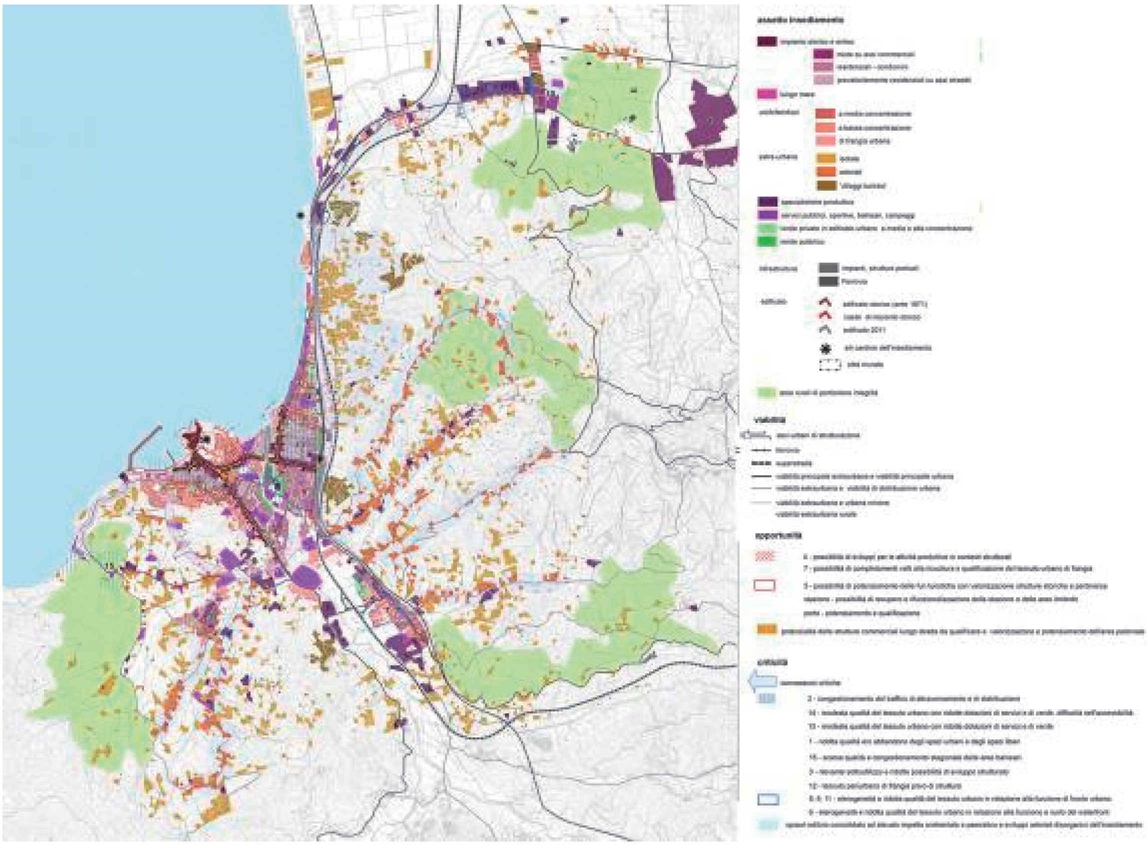

**Fig. 5: Settlement structure of the Agropoli Municipality (Source: Agropoli Urban Plan)**

## 2.3 ENERGY SAVING AND BUILDING STOCK: THE PROJECTS

A significant part of the proposed strategies refers, in addition to regulation measures directly defined by the PUC in itsbody of regulation,to projects, more or less complex and extended. Some of them are directly related to the issue of resource management and energy saving.

Energy efficiency over the past four decades has focused on individual buildings. More recently, building environmental assessment systems and methods are being extended to address sustainability issues at neighbourhood and district scales. Where energy is concerned, the neighbourhood or city cannot be considered simply as an aggregation of buildings. According to this, different actions are defined in the PUC.

The first action regards the building stock retrofitting. The existing building stock must undergo an energy efficient transformation. In particular for the all Municipality, the plan defines rules and interventions for upgrading the energy efficiency of buildings to favour with the provisions of the building code, with the improved thermal insulation and the provision of energy-saving appliances.The challenge lies in how to communicate the benefits of energy efficiency and retrofitting to the wider community, and how to address the upfront capital costs. Understanding what motivates consumers to undertake retrofit works is an integral component of stimulating retrofit demand in sustainable cities.

The second action regard the energy saving, according to the general objective of containing light pollution and energy consumption by public and private outdoor lighting to protect the environment. Containment of energy use through measures to rationalize, do not waste and reduce the use of non-renewable resources, by promoting: the spread of "best practices" from the management of public assets, the use of innovative technologies in all sectors and activities, the dissemination of renewable energy production, with care to avoid impacts and interference with the historical landscape, including through the promotion of programs and management interventions

The Agropoli administration, also under the pressure of the PUC, is working at Action Plan for Sustainable Energy (PAES), which shall consist of a document in which to bring together the efforts of the City and of public and private actors operating in the area, with the ambitious goal of achieving the reduction of CO2 emissions, and in drawing up a basic inventory of emissions. Within the PAES, the consumption of energy throughout the city is being detected, starting from the Town Hall, and then check the Schools, the Public Transport, until to monitor emissions in Agriculture, Industry, Commercial, residential buildings, private transport. To date, not many Italian municipalities have completed the process of SEAP, both for the complexity of the work to be done, both for the harsh review of the same made by the analysts of the European Community. Agropoli is one of the first municipalities in the province of Salerno that started to realize the PAES, the main instrument to access grants and funding provided by the EU in environmental matters. The implementation of the SEAP will make a significant contribution to private entrepreneurship that will be called to carry out the works that are going to plan and provide jobs for young people. After a first draft the SEAP, will hold a meeting aimed at stimulating suggestions and nominations for investments in the fields identified by specialists for the environment, particularly in innovative sectors such as, heat accumulation, biomass, insulation of housing, urban forestry, mobility, lighting. It is a path of extraordinary importance to ensure Agropoli also to be at the forefront on the Environment and Sustainability.

Furthermore,with the Act - Rational Use Of Energy (n.372/2012) the Municipality is developing in the field of maintenance and public works, actions aimed at rational use of energy and energy efficiency and the use of renewable energy sources, highlighting, in particular, its intention to support the introduction of equipment and/or high-efficiency technologies in the field of public lighting(such as LED, fluorescent lights, low-power, cogeneration, etc..), as well as actions aimed at the promotion and use of renewable energy sources, including measures to provide information and raise awareness on the issue.

**Fig. 6: Example of settlements in Agropoli**

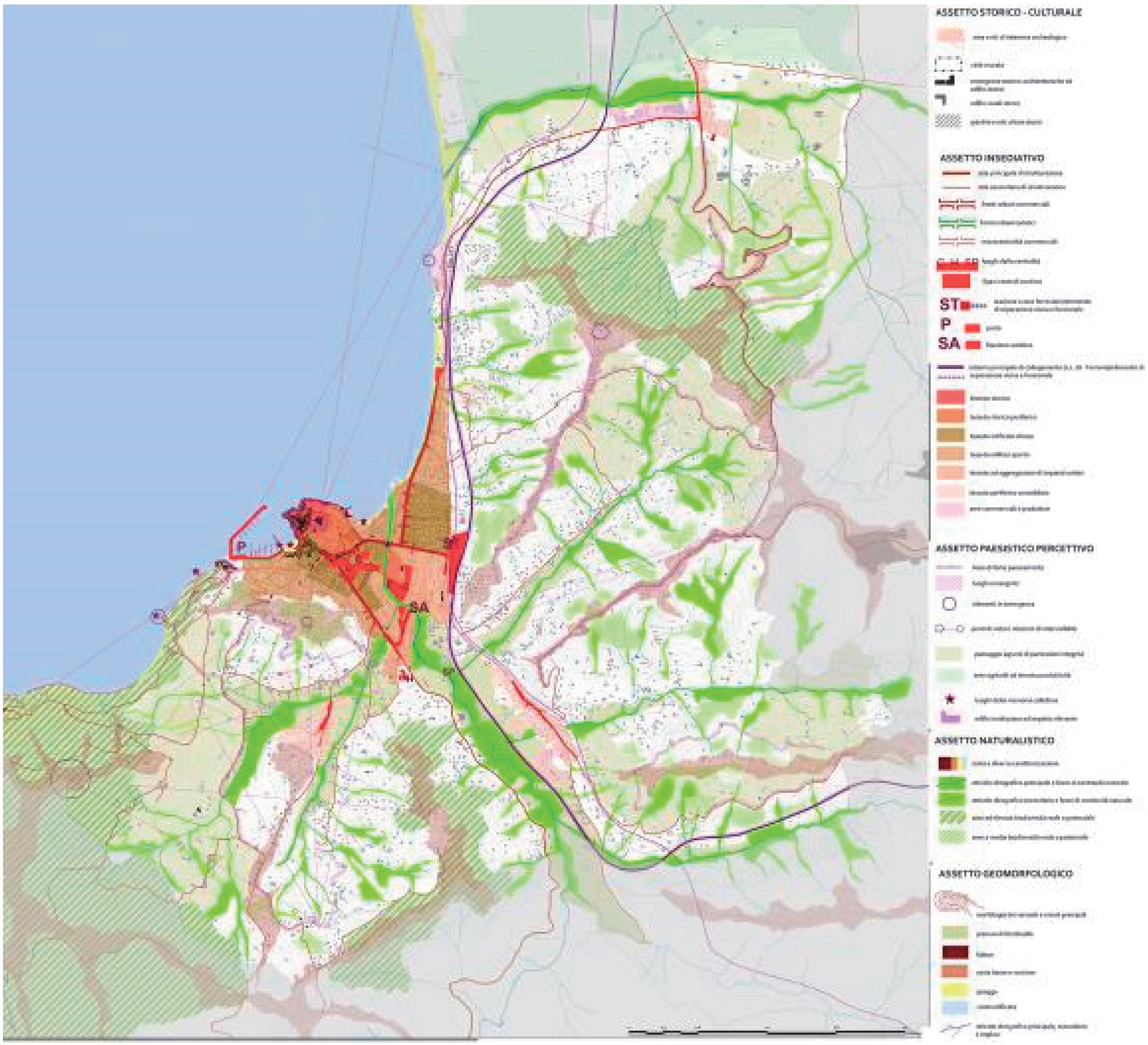


**Fig. 7: Structural plan**

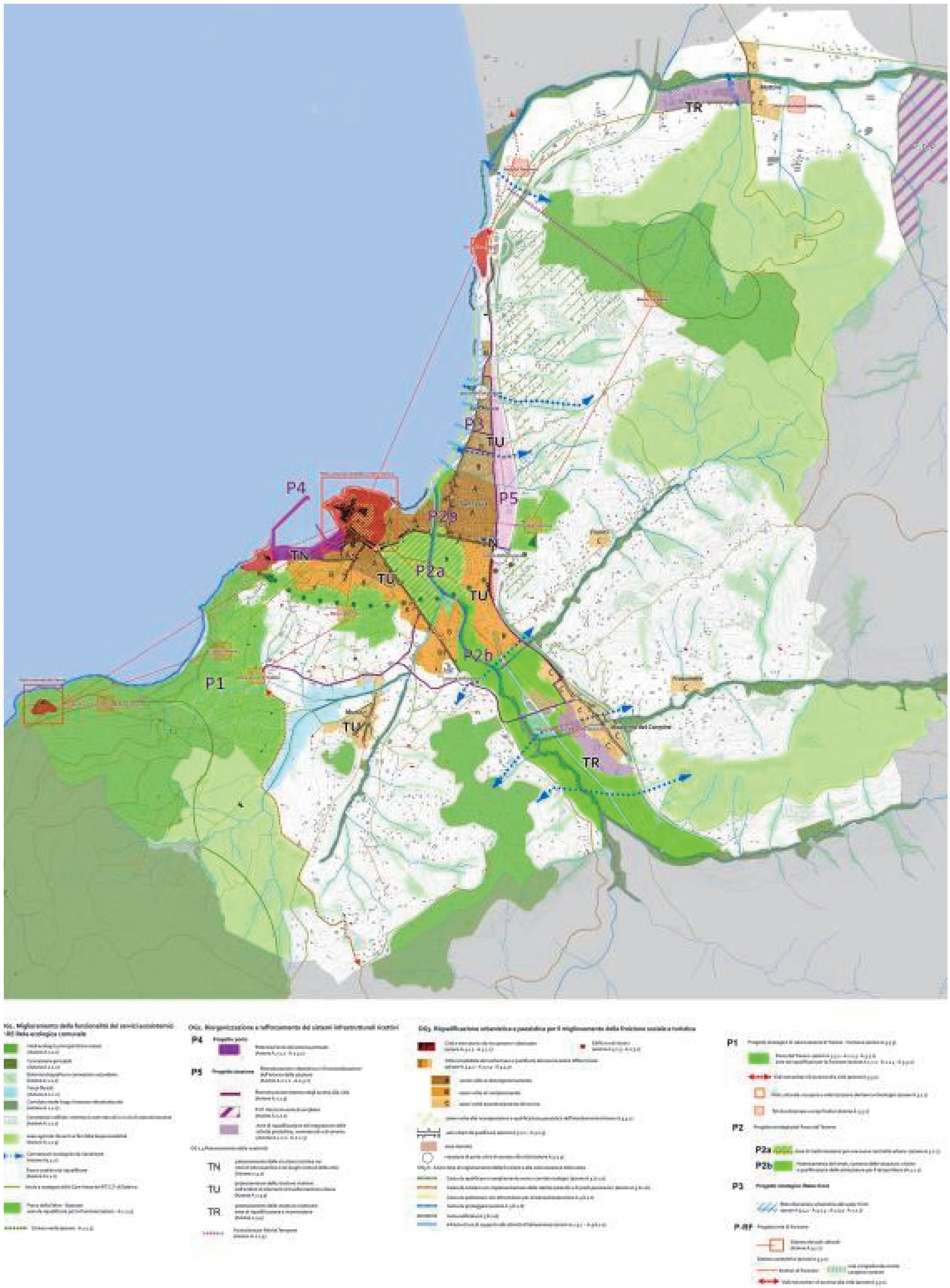


**Fig. 8: Strategic plan**

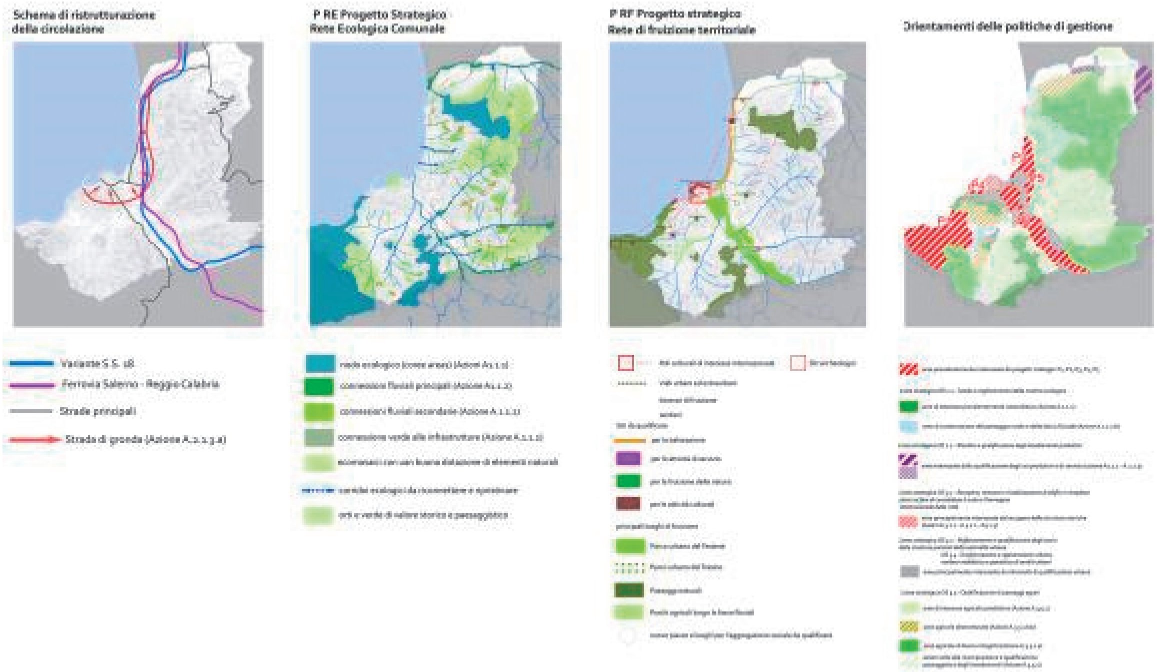


Fig. 9: Strategies and actions for the mobility network, the ecological network, the territorial fruition and the management


## ACKNOWLEDGMENTS

The Agropoli Urban Plan has been designed with the help and work of a multidisciplinary team made by the ing. Agostino Sica, arch. Giuseppe Bilotti, prof. arch. Francesco Domenico Moccia, prof. arch. Roberto Gambino, arch. Antonio Elia Sica, ing. Luigi Vaccaro, ing. Michele Infante, arch. Federica Thomasset, arch. Giuseppe Anzani, arch. Raffaella Gambino

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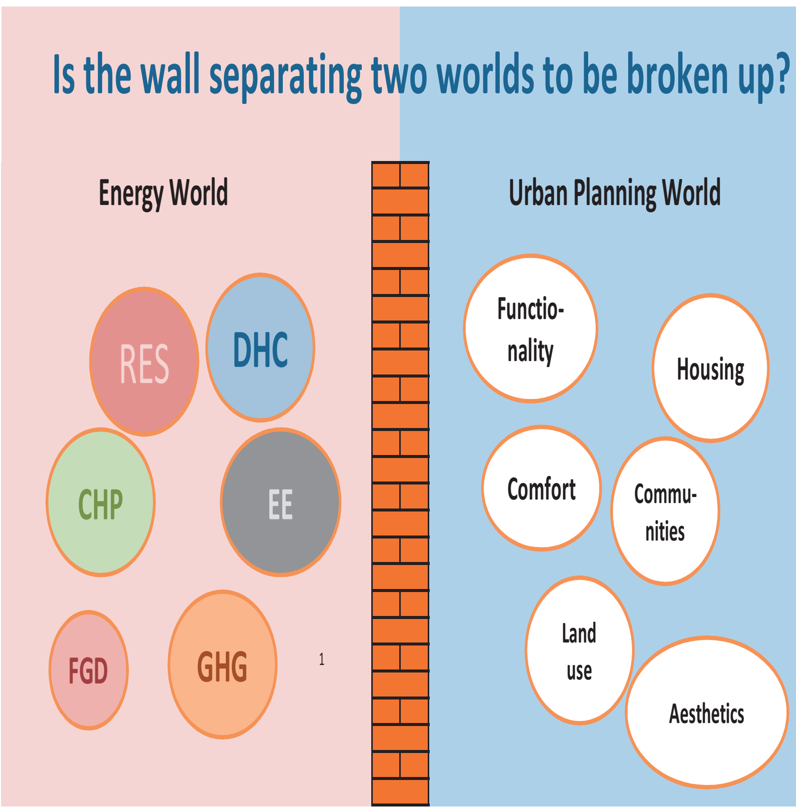
TeMA

Journal of
Land Use, Mobility and Environment

TeMA 2 (2013) 159-170
print ISSN 1970-9889, e-ISSN 1970-9870
DOI: 10.6092/1970-9870/1569

review paper received 07 May 2013, accepted 15 June 2013

www.tema.unina.it




# URBAN PLANNERS WITH RENEWABLE ENERGY SKILLS

## TRAINING DESCRIPTION

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ABSTRACT

The paper at hand describes the need, methodologies and results of pilot training of urban planners in order them to become familiar with renewable energy systems (RES) and energy efficiency (EE).

There is little tradition in the world to integrate energy and emissions to urban planning even though energy mainly used in housing and transportation is the main reason to Climate Change, and the urban planner is the first actor to decide how renewable energy and energy efficiency can or cannot be applied in the community to be planned.

Therefore, pilot training of urban planners with energy skills has been carried out in five European countries to start filling the gap of the needed skills. The objective is that similar training be extended to other countries and universities both to continuing professional as well as master level training of urban planners.

Thus, a training package of 3 000 slides and related explanatory texts have been made freely downloadable in 10 European languages.

KEYWORDS:
Urban planning, Renewable energy, Energy planning

## 1 NEED OF CO-PLANNING OF ENERGY AND URBAN STRUCTURES

In very few planning schools in the world, the urban and regional planners are educated with understanding on energy, and on renewable energy sources (RES) and energy efficiency (EE) in particular. Based on the survey made in year 2009, only one such planning school was identified in North America (Canada) and three in Europe, namely in Germany (Stuttgart), Denmark (Arhus) and Finland (Oulu). Later on, a few other planning schools have adopted energy issues to their urban planning curricula.

AESOP – the Association of European Schools of Planning is the largest global association in the area of urban planning – not only European anymore. In the annual conferences of AESOP there are about 700 participants from both Europe and elsewhere. More than 1 000 papers have been submitted for review every year. In the last three annual conferences (2012 Ankara, 2011 Perth, 2010 Helsinki) there has been only a session or two with only some 20-40 participants to learn of how energy should be adopted as a new element to urban planning. The international urban planning audience has not yet recognized energy and emissions as a new element in urban planning, but traditional topics dominate discussion.

Therefore, there is rather no research available on combined energy and urban planning as the subject is new to the research community. Otherwise, any training is based on the results of the relative research. In this case, however, training had to start from the scratch as research material was not available.

Nevertheless, such combined skills of energy and urban planning have become vital while fighting the Climate Change: the urban planner is the first actor in the planning process, the plans of whom will either restrict or enable optimal RES and EE implementation later on.

The traditional way is that a municipality creates a general location plan in which the buildings can be easily built and connected to reads, and defines the physical dimensions of the buildings. The building code ensures the new buildings meet the EE norms. Thereafter, the energy and water utilities connect the buildings to their infrastructure in the best way still possible. In such away, however, it may be too late to optimize the RES and EE!

In the existing urban structures we have barriers to introduce RES and EE as well as district heating to integrate them to customers.

Therefore, training of urban planners with energy skills has been carried out as pilot training in five countries such as Germany, Hungary, Spain, U.K. and in Finland, the latter country to cover the coordination responsibility of the project with the acronym UP-RES (Urban Planners with Renewable Energy Skills). Because the training topic was new, it was challenging to attract participants to the pilot training courses. Normal marketing of training was not adequate as most urban planners considered the energy and emission issues too mathematical and complicated, and they were afraid of that the energy issues would set new constraints to the already challenging and comprehensive urban planning task. Without strong financial support from the EU amounting to 70% of the total project costs, the pilot training would not had materialized.

## 2 MANAGEMENT INNOVATON – CO-PLANNING OF CITY AND ENERGY INFRA

In the new way, the energy experts and the urban planners start working together in the general plan stage already. The impacts of various plans will be quantified in terms of energy consumption, investment and operation costs as well as emissions. The particular plan will be chosen for implementation which offers the lowest lifecycle costs and emissions. In city of Porvoo case in Finland, for instance, the new urban plan that was based on maximizing the share biomass fuelled CHP and DH appeared to be the best choice from environmental point of view, and moreover, with the overall life-cycle costs much lower than the traditional plan would have caused. In other words, the new combined energy and urban planning was a win win approach from both the reduced emission and the lowest cost point of view that was highly appreciated by the local decision makers.

In the Finnish city of Porvoo, a new management approach was adopted in planning of the new urban area, named Skaftkärr. In the very initial stage of planning both the urban and energy planners were invited to work together. As the reference for their co-planning, the Skaftkärr plan from year 2007 was adopted, but assuming that passive energy houses would be used apart to those assumed in the plan of 2007. The reference plan was a sub-urban plan traditionally dominated by small houses to be located so that personal cars would need to be used. As heating sources in the reference plan, a combination of district heating, electricity and heat pumps was assumed.

Co-planning started with a few studies about how people live, move and what are their expectations. Co-operation among the urban and energy planners was not that simple in the beginning, but some time was needed for them to learn each others' way of work and thinking. A year was mentioned as a period of time that was needed to harmonize their co-operation.

Finally, the co-planning methodology provided four options to the urban scheme to be applied in Skaftkärr. All four options had the primary energy consumption and the emissions 30-70% lower than the reference plan.

The four options generated by the co-planning were as follows:

*Option 1*

- A dense new area that is supported by the existing city structure.
- The passive energy buildings are connected to the DH.
- Effective public and light transport routes are created to the city center.

*Compared to Reference case:*

- Primary energy consumption 40% lower
- $CO_2$ emissions 34% lower

*Option 2*

- Effective small-house characterized Option, where 50% of heat is based on DH and the balance of other 50% on ground water heat pumps.
- Effective public and light transport routes are created to the city center.

*Compared to Reference case:*

- Primary energy consumption 36% lower
- $CO_2$ emissions 31% lower

*Option 3*

- A loose land use Option, where heat and power are produced inside the buildings 100% based on RES.
- Passive energy houses.
- Traffic like in Reference Case based on private cars and a little public transport.

*Compared to Reference case:*

- Primary energy consumption 67% lower
- $CO_2$ emissions 48% lower

*Option 4*

- Community type land use Option, in which the focus was on reducing the need of transport and by locating working places and services in the area.
- Effective public and light transport routes are created to the city center.
- Passive energy houses served 100% by solar heating. The area will supply solar heating to all citizens of Porvoo.

*Compared to Reference case:*
- Primary energy consumption 45% lower
- $CO_2$ emissions 62% lower

The life-cycle costs of the four options (M1 - M4) in terms of Euro per inhabitant during 30 years to come are presented in the next picture. In three of four options the life cycle costs were lower than in Option 3. In the latter one, the investment costs of RE as well as the individual heat pumps using the electricity produced in the building itself became extremely high.

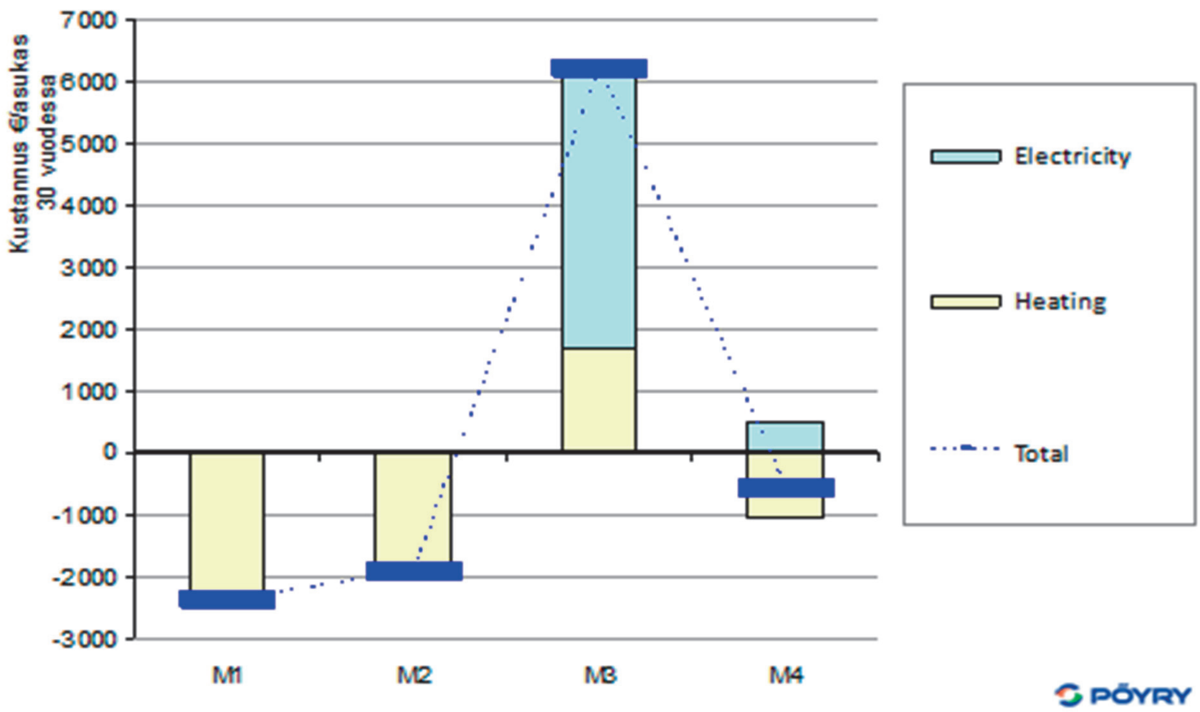


Fig. 1: The life-cycle costs of the different options (M1 - M4) in terms of Euro per inh. during 30 years

The final option selected for implementation was based on prioritizing light and public transport (biking highway, for instance), using district heating in most buildings and enabling solar heating to be used later on. District heating as the primary source in Porvoo is a special case as 92% of the heat energy in Porvoo is from the co-generation of heat and power (CHP) plant, the fuel of which is 70% from biomass (wood chips).

The city management of Porvoo was happy with the results as well, as the infrastructure costs (streets, pipelines, etc.) were substantially reduced as well.

The new co-planning approach in Porvoo was supported and monitored by the Finnish Ministry of Environment and the Finnish Innovation Fund - Sitra. The co-planning approach is currently expanding to other cities in Finland, sooner or later maybe to other cities in Europe as well. Such expansion, however, will need training similar to that used in UP-RES pilot courses and adjusted to local conditions and country specific differences.

## 3 COUNTRY SPECIFIC DIFFERENCES

Designing and implementing the training depends on the local circumstances, and should therefore be adjusted to the local needs and conditions. The awareness and establishment level of various RES components in the five countries is different as illustrated in Table below:

| RES | Initial | Scarce | Dense | Established |
|---|---|---|---|---|
| Solar | FI | UK | DE, HU | ES |
| Wind | FI | UK | ES, HU | DE |
| Biomass | ES, HU | DE, UK | | FI |
| Waste heat | ES, HU, UK | | FI, DE | |
| District heating | ES , UK | HU | DE | FI |
| District cooling | HU, UK | DE, ES | FI | |
| Level: | Awareness | Knowledge | Competence | Professional practice |

Tab.1: The awareness and establishment level of various RES components in the five considered countries

District heating and cooling, for instance, is a well-established practice in Finland, but neither in U.K. nor Spain. On the other hand, solar and wind power are largely used in Spain and Germany, but are still at a very initial stage in Finland.

For instance, different approaches were taken in the five countries, in which the pilot training was carried out, including the following:

- In Finland, there was the 9 month 'long' course taught to urban and regional planners. The course consisted of 8 modules each of two days duration from Fall 2011 to Spring 2012. The trained planners now work in the different parts of the country to adjust their plans to adopt new features that favor RE and EE. The training of 20 CETS took place in Aalto University.
- In Hungary, the long pilot course was organized as a normal university course to students. The course having had lasted 9 months as well as comprised even 60 ECTS credits was organized at University of Debrecen.
- In Germany, the long two-year lasting long has started to both urban and energy planners combined. The benefit of educating both professions to together is expected to create mutual understanding on the way of thinking, terms and objectives, way of working. All training takes place in Frankfurt.
- In Spain, the long course of 9 months duration both for students and officers of urban planning was organized in Barcelona.
- In the United Kingdom, there were no such long course, but 20 charettes of three days each were organized in different cities of the country. To each charette, the local stakeholders such as city planners, developers, politicians, energy experts were collected to learn the main features of Climate Change oriented urban planning. Based on the outcome, the attending stakeholders were asked to select a real planning case in their city to which RE and EE could be incorporated.

In the five countries above, the pilot training covered about 500 experts, which can be considered a decent start towards co-planning of energy and urban structures in the future.

## 4 LEARNING OBJECTIVES OF TRAINING

There is very little tradition of spatial planners and energy experts working together anywhere in the world. Their educational backgrounds (physical versus visual sciences) and their linguistic backgrounds are different, which creates a communication barrier between the two professions.

The training was focused on introducing the energy technologies, together with the opportunities and implications associated with them from the urban planning perspective.

## 5 TRAINEES

The trainees comprised urban and regional planners and developers working in city planning offices, regional councils, planning schools, construction and consulting companies. In Germany in particular, energy experts were also invited to participate the pilot training. Moreover, in U.K. all key stakeholders who would need to work closely with the planners in developing future energy systems were also invited – notably including environmental, sustainability and housing professionals.

In all five partner countries, the UP-RES materials and methodologies will be used for Master level education as well.

## 6 PILOT TRAINING APPROACH

The structure of the long pilot courses comprises ten modules, from M1 to M10. Each module typically consisted of two days of training.

The module titles and summarized motivations to urban /spatial planners are as follows:

| | |
|---|---|
| M1 | SUSTAINABILITY CONCEPTS IN REGIONAL AND URBAN PLANNING: A HOLISTIC VISION<br>As introduction, the main reason to Climate Change is energy production based on fossil fuels. Housing and transportation cover more than half of all primary energy consumption, both sectors being under influence of regional and urban planners. Many countries in the world (mainly EU) have set targets to reduce primary energy consumption and greenhouse gas emissions. In practise, however, behaviour of people and scattered urban structures create barriers to expansion of EE and RES. Those barriers should be phased out, in which the urban planner has an important role. Measures and policies to phase out such barriers are discussed in the 9 modules to follow. |
| M2 | ENERGY. FORMS - TRANSFORMATION - MARKET OUTLOOK<br>Fossil fuels increasingly dominate the energy market, and new reserves are found constantly. How to convert various forms of energy to uniform concepts of primary energy and GHG emissions in order to compare “energy” to “energy”.<br>How can be fossil fuel replaced by RES, and what would such replacement require from planning.<br>A spreadsheet tool was used which gives the energies and emissions of various power and heat production plants and fuels. |
| M3 | ENERGY DEMAND REDUCTION STRATEGIES: POTENTIAL IN URBAN PLANNING<br>The module introduces two real examples, in which RES and EE have been successfully adopted, (i) one implemented in Germany (Freiburg), where solar and biomass have successfully penetrated to the local energy market as well as both public transport and bicycles have successfully conquered market share from private cars; (ii) and another one introducing a new integral urban and energy planning concept in Finland (Porvoo), which was described in Management Innovation Chapter in detail. In both cases new ways of city planning have taken place as having integrated RES and EE issues with the traditional urban planning process. |
| M4 | ENERGY DEMAND REDUCTION STRATEGIES: POTENTIAL IN NEW BUILDINGS AND REFURBISHMENT<br>The Module presents the possible ways how RES and EE can be adopted in the building level. Integration of solar panels and collectors to structures based on appropriate facing of the building walls and roofs,, waste heat recovery allowing air conditioning and high energy efficiency in parallel, for instance, are examples of such measures. In the life cycle analysis, the relative importance of construction materials increases as expanding RES and EE reduce primary energy consumption and emissions. Energy labelling of buildings sets requirements to the planners and designers of buildings. |

| | |
|---|---|
| M5 | ENERGY RESOURCES AND RENEWABLE ENERGY TECHNOLOGIES<br><br>There are several forms of RES to be considered such as solar, wind, biomass, wastes, sea water, geothermal heat, hydro power, and new ones (wave energy) are invented as well. The planner needs to understand the feasibility of the RES options in the urban structures. Solar energy requires surfaces facing the sun in an optimal way, bio mass can be most economic and ecological in large scale, municipal and industrial waste can be integrated to local energy palette either as distributable heat or fuel to be used for power and/or heat generation, etc. Gasification instead of traditional combustion offers environmental and economic benefits to the community, but requires different technologies. |
| M6 | ENERGY DISTRIBUTION: DISTRICT HEATING AND COOLING<br><br>District heating (DH) and cooling (DC) are effective ways to enhance the economy of scale and integration of various RES options, mainly bio fuels and waste energies to be used in energy supply of the community. Co-generation of heat and power (CHP) as the most efficient way to use any fuel to produce electric energy will be introduced. Existing DH system is the precondition to CHP as much as waterfall to hydropower. Nevertheless, feasibility of DH, DC and CHP sets requirements to city planning in terms of location of energy sources, piping networks, consumer connections. Sufficient heat load density is vital to economy of DH and DC. Urban planner is the first actor to influence the heat and cooling load density of any community. |
| M7 | THE RIGHT SCALE FOR EVERY ENERGY CONCEPT: HEAT AND COOL DENSITY (DEMAND SIDE), POTENTIAL ON SUPPLY SIDE<br><br>The Module introduces various modes of energy, and their feasibility in terms of optimal scale. Some energy modes are transmittable to short (district heating and cooling) or long (electricity, fuels) distance, but some other not (steam). Some can be optimal in small and local scale (solar, hydro power) whereas others require large scale (biomass, municipal waste). Many energy modes are easy to be stored (fuels) but some others face challenges in long term storing (steam, hot water, electricity). The objective of the module is to let the planner understand the restrictions set and opportunities offered by various modes of energy. |
| M8 | NEW MANAGEMENT CONCEPTS IN THE ENERGY MARKET<br><br>There are different ways to extend RES and EE market in a community. Various management methods, such as energy service companies (ESCO) and agencies are introduced in the Module to give an idea to the planner how RES and EE expansion can be effectively organized. |
| M9 | ENERGY PLANNING<br><br>Both spatial and energy planning use maps, have interdisciplinary approaches, customer surveys and other common methodologies. In practice, however, real co-planning of urban and energy seldom takes place due to different educational backgrounds and planning objectives of the planners. The module offers tools and ideas for integrated energy and urban planning. |
| M10 | NEW TRANSPORT MODELS AND URBAN AND INTERURBAN MOBILITY<br><br>All transport creates emissions, some more than the others. Spatial planning influences the need of mobility and the feasibility of various means of transportation. In the Module some facts are given on sustainability of various transportation modes as well as examples of best practices to the planner to consider. Such examples emphasize public transport, car pooling and light transport (walking, bicycles) to private cars. Success stories are available from some cities to be shared with many others. |

Tab.2: The training modules

## 7 EXAMPLE OF TRAINING MODULE

Here is an example of the contents of a training module. It is a combination of delivered lectures, team-work, and a site visit.

| **M5** | **ENERGY RESOURCES AND RENEWABLE ENERGY TECNOLOGIES** |
|---|---|
| **Fasilitator: N.N.** | **13.-14.2.2012** |
| **Time** | **1st Day: Familiarization with RES** |
| 9.00-9.15 | Introduction to Module Topics |
| 9.15-10.30 | Presentation of RES technologies and applications |
| 10.30-10.45 | *Break* |
| 10.45-12.00 | Based on the presentation, five groups of trainees search for information from Internet. One group specifically for solar electric, solar heat, wind, biomass and the fifth group for waste to energy. |
| 12.00-12.45 | *Break* |
| 12.45-14.00 | Five groups continue |
| 14.00-14.15 | *Break* |
| 14.15-15.30 | Presentation of the results of five group works |
| 15.30-16.00 | Conclusion |
| | **2nd Day: Rural Energy Supply** |
| 9.00-10.30 | Local economy: impacts of RES on rural economy and survival |
| 10.30-10.45 | *Break* |
| 10.45-12.00 | Off-grid village based on RES (Kempele, Finland) |
| 12.00-12.45 | *Break* |
| 12.45-14.00 | Agricultural waste to liquid fuel |
| 14.00-14.15 | *Break* |
| 14.15-16.15 | Excursion to a bio mass fuelled CHP plant |

Tab.3: Structure and contents of a training module

## 8 TRAINING METHODS

In the pilot training several methodologies were applied, as follows:

- Facilitator to be chosen for each module to link the learned energy issues to urban planning. As the topic of integrated energy and urban planning is new, guidance and stimulation is needed to emphasize the key issues and links of energy to urban planning.
- Lectures based on slides and discussions. Discussions among the trainees and the trainer were found useful to stimulate the learning process.
- Excursions both locally and internationally to best practice locations. Excursions helped the trainees understand the lessons learned on a real practical level.
- Exercises carried out by the trainees in small groups and individually about issues combining RES and EE to spatial planning helped trainees quantify the energy issues, not only use qualitative expressions and terms in their plans.
- Simple spreadsheet tools developed for specific planning areas such as heat planning of a city or urban district, quantification of energy balance and emissions of various heat and power sources, economy of district heating depending on the heat load density, life-cycle cost analysis comparing fossil to biomass fuelled boilers in district heating.
- Distance learning reduced the need of travelling of trainees, thus a little contributing to cleaner environment
- Movies (Inconvenient Truth, District Cooling,..) as ready-made and well-designedaudio-visual means clearly expressed the key messages of Climate Change and applicable measures to fight the Change to the trainees.
- Expert panel (clinic) advisory services to support the trainees to carry out their exercises was found helpful to support the trainees to carry out their homework. In the middle of the homework, the trainees met with the top experts of either energy or urban planning to learn to which direction to carry out the homework.

## 9 TOOLS

Six simplified tools using common spreadsheets were developed for energy and urban planning in Germany and Finland, and used in the pilot training of the country of tool origin. The tools and their short descriptions are as follows:

- **Energy and emission balance of energy production:** the energy balance comprising inserted fuel, output heat and electric power as well as $CO_2$ and $SO_2$ emissions can be calculated for various types of energy sources such as heat only boiler, power only plant, CHP based on natural gas, coal, fuel oil and biomass.
- **Energy and GHG balance of a community:** The spreadsheet calculates the rough estimate of an energy and greenhouse gas (GHG) emission balance in a community. The word "balance" does not really apply at the moment, because only energy consumption is summed up. Energy supply is only modelled through emission factors, which assign a certain amount of emissions to an energy unit.
- **Economy of district heating**: the economy f district heating depends on the linear heat load density in terms of sold heat energy divided by the network length. As a rule of thumb, the densities equal and larger than 2 MWh/m clearly indicate that DH is the least cost heating option, whereas at the densities below 1 DH would not succeed under commercial terms but individual solutions should be considered instead. If DH is regulated, as in Denmark for instance, even low density values may allow DH survive on the market. On the economic basis, the density values between 1 and 2 MWh/m require a life-cycle analysis of the available heating options to be carried out before the heating selection can be made.
- **Economy of heat pumps in a CHP system:** Economy of individual heat pumps may be questionable in a CHP system as the heat pump substitutes the heat load of the CHP plant. as the heat load of CHP declines, so

does the efficient power generation of CHP. Conclusively, power alone production is needed to compensate the not generated power of CHP and the power need of heat pumps, thus leading to increased primary energy consumption and GHG emissions.

- **Life-cycle costs of fossil and biomass fuel boiler in DH**: The spreadsheet tool can be used to compare the economy of fossil fuel boiler to biomass boiler depending on the investment costs, fuel and other operation and maintenance costs.
- **Heat demand of residential buildings**: The tool provides an estimate to a building's transmission heat loss, based on predefined surface parts. Solar radiation, physical properties of the building envelope and the size and location (city) are taken into account. As example the climate conditions of the cities Barcelona, Budapest, Glasgow, Hamburg, Helsinki, London, Munich, Oulu and Sevilla are available in the tool, and new ones can be inserted as necessary. The tool calculates the heat demand of various buildings.

## 10 TRAINING MATERIAL IN 10 LANGUAGES

The training material had to be compiled from existing practices, as no research material combining energy to urban planning was available.

The major deliverable of the pilot training is the compilation of the selected material to a training package.

The package can be used in other planning schools in Europe as it has been translated to 10 languages. The package comprises the material of ten modules, each in about 300 slides and explanatory texts. In addition to Italian, the package is freely downloadable in English, Finnish, French, German, Hungarian, Polish, Romanian, Spanish and Swedish.

The pilot training was a part of Intelligent Energy Europe (IEE/EACI) research program that promotes RES access on the energy market. The other partners of UP-RES were the universities of Augsburg and Debrecen, University of Technology in Munich, The District Heating Association in Germany (AGFW), BRE Ltd (Watford) U.K.), and SAaS (Barcelona).

## 11 CHALLENGES

The pioneering UP-RES training was first of its kind implemented on the European level. In a few planning schools such combined urban and energy planning has been adopted already, but it still a rare practice in Europe. UP-RES training implementation faced five major challenges, as follows:

- Traditionally at any education branch, there is first research and thereafter outcome of the research, which creates the basis for training. In UP-RES, however, as there was practically no research tradition combining urban planning with energy and emission issues anywhere, the controversial approach had to be adopted: Teaching had to be started from scratch as no research results on integrating urban planning with energy and emissions was available.
- Energy and emissions as engineering, mathematics and physics based science did not fit with the urban planners background being mainly architectural. Some fear was identified among the urban planner towards quantitative analysis of energy and emissions, even though the quantitative analysis of energy and emissions related to the individual plans should be crucial for evaluation of various planning schemes .
- Urban planning is already a multidisciplinary, comprehensive and a challenging activity. No new expansions such as economy, energy, emissions, for instance, are welcomed to come in anymore.
- The actual financial crisis in Europe has reduced training budgets of public institutions, such as municipalities, regional councils and planning schools. The reduced budgets made the pioneering UP-RES training more challenging to implement as less funding for even the traditional training was available. In Finland, for instance, even though not being on the worst side of the crisis, more than 100 phone calls were made to city planning offices, regional councils and consultants in order to have 25 trainees on the long training course, still

five less than the targeted 30 trainees. Traditional invitations based on emails and public advertisement were rather ineffective.

- In all partner countries, lack of co-operation between the urban and energy planners was identified. Typically, those two planner professions work in different organizations. Traditionally and typically, the co-operation between the two organizations has been based on commenting the plans of the others in writing, having common meetings rather rarely, asking and providing comments sometimes without response from the other, neglecting requests or comments because of misunderstanding the idea, etc.

In general, the main challenge was to attract trainees to the courses because of the challenges mentioned above. Finally, after completion of the pilot training courses in five countries, the trainees (and other stakeholders) expressed their satisfaction in an independent evaluation survey. The satisfaction level ranged from 5 to 6 as medians out of the maximum of 7 in the sample of 53 replies.

| | Finland | Germany | Hungary | Spain | United Kingdom | | mean | median | deviation |
|---|---|---|---|---|---|---|---|---|---|
| The UP-RES project has communicated effectively on its goals and objectives. | 5,4 | 4,3 | 6,5 | 5,4 | 6,9 | | **5,7** | 5 | 1,0 |
| The UP-RES project has communicated effectively on its activities (such as courses). | 5,4 | 3,2 | 6,2 | 5,9 | 6,8 | | **5,5** | 6 | 1,4 |
| The UP-RES project has improved the awareness of the role of renewable energy sources in urban planning in my country. | 5,1 | 4,7 | 6,5 | 5,6 | 5,7 | | **5,5** | 6 | 0,7 |
| The UP-RES project has increased the interest on renewable energy sources in urban planning in my country. | 4,9 | 3,1 | 5,8 | 5,3 | 5,0 | | **4,8** | 5 | 1,0 |
| The UP-RES project has fulfilled its promises with its actions. | 5,5 | 4,2 | 6,2 | 4,8 | 6,1 | | **5,4** | 6 | 0,9 |
| The UP-RES project has increased the practical skills of urban planners. | 5,5 | 4,4 | 6,3 | 6,3 | 6,8 | | **5,9** | 6 | 0,9 |
| The UP-RES project has motivated the participants to deepen their professional development. | 6,2 | 4,7 | 6,6 | 5,9 | 6,9 | | **6,1** | 6 | 0,9 |
| The UP-RES project has created a community of interested urban planners in the field renewable energy sources. | 4,5 | 3,8 | 4,4 | 5,1 | 4,9 | | **4,5** | 5 | 0,5 |
| The UP-RES project has created a sustainable training concept for urban planners. | 5,1 | 4,2 | 5,6 | 5,8 | 5,5 | | **5,2** | 6 | 0,6 |
| The UP-RES project has improved the communication and co-operation between the different key actors in professional development according to renewable energy sources in urban planning in my country. | 4,6 | 4,5 | 5,6 | 4,8 | 4,6 | | **4,8** | 5 | 0,4 |

Tab.4: Human Capital Investments as UP-RES project evaluator.

## 12 CONCLUSION

During the past decades, Urban Planning has been complemented with social and environmental assessments. Now RES and EE shall be included as a means to reduce primary energy consumption and extend RES to fight Climate Change. It is the time now to include quantitative analysis energy and emission impacts on the urban planning.

Finland, for instance, has been famous for its nature related architecture and highly efficient energy systems. However, combined urban and energy planning was a virgin area until UP-RES and Porvoo cases were implemented. Situation is likely even worse in most European countries.

Both above together indicate a huge **training demand** in order to make urban and energy planners, not only to co-operate, but to co-work together in the near future.

In addition to training, **planning guidelines** in all levels should take into account RES implementation and EE. This would change and direct planning practices, enable impact assessment and also reinforce co-operation and co-planning.

## REFERENCES

As there is practically no research material available so far on integrated energy and urban planning, the below listed links provide support in search of moredetailedinformation.
The training material package: http://aaltopro2.aalto.fi/projects/up-res
The Skaftkärr case in the city of Porvoo, Finland: http://www.skaftkarr.fi/en
AESOP - Association of European Schools of Planning: http://www.aesop-planning.eu
Advanced city planning in Germany: http://www.freiburg.de/pb/,Lde/232045.html

## IMAGES SOURCES

Cover Image, Tables 1,2,3,4: elaborated by the Authors.

Fig. 1: http://www.skaftkarr.fi/en

## AUTHORS' PROFILE

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Dr. Nuorkivi currently works as a part time researcher at the Energy Department of the School of Engineering Sciences of Aalto University. He has worked as consultant on rehabilitation and development of communal energy systems in more than 30 countries and in more than 100 cities outside his native country, Finland. The projects have been financed either by IFIs such as the World Bank, EBRD, KfW and NEFCO or by individual European governments. During his currier, Dr. Nuorkivi has issued six books about research and development of district heating and CHP as well as corporate social responsibility for various institutions such as the Nordic Council of Ministers, the International Energy Agency (IEA), the Energy Charter Secretariat, the Baltic Sea Region Energy Co-operation (BASREC), Uusimaa Regional Council (Helsinki capital region) and Helsinki University of Technology. Recently, he has been the project leader of the EU- supported UP-RES project.

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TeMA
Journal of
Land Use, Mobility and Environment

TeMA 2 (2013) 171-188
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1608

review paper received 24 May 2013, accepted 15 June 2013

www.tema.unina.it

# WALKABILITY OF SCHOOL SURROUNDINGS

## AND ITS IMPACT ON PEDESTRIAN BEHAVIOR

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ABSTRACT

Pedestrian safety due to traffic accidents is seen as a serious problem in Jordan. It is believed that walking environment is a contributory factor. This study looks into pedestrian environment in schools' vicinity. Seventeen schools were selected and 231 students were followed from school to home. Pedestrian walking environment for each student trip was assessed by considering the sidewalk and crossing facilities; driver and pedestrian behavior; attractiveness and school location. Analysis indicated that pedestrian environment is rather poor and very few walking paths are in good conditions. Behavior of each pedestrian was observed by considering the trip time; walking time on sidewalk and on pavement; crossing time; number of crossings; and involvement of conflicts. Results showed that 15% of observed subjects were involved in conflicts. Average walking time is 17 minutes; almost half of this time is spent either by walking on street or crossing. On average, children cross two junctions on their way back from school. Females are involved in less conflict and they spend less time in traffic. Drivers give priority to pedestrian in one-thirds of all observed crossings with preference to males.

KEYWORDS:
Pedestrians, walking behavior, pedestrian safety, school routes, children accidents.

## 1 INTRODUCTION

Worldwide and for many years, road accident fatalities and injuries were major life threats for humanity (WHO, 2009). In Jordan, road accident fatalities and injuries were increasing with no sign of being under control but not after 2007, when a set of firm measures were considered. In 2007, a total of 110,630 crashes were reported by police compared to 140,014 in 2010, which mounts up to an increase of 8.1%. The deaths, on the other hand, reduced in 2007 from 992 (17.3 deaths per 100,000 inhabitant) to 670 (11 deaths per 100,000 inhabitant) in 2010 (JTI, 2010). Pedestrian accidents that compose 6% of all accidents lead to 33% of all deaths in traffic (3.57 deaths per 100,000 inhabitants). Half of death toll in traffic was among children under age of 15 years (4.55 deaths per 100,000 inhabitants). Pedestrian children are considered a high risk group. Globally, over 400,000 pedestrians are dying every year (Naci *et. al.*, 2009).

This may be due to children understanding and perception of traffic situations, which is not always well developed (Gibby, Ferrara, 2001). Children are not young adults and it is important to understand their limitations in understanding traffic as mainly they have a limited sense of danger. Children are described as impatient and impulsive, concentrating on only one thing at a time. They have a narrower field of vision than adults, about 1/3 less; they cannot easily judge the speed and distance of approaching vehicles, assuming that if they can see a vehicle, the driver must be able to see them.

In general, pedestrians are facing higher risks in urban areas where more pedestrians and vehicular activities take place (Zegeer, Bushell, 2012). A study in Montreal, Canada revealed that children pedestrian accidents are more likely to happen at mid-block in residential areas (David, Rice, 1994), male children between the ages 5 to 8 are the main victims. Cheng (1991) investigated the trend of Utah's pedestrian accident rate and discussed factors involved. His study produced similar results to David and Rice (1994). Jordan (1998) analyzed 2,167 pedestrian accidents in Philadelphia. He found that more children are injured in route to/or from school, but not near the school. A greater number of children are injured while playing after returning home from school rather than during their trips to/or from school. In Netherlands, 90% of children accidents occurred on foot or on bicycles are within built-up areas (Westdijk, 2001).

**Walkability** is a measure of how friendly an area is to walking. Walkability takes into account the quality of pedestrian facilities, roadway conditions, land use patterns, community support, security and comfort for walking (VTPI, 2012). **Bikeability** is also a term for the extent to which an environment is friendly for bicycling. Moudon and Lee (2003) reviewed existing environmental audit instruments used to capture the walkability and bikability of environments and to provide an understanding of the essential aspects of environments influencing walking and bicycling for both recreational and transportation purposes.

Zegeer and Bushell (2012) suggested a set of actions to improve traffic safety for pedestrians; eight actions were recommended covering engineering; education; and enforcement treatments. A cross-sectional study (Zhu, Lee, 2008) examined disparities in the environmental support for walking around 73 public elementary schools in Austin – Texas. Field audits were conducted to assess the street-level walkability and GIS was used to measure the neighborhood-level of walkability and safety. The study showed that economic and ethnic disparities exist in the environmental support for walking, suggesting the need for tailored interventions in promoting active living. Children in low income areas are more likely to live in unsafe areas with poor street environments but with some favorable neighborhood-level conditions (Zhu, Lee, 2008). Safe route to school program in El Paso was introduced in 90 elementary schools (Schatz *et al.*, 2009). The program addressed the 5 E's (Education, Encouragement, Engineering, Enforcement, and Evaluation). The study looked into the perception of parents and children based on before and after field survey.

Committee on injury, violence, and poison prevention of American Academy of Paediatrics (Pediatrics, 2009) reviewed the contributory factors that lead to high death toll among pediatric pedestrians younger than 19 years, which include lack of playground in low income areas and the high speed.

In Jordan, children pedestrian accidents and behavior have been investigated to some extent (Shbeeb, Mujahed, 2002). The pilot study looked into school environment and its walkability. Ten schools in Amman, the capital City of Jordan were selected and a sample of 200 students is selected to assess their level of traffic safety education. The study revealed that the school plays minor role in educating children and their families are the main source of information in this regard. The study looked also into pedestrian behavior on their way back home from school and examined the surroundings environment. The study indicated that pedestrians are exposed to frequent hazardous situations. Walking environment is relatively poor. Pedestrian facilities are lacking in most locations, and they are not used for pedestrian crossing when such facilities exist. If pedestrian crossings are provided, pedestrians are rarely given priority.

This paper further looks into pedestrians' behavior in Jordan and is a continuation of the pilot study made to assess school surroundings from pedestrians' perspective. The environment that surrounds schools is assessed with regard to its walkability. The size of observed sample is enlarged to provide better understanding of pedestrians' behavior within school vicinities. Particular emphasis is given to children (age of 18 years or less). The outcome of this study is expected to provide insight into the local environment of deficiencies facing walkability, which should be treated in the future, where safer routes to school must be provided through introducing a set of guidelines to select school locations, and develop procedure for safety auditing in the surrounding roads.

## 2 RESEARCH OBJECTIVES

This research paper main goal is to explore pedestrians' behavior in traffic on their way back home from school. The way back home has been proven in literature to be more hazardous than the way to school, in addition to that justification, data collection would be very difficult to track students in their way to school due to spatial distribution of homes and to the temporal variation in trip time from one student to another. Two other objectives are required to fulfill the main goal: first to analyze accident data to identify the nature and size of pedestrians' accident problem with emphasis on children. And second to appraise school route environment from pedestrian children safety perspective.

## 3 METHODOLOGIY

Police reported accident data in Jordan in 2010 and 2011 were reviewed and analyzed. Observations of children behavior while walking and crossing roads were analyzed to assess their actual behavior. Inventory of routes leading to school were made to assess how friendly their environment is to students? The school surrounding is the area that includes all streets within 1-2 km radius from the school site. The observations were completed by examining behavioral actions and physical conditions, such as pavement conditions; characteristics of pedestrians' crossing; behavior at crossings (drivers and pedestrians); whether users comply with traffic rules or not? The next paragraphs describe the nature of observations.

Routes pavement condition were assessed in terms of width, maintenance conditions, continuity, slipperiness, usage for other purposes [vendors, parked cars] and the existing of light and advertisements poles. Pedestrian crossing areas were checked; the checked items covers looking into pedestrian crossing marking and if appropriate road signs were provided. Road environment in the crossing vicinity was assessed [wide road, high speed traffic; parked vehicle or trees that obscured the view]. Observations include checking if traffic calming devices ahead of the crossing were installed. Streets were considered wide, if pedestrians need to cross more than one lane per direction. High traffic speed is defined as high if it exceeds 30 km/h. Observers are trained to assess if speed exceeds such a threshold.

Driver behavior on pedestrian crossing [if available] included driver speed at crossing and whether drivers comply with the traffic rule of giving pedestrians the priority on the crossing? Also, pedestrian ability to comply with traffic rules; such as stopping safely at the pavement adjacent to the crossing? Is he/ she visible to drivers; are crossings designed in such a way to allow pedestrians to visually search before crossing? School location was characterized by answering questions like is the school located on a main road with high speeds; is school main entrance on a minor road? Has the site been provided with the necessary marking, signing, and if speed humps are present? The attractiveness of the routes for walking was explored by answering questions like is the road lit? Are plants grown on road side? Have benches been provided? Are shops available on road sides? Are roads and pavements clean?

Observations included monitoring pedestrians' behavior in traffic around 17 schools in the Greater City of Amman. A general description of the selected schools is shown in Table 1; school administrative staff (with few exceptions), are few in numbers and the teacher /student ratios for schools are high particularly for boy schools, which may limit the possibility of assigning role for teacher related to traffic safety issues. On average in Organization for Economic Co-operation and Development (OECD) countries, there are 16 students for every teacher in primary schools whereas it is 14 students per teacher at the secondary level in Jordan (OECD, 2011). Primary school is the first stage of compulsory education and is followed by secondary education.

| Schools | Student Gender | School statistics (numbers) | | | | Teacher students ratio |
|---|---|---|---|---|---|---|
| | | Classes | Students | Teachers | Administrative | |
| Al-Lttehad Secondary | Girls | 80 | 1670 | 130 | 32 | 12.8 |
| Al-Esra' Secondary | Co-educ. | 23 | 950 | 36 | 9 | 26.4 |
| Sameer Al-Rrefa'I Basic | Boys | 11 | 350 | 15 | 5 | 23.3 |
| Princess Iman Basic | Boys | | | | | |
| Ibn Tofeell Basic | Boys | 37 | 1600 | 58 | 8 | 27.6 |
| Jubile Secondary | Boys | 26 | 1529 | 42 | 6 | 36.4 |
| Nafeesah Bent Al – Hasan | Girls | 6 | 100 | 7 | 2 | 14.3 |
| Shmeisani Basic | Girls | | | | | |
| Um Hutheefa Basic | Girls | 21 | 774 | 35 | 6 | 22.1 |
| Swelieh Secondary | Boys | | | | | |
| Daheeat Prince Hasan Basic | Boys | 7 | 200 | 9 | 2 | 22.2 |
| Youcoub Hashem Basic | Boys | 25 | 930 | 38 | 6 | 24.5 |
| Um Kulthoum Basic | Girls | 21 | 712 | 42 | 18 | 17.0 |
| Aaka Basic Basic | Co-educ. | 23 | 870 | 31 | 6 | 28.1 |
| Um Mutta'a Basic | Girls | 18 | 670 | 27 | 7 | 24.8 |
| Ali Reda Ar Rekabi | Boys | 52 | 1131 | 52 | 31 | 21.8 |
| Princess Bassma Basic | Boys | 39 | 1300 | 80 | 12 | 16.3 |

**Table 1 General description of studied schools**

All selected schools are located in densely populated areas with low and middle class income and low levels of vehicle ownership.

To assess pedestrian behavior, 231 students (111 Females and 120 males) were followed from the moment they left the school until they arrived home. The decision to track students in their way back home rather than tracking them in their way to school was made to simplify the data collection process, since the home of each student is different and unknown. For each observation, total walking trip time in minutes is measured from the moment the student leaves the school gate until he arrives at his/her home. The time spent walking on street instead of the pavement due to the lack of sidewalk continuity; pedestrians are often forced to step-down from the sidewalk and walk on street. The observers were asked to measure the time once the pedestrian step-down until s/he comes back to the sidewalk. In addition, observers were instructed to write down number of times pedestrians are forced to leave the sidewalk.

The crossing behavior pattern was investigated by reporting the number of crossings, where the observers are instructed to count how many streets the pedestrian needs to cross during their trip from school to home. The crossing time is the time (minutes) spent from the moment the pedestrian begins to wait by the curb or edge of the street (if there is no curb) to cross the street to the moment he reached the other side of the street, including the waiting time by the median, if any. The observers were also asked to identify the type of crossing locations; the observation forms list five crossing types (un-marked crossing at intersection or at mid-block, marked crossing at intersection or at mid-block of crossing, mid-block with hump in place, signalized intersection, and footbridge).

In addition, the observers were asked to identify pedestrian crossing style and it is defined by speed. Two options are given in the observation form (normal walking speed (≤ 1.8 m/s) or running speed (≥ 3 m/s). Huang, Yang and Eklund (2006) compared pedestrian walking speed to running speed. The average 15th, 50th and 85th normal walking speeds in their study are found to be 1.33, 1.55 and 1.85 m/s. The corresponding 15th, 50th and 85th pedestrian running speeds are 3.11, 3.8 and 4.5 m/s. For the purpose of this study, the observers were trained to differentiate between normal walking speed and the running speed but during the observations, observers were not asked to measure the speed during crossings.

Visual search involved looking for vehicles before and during the crossing manoeuvre in order to avoid a possible collision, the observer is supposed to check one of two options of each observation: whether the pedestrian is looking or not looking for vehicles before crossing. Pedestrians can rely on their hearing ability to look for traffic, but this is hard to observe besides it can't be the only sense used by pedestrian before crossing. Visual search and eye contact give the pedestrian the confident to perform the crossing.

The Highway Code in Jordan obligates motorists to give pedestrians priority. If a pedestrian is crossing the street or waiting by the curb at pedestrian crossing, the driver is expected to yield for the pedestrian and give him/ her priority. The observers were asked to identify driver interaction with pedestrian (slowing down or stopping to let the pedestrian crossing or continue driving at the same speed).

Traffic conflict involvement: A traffic conflict is an observable situation in which two or more moving road users approach each other in space and time to such an extent that a collision course is imminent if their movements remained unchanged (Amundsen, Hydén, 1977). The observers were trained to detect if there is a collision course, evasive action type and urgency. During the survey, observers were asked to detect the conflict occurrence during the crossing.

The walking environment for each trip was assessed according to the above listed items. The survey involves two observers for each pedestrian trip. The first observe rate trip walkability environment while the other record the pedestrian behavior.

To rate the safety impacts of the inspected items that has been used to assess the walkability environment of the school surrounding, a questionnaire was prepared and distributed among a group of highway and traffic experts (engineers working in highway design and traffic with at least five years of experience). The experts were asked to rate the impact of each variable on pedestrian safety that is used to assess the walking environment on scale from 1 to 5. The lower scale (1) is used if the tested item has no effect. In total, 16 experts participated in the rating. The sample includes academician, practitioners from public and private sectors.

In addition to the field survey that was completed in this study, a questionnaire was prepared and distributed for each selected school. The principal in the selected schools were asked to fill in the questionnaire that was formulated to investigate safety conditions in the school area. Only 14 duly filled in forms and returned back, which composes 82% of total distributed forms.

# 4 ANALYSIS AND RESULTS

## 4.1 PEDESTRIA ACCIDENTS IN JORDAN

The road safety in Jordan in relation to countries was compared by considering pedestrian fatality population-based rates. The analysis is based on police reported accident data. Accident reporting system falls under police authority. In every hospital, there is a police officer who will be notified about any case admitted to the hospital or treated in the emergency unit if it related to road accidents. The insurance company will not process any claim unless police report is attached. A study is made to assess the under-reporting indicated that all fatal accidents are reported to police and only 5% of injury accidents are not reported (Shbeeb *et. al.*, 2004).

Road accident fatality population-based rate of Jordan compared to 29 countries that contribute data to IRTAD shows that Jordan appears to perform rather poor and it is ranked the worst among the listed countries using pedestrian fatality-population scale, as it has the highest rate (Figure 1). In 2010, pedestrian fatality rate in Sweden was 0.34 per 100,000 inhabitants while it was in Jordan 3.57 fatality per 100,000 inhabitants, which almost 11 folds the rate in Sweden.

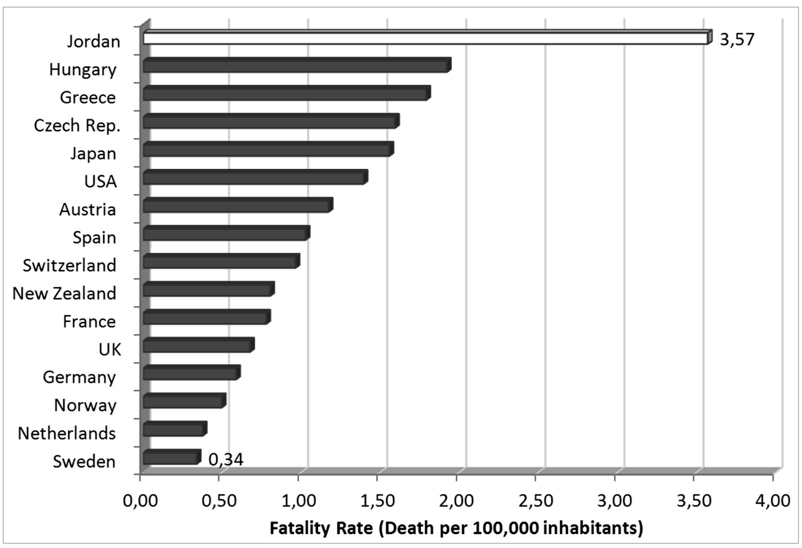


**Figure 1: Pedestrian fatality rate-population based (2010)-IRTAD and JTI.**

Pedestrian fatalities compose a considerable proportion of road fatalities in developing countries and smaller proportion in developed countries. In Jordan, pedestrian accidents accounts for 33% of all fatalities compared to only 9% in New Zealand (Figure 2). Comparing the road fatalities in Jordan with other countries indicated that fatality rate for the age group 0-15 is three to five times as high as in the industrialized countries. The risk of being involved in fatal accident of elderly pedestrian is half that of corresponding rate in the industrialized countries. Of course, that is partially due to differences in exposure and to the proportions of elderly in the society. Figure 3 indicates that the fatality rate for road-user of young age group (15-24) is within the rates reported for a number of industrialized countries, but tends to fall within the upper range of fatality rates. Fatality rate of age group 25-64 falls in the lower range of industrial countries fatality rates.

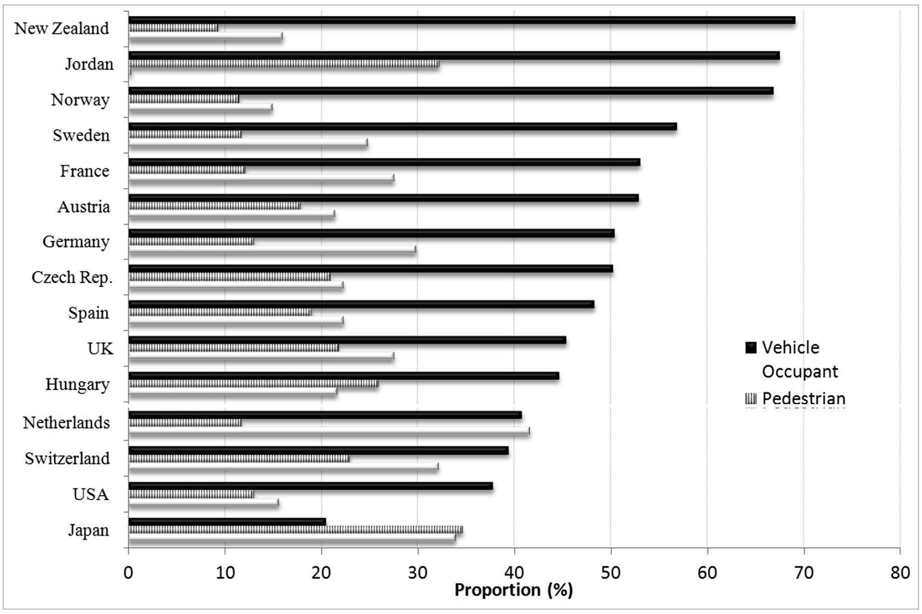


**Figure 2: Road accident fatality proportion by mode of transport (2010)-IRTAD and JTI.**

## 4.2 CHILD PEDESTRIAN ACCIDENTS

For the purpose of this comparison, children were defined as those under the age of 15 years. They were further subdivided into three groups [<5, 6-9, and 11-14]. Children were 49% of all pedestrian fatalities in 2010 (JTI, 2010). Females constitute only 19% of all fatalities. This may be a reflection of the fact that females are not equally represented in traffic as males. The highest pedestrian fatality rate is among children under age of 5 years. The highest injury rate is reported also for the same age group (Figure 4). Fatality rates for the age groups of less than 5 years old are higher than the corresponding rate for all age groups (approximately two folds). Serious injuries rate for all age groups is lower than that of the three age groups of children. This is an indicative that such groups are at a high risk of being killed in traffic. Children are often left unaccompanied in traffic. A study was made to assess the effectiveness of safety measures in school vicinity showed that only 30% of children are accompanied by one of their family members (Shbeeb, Awad, 2012). Pedestrians are one of the most vulnerable groups in traffic. If they are involved in an accident, the consequences are serious.

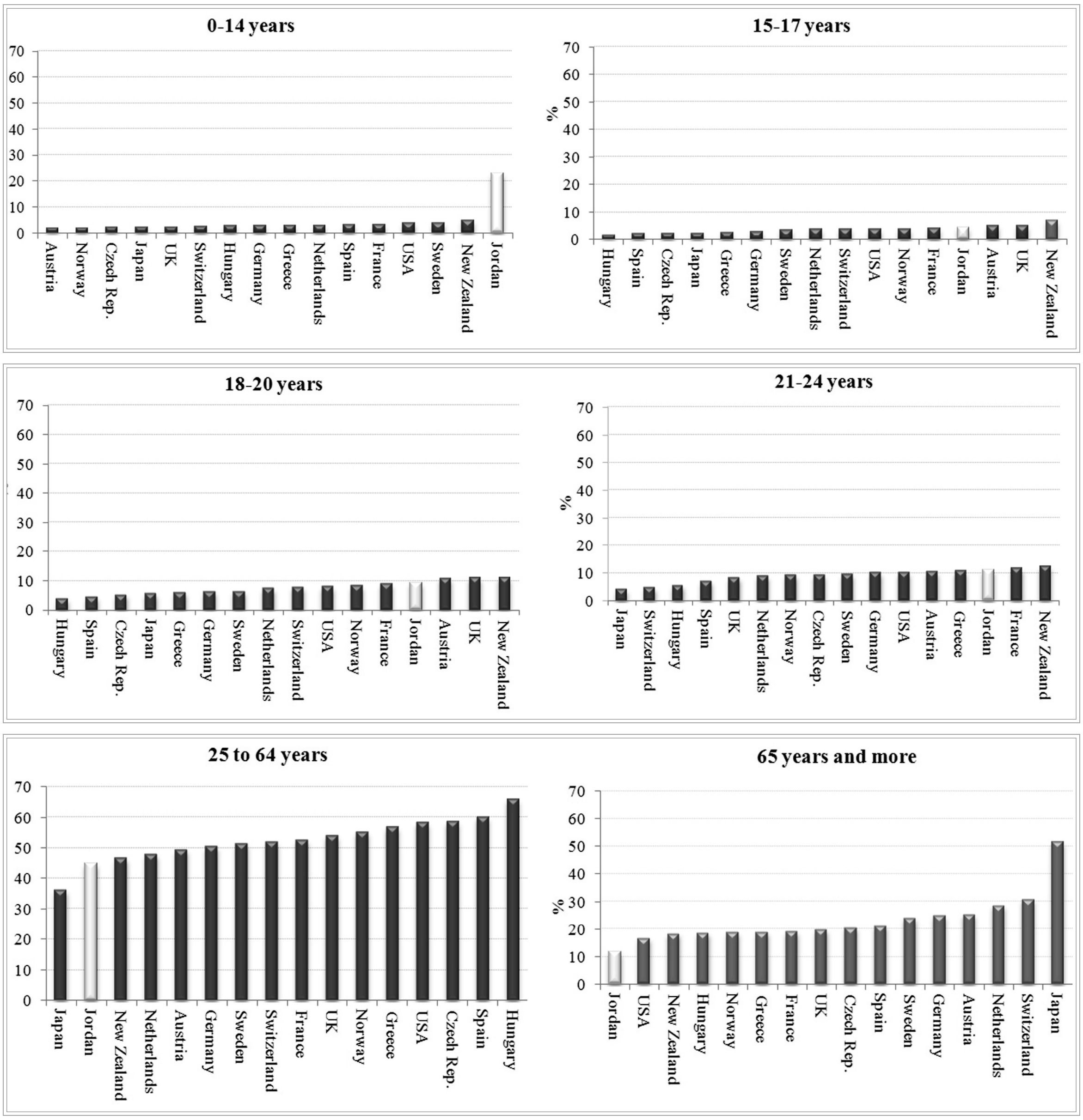


Figure 3: Road fatalities by age group for a number of Countries (IRTAD, 2010 and JTI, 2010).

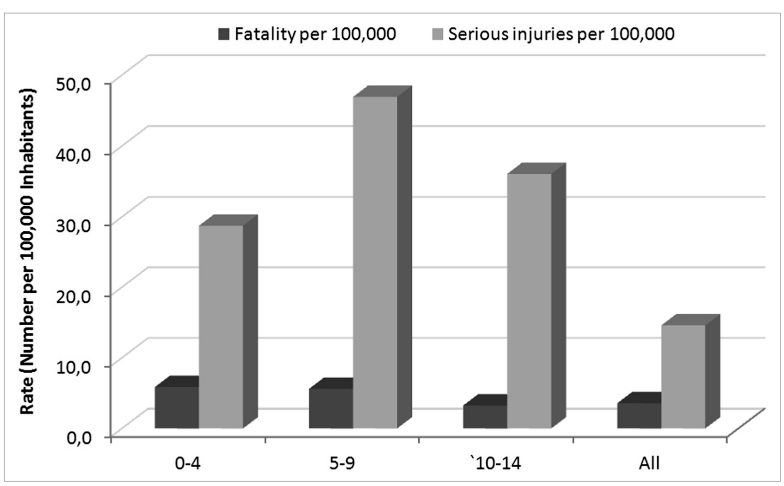


Figure 4: Child pedestrian injury / fatality rate by age group (JTI, 2010).

## 4.3 SCHOOL ENVIRONMENT ASSESSMENT

The principals were asked to state what kinds of measures were taken to regulate student movements to and from the schools (Figure 5). Around one-third of the principles reported that no measure is taken as there is no safety problem. Traffic warders, who have been trained to regulate traffic in school vicinity, are assigned to help colleague students in only three schools of the studied schools.

The surroundings were assessed by a trained person who was asked to check the routes leading to each school. The training covered all aspects included in the study (speed assessment, conflict detection, etc.) A surrounding area with a radius of 2 km was considered for this purpose. The survey showed that 36% of the schools' entrances are directly on main roads. Humps have been installed nearby 12 out of the 17 selected schools (70%). Traffic light signals have been installed in the surrounding areas of five schools. Proper signing has been provided at only 8 schools to indicate the presence of a school. Fifty percent of the principals reported that there is a speeding problem in the school vicinity.

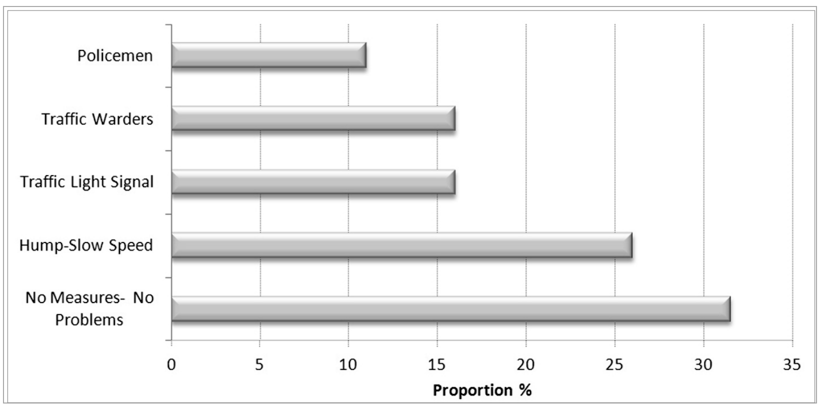


**Figure 5: Measures taken to regulate traffic in the vicinity of studied schools.**

One-third of the principle indicated that there is a safety problem in the surrounding area of the schools. According to Table 2, high proportions of students are walking to and from schools. One of the selected schools is a private school that provides bus school service and most of its students arrive with buses.

| School Name | Ownership | Walking | School Bus | Public Bus | Taxi | Private Automobile |
|---|---|---|---|---|---|---|
| Al-Lttehad Secondary | Private | 3 | 95 | 2 | | |
| Al-Esra' Secondary | Public | 70 | | 20 | | 10 |
| Sameer Al-Rrefa'I Basic | Public | 30 | | | 70 | |
| Princess Iman Basic | Public | | | | | |
| Ibn Tofeel Basic | Public | 70 | 10 | 10 | 5 | 5 |
| Jubile Secondary | Public | 90 | | 10 | | |
| Nafeesah Bent Al – Hasan | Public | 97 | | | | 3 |
| Shmeisani Basic | Public | | | | | |
| Um Hutheefa Basic | Public | 80 | | | 16 | 4 |
| Swelieh Secondary | Public | | | | | |
| Daheeat Prince Hasan Basic | Public | 90 | | 10 | | |
| Youcoub Hashem Basic | Public | 70 | | 30 | | |
| Um Kulthoum Basic | Public | 90 | | 10 | | |
| Aaka Basic Basic | Public | 25 | | 50 | | 25 |
| Um Mutta'a Basic | Public | 70 | | | 10 | 20 |
| Ali Reda Ar Rekabi | Public | 80 | | 15 | | 5 |
| Princess Bassma Basic | | 70 | | | 20 | 10 |

**Table 2: Mode of transport to and from school by ownership.**

For the purpose of assessing the walkability of streets leading to schools, six aspects were considered (Table 3). The evaluation was done in two methods, the first method assuming equally weight (without weight) assigned binary score (0 if conditions contribute negatively to safety, and 1 if the existing conditions contribute positively to safety). The second method (with weight) introduced a safety scale (1 to 5), where one for little impact on safety and 5 for high impact on safety.

| Assessment aspect | Assigned points (maximum) |
|---|---|
| Sidewalk conditions | 8 |
| Pedestrian crossing conditions | 8 |
| Driver behavior at pedestrian crossing | 5 |
| Pedestrian ability to comply with traffic rules | 4 |
| The attractiveness of streets for walking | 6 |
| The general location of the schools | 4 |
| Total | 35 |

**Table 3: Maximum points assigned by assessment aspect.**

Streets have been appraised according to the above six aspects. The maximum point on the scale summed to 35 points. Sidewalk conditions have been assigned 8 points on this scale. Same points were given to crossing conditions. Six points were allocated to attractiveness and 4 points for school location. Driver behavior at crossing was given 5 points while pedestrian compliance with the rules received 4 points. For each aspect, a set of variables were identified and tested. To cross examine the proposed rating scheme, each aspect was weighted according to the average weight given to each tested variable as viewed by a group of experts in the country (Table 4). The total weights add up to 97.3. The overall rate given to each case was adjusted to be 100.

| Aspect | Tested variable | Average Weight | Group | Tested variable | Average Weight |
|---|---|---|---|---|---|
| Side walk | Sidewalk Width | 2.94 | Pedestrian behavior | Pedestrian is visible and cars are visible to him/her | 2.53 |
| | Sidewalk maintenance | 2.19 | | Safe to walk on the sidewalk | 4.00 |
| | Sidewalk continuity | 3.00 | | If there is no side walk, still it is safe to walk against traffic | 3.00 |
| | Sidewalk used for vending machine | 2.44 | | Use Well marked and guided pedestrian crossing | 2.31 |
| | Sidewalk is used for parking | 2.13 | Attractiveness | Lit street | 2.80 |
| | Sidewalk is occupied with trees and advertisement pole | 2.94 | | Street with flowers | 2.56 |
| | Sidewalk with skid surface | 2.25 | | Benches are available | 2.75 |
| | No sidewalk | 2.53 | | Clean sidewalk and streets | 3.00 |
| Crossing | Marking for pedestrian crossing | 2.50 | | No gang or bad people | 2.20 |
| | Signing for pedestrian crossing | 2.70 | | Attractive shops | 3.13 |
| | Street width | 4.50 | Location | School at high speed street | 3.25 |
| | Traffic speed | 3.00 | | School at high speed street but not the entrance | 3.00 |
| | Long delay at signals | 2.50 | | Humps are available the school vicinity | 2.81 |
| | Parked vehicle obscure the view | 2.40 | | The school is well marked and signed. | 2.75 |
| | Tress on crossing | 2.90 | Scale: 1for little impact on safety<br>5 for high impact on safety | | |
| | Hump existence | 2.80 | | | |
| Driver behavior | Ignoring pedestrian and maintain speed | 2.80 | | | |
| | Giving way to pedestrian | 2.60 | | | |
| | Reversing without being attention to pedestrian | 2.60 | | | |
| | Speed at pedestrian crossing | 2.50 | | | |
| | Comply with rules | 3.00 | | | |

**Table 4: Weights Given to Each Tested Aspect to Evaluate School Environment Walkability.**

The average weight of all tested aspects within each category was calculated. Figure 6 show that experts give more weight to school location and pedestrian behavior and less weight to driver behavior and sidewalk.

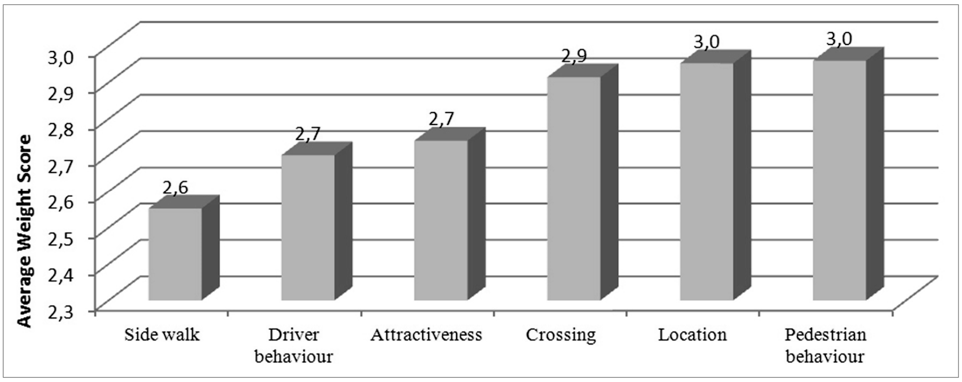


**Figure 6: Road expert average weight by investigated aspects used to rate school zone walkability.**

Scores of tested aspects were classified into five categories (Table 5) from very poor atmosphere to excellent atmosphere. Considering the two methods of evaluation (with and without weight), Table 5 shows that about 56% of the cases are rated as poor or very poor if weights are not considered, while the ratio is changed to 34% if the weights are considered.

The observations made include collecting data on conflicts that may involve the observed subjects. The total number of conflicts observed is correlated to the overall rating giving for walkability with and without weighting. The results indicated that a negative relation (r = - 0.126 (with weight) and r = - 0.141 (without weight)). Although the correlation is low, the level of significant is marginal (p=0.05).

| Evaluation Method | | Excellent atmosphere | Very Good atmosphere | Good atmosphere | Fair atmosphere | Poor atmosphere | Very poor atmosphere |
|---|---|---|---|---|---|---|---|
| Without weight | Range | 30-35 | 27-29 | 23-26 | 19-22 | 15-18 | <15 |
| | Number | 1 | 7 | 22 | 72 | 101 | 28 |
| | % | 0.4 | 3.0 | 9.5 | 31.0 | 44.0 | 12.0 |
| With weight | Range | >80 | 70-80 | 60-<70 | 50-<60 | 40-<50 | <40 |
| | Number | 4 | 20 | 32 | 97 | 63 | 15 |
| | % | 2.0 | 9.0 | 14.0 | 42.0 | 27.0 | 7.0 |

**Table 5: Rating walkability of school surroundings.**

The average rating for each school is calculated to examine the overall walkability. The analysis was completed for with and without weighting. Table 6 shows the without weighing case and illustrate the rank of each school for each assessment aspect.

Table 6 shows that an agreement seems to exist between raking of the site according to how attractive they are or pedestrian ability to comply with traffic rules and the overall rating giving to each school. The correlation analysis yield a significant relation between the overall evaluation with attractiveness (r = 0.75, p=0.001) and pedestrian ability to comply with traffic rules (r = 0.65, p=0.005). Table 6 shows that the schools that have not taken any measure to regulate traffic in their vicinity have poor ranking. Table 6 also shows a good agreement (r = 0.96, p=000) between the overall rating (with weight) and the overall rating (without weight).

| School | Sidewalk | Crossing | Driver behavior | Pedestrian Behavior | Attracti-veness | Location | Overall Without Weight | Overall With Weight | Regulation Measure |
|---|---|---|---|---|---|---|---|---|---|
| Al-Lttehad Secondary | 17 | 11 | 7 | 1 | 6 | 2 | 1 | 2 | |
| Al-Esra' Secondary | 16 | 5 | 15 | 2 | 1 | 4 | 2 | 1 | No measure |
| Sameer Al-Rrefa'I Basic | 13 | 6 | 16 | 3 | 5 | 14 | 3 | 3 | |
| Princess Iman Basic | 5 | 16 | 3 | 5 | 7 | 8 | 4 | 4 | |
| Ibn Tofeell Basic | 10 | 7 | 5 | 9 | 2 | 10 | 5 | 5 | |
| Jubile Secondary | 7 | 13 | 4 | 14 | 4 | 7 | 6 | 6 | No measure |
| Nafeesah Bent Al – Hasan | 9 | 17 | 1 | 11 | 8 | 11 | 7 | 7 | |
| Shmeisani Basic | 6 | 15 | 8 | 7 | 12 | 13 | 8 | 9 | |
| Um Hutheefa Basic | 12 | 8 | 9 | 13 | 15 | 1 | 9 | 10 | |
| Swelieh Secondary | 3 | 4 | 14 | 12 | 3 | 12 | 10 | 11 | |
| Daheeat Prince Hasan Basic | 4 | 12 | 2 | 8 | 10 | 6 | 11 | 8 | No measure |
| Youcoub Hashem Basic | 1 | 3 | 6 | 4 | 11 | 5 | 12 | 12 | |
| Um Kulthoum Basic | 13 | 14 | 13 | 16 | 14 | 15 | 13 | 15 | No measure |
| Aaka Basic Basic | 2 | 9 | 11 | 6 | 16 | 9 | 14 | 13 | |
| Um Mutta'a Basic | 8 | 2 | 12 | 10 | 9 | 17 | 15 | 16 | |
| Ali Reda Ar Rekabi | 11 | 10 | 10 | 15 | 13 | 16 | 16 | 17 | No measure |
| Princess Bassma Basic | 15 | 1 | 17 | 17 | 17 | 3 | 17 | 14 | |

**Table 6: Rating of the Suitability of School Environments for Walking Based on the Six Aspects.**

## 4.4 PEDESTRIAN BEHAVIOR

To provide insight into the interaction of pedestrians and the environment, pedestrian behavior on some of routes that lead to the selected school were further examined. Pedestrians were followed from when they left school until they reached home and the time they spent walking on the pavement or the road was recorded. Their crossing behavior was closely observed. On average, children cross two junctions during their trips (Figure 7). There is no significance difference in the number of junctions crossed by students due to gender (t = 0.55, p = 0.58).

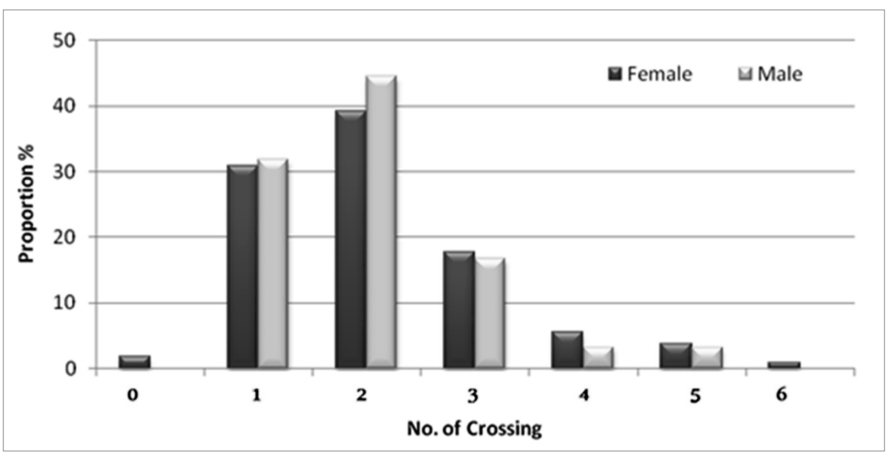


**Figure 7: Number of crossing by gender.**

Observations made showed that 8% of all crossings tasks were completed with no interaction with vehicles (No vehicle presents on the street at the moment of crossing). The results showed that a slightly above two-thirds of the crossings were made on un-marked crossing (mid-block). Only 2.3% of all crossings were made near humps, even though humps were installed in the vicinity of 12 of the schools included in the study (Figure 8).

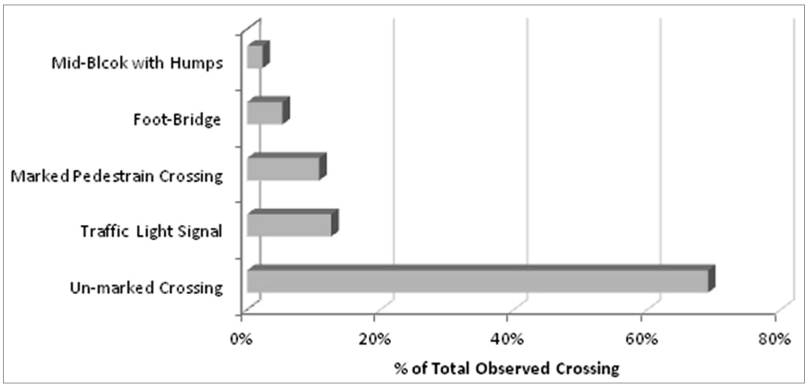


Figure 8: Proportion of crossings by type of traffic control device.

Looking into pedestrian crossing style shows that 26% of males were running compared to 16% of females who were running while crossing (Figure 9). Nevertheless, there is no significant difference in their behavior ($\chi^2$=2.44 p=0.1183).

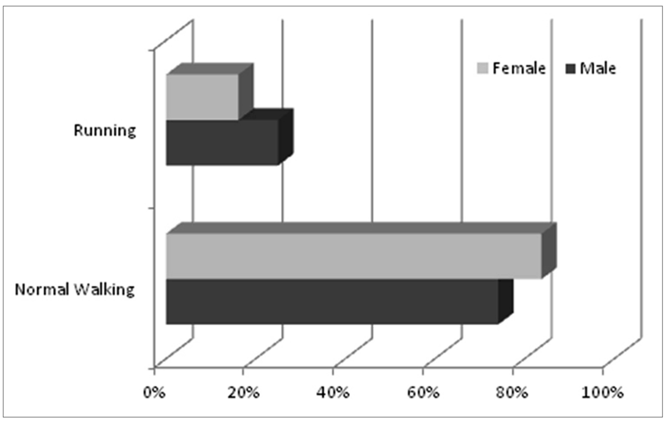


Figure 9: Crossing style by gender: crossing speed.

The visual search when crossing the streets was closely observed. The ratio of number of crossings that was preceded by visual search to number of all crossings made is calculated by gender. The results indicated that male performed visual search more often than female did (Figure 10). However, no significant difference was detected (t = -1.71, p = 0.088). Around one-fourth of all crossings were made without any visual search.

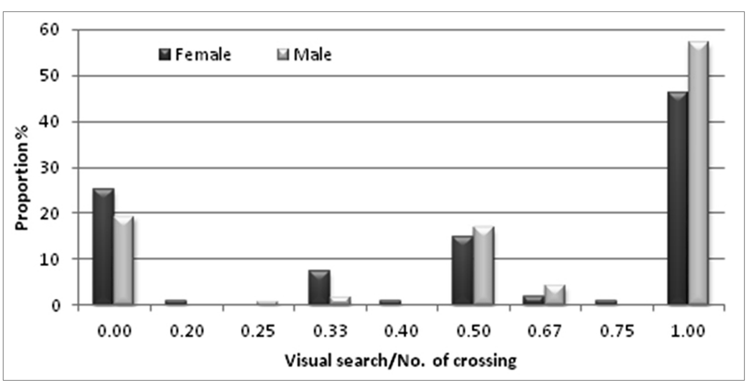


Figure 10: Ratio of number of positive visual search crossings to all observed crossings by gender.

Driver interaction with pedestrian was investigated. Crossing priority was given to pedestrians in 34% of all observed situations. Crossing priority was more frequently given to male children than female children

(Figure 11). The study indicated that there is significant difference in driver behavior towards pedestrian gender ($\chi^2$ = 8.85, p = 0.0029).

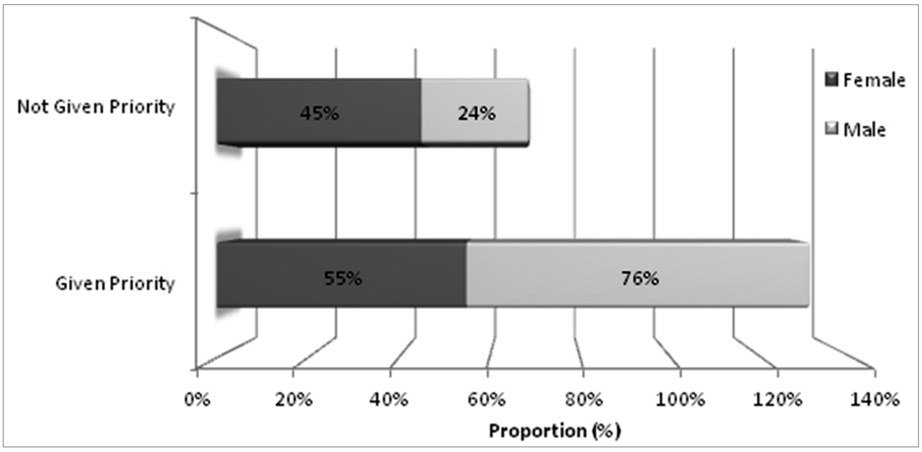


Figure 11: Pedestrian given priority by gender.

Pedestrians were involved in 34 conflicts on their back home trip (15%). Figure 12 shows that females were less involved in conflicts (12%) compared to male (18%). However, there is no significant difference between number of conflicts due to gender (t = 0.54, p = 0.59).

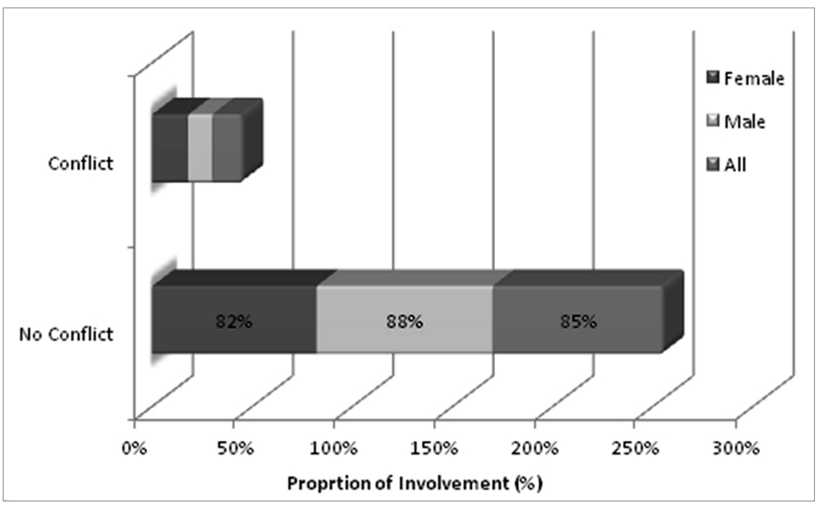


Figure 12: Involvements in conflicts by gender.

The mean time spent by the 232 pedestrians walking was 17.4 (Std = 9.2 minutes). The pedestrians spent 52% of their time walking on the pavement, 32% along the road, and 16% of their time crossing. This clearly shows that they are over exposed to traffic which increases the likelihood of being involved in an accident (Table 7). There was no significant difference between average times of trips, on-street walking time or crossing times due to gender (t-test at 5% level of confidence). Table 7 shows that male children walk along the road longer than female children. In general, male walk longer with an average of 20.1 minutes while female walk for 14.8 minutes.

| Indicator | All | | | Female | | | Male | | | t-test |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | Mean | Std. Deviation | N | Mean | Std. Deviation | N | Mean | Std. Deviation | |
| Total Walking Trip Time (minutes) | 232 | 17.4 | 9.2 | 108 | 14.8 | 8.1 | 119 | 20.1 | 9.4 | t=-4.61 P=0.001 |
| On Street Walking Time (minutes) | 232 | 5.7 | 5.0 | 108 | 4.5 | 4.4 | 119 | 6.8 | 5.4 | t=-3.43 P=0.01 |
| Street Crossing Time (minutes) | 225 | 2.4 | 1.6 | 104 | 2.1 | 1.4 | 119 | 2.7 | 1.6 | t=-2.88 P=0.04 |
| Proportion of time spent walking on Street Time/ Trip Time (%) | 229 | 0.32 | 0.2 | 108 | 0.30 | 0.2 | 119 | 0.34 | 0.21 | t=-1.32 P=0.19 |
| Street Crossing Time/ Walking Trip Time (%)) | 224 | 0.16 | 0.1 | 108 | 0.18 | 0.1 | 119 | 0.15 | 0.10 | t=2.02 P=0.045 |

**Table 7: Walking trip time (minutes) characteristics.**

## 5 DISCUSSION OF RESULTS

The study indicated that pedestrians in Jordan are at a high risk of being involved in a traffic accident when compared to reported risk in a number of industrial countries. Children under the age 15 years [40% of Jordan's population] suffer the most. Children under five years old are subjected to the highest risk of being killed in traffic compared to other age group. Pedestrian environment is a contributory factor that needs to be assessed. Pedestrian facilities are of poor standards and this study looked into the facilities provided in the vicinity of 17 schools indicated that the surrounding environment is poor. The study showed that pedestrian compliance with traffic rules is better in areas that are characterized as attractive for pedestrians to walk through. The correlation analysis yield a significant relation between the overall evaluation and the pedestrian ability to comply with traffic rules (r = 0.65). As a result, there are more traffic conflicts in the vicinity of schools with poor walkability.

Observing pedestrian behavior indicated that they spend half of their walking trip time either by crossing or walking on the street instead of pavements. On average, children cross two junctions on their way back from or to school. One-fourth of male children tends to run when walk back from school. The proportion of female who walk fast is slightly lowers (16%). Running or jogging combined with crossing more than one junction may increase the risk of subjecting the children to conflicts or crashes. Combing poor environment condition with impropriate behavior makes walking hazardous progression. The results showed female walk less but there was significant difference in their involvement in conflicts. Male involvement in conflict is more than female involvement in conflict, despite the fact that male children were given more priority in traffic compared to female children. On the other hand, the results also indicated a lower proportion of female pedestrian made visual search ahead of their crossing, which may induce them to more hazardous situation because they are not always given the priority.

Internationally, the application of active transportation concept is not widely spreading in Jordan within the given context. Active travel has been positively associated with higher daily levels of physical activities (Rosenberg et. al. 2006 & Cooper et. al. 2006) and higher fitness levels (Andersen *et. al.*, 2009; Voss, Sandercock, 2010). Although, rates of active transportation to schools have declined during the past years (McDonald, 2007), and many initiatives took place as a response to such decline (e.g. Safe Routes to School (SRTS) and the Walk to School (WTS) program).

Active transportation concepts would require providing walkable environment that encourage walking, as safe mode of transport to and from school. The study clearly shows that the surroundings of the selected school are in large not a friendly walking environment. Guidelines ought to be developed to meet pedestrians' needs and safety requirements around schools.

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## IMAGES SOURCES

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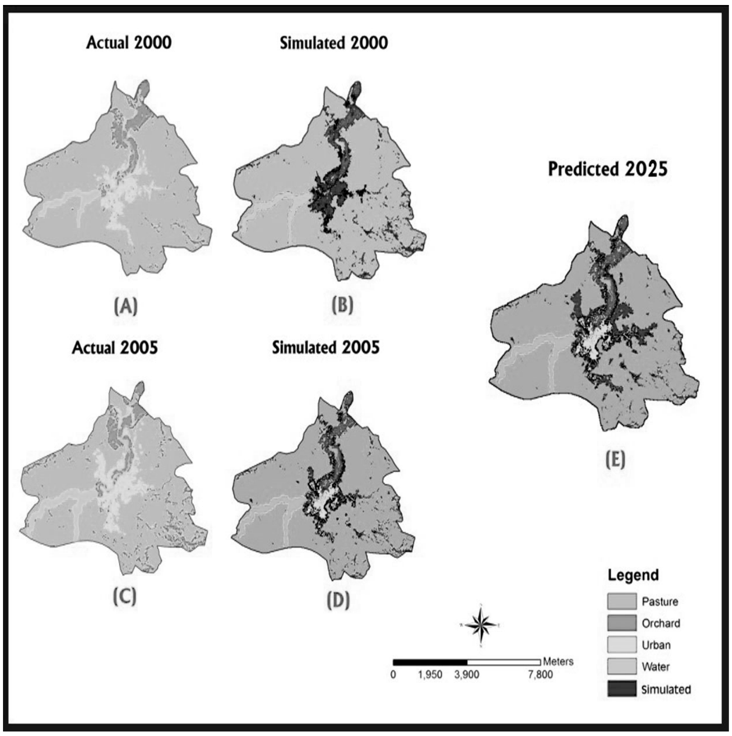
TeMA

Journal of
Land Use, Mobility and Environment

TeMA 2 (2013) 189-200
print ISSN 1970-9889, e-ISSN 1970-9870
DOI: 10.6092/1970-9870/1547

review paper received 24 April 2013, accepted 15 June 2013

www.tema.unina.it




# THE SPATIO-TEMPORAL MODELING OF URBAN GROWTH

## CASE STUDY: MAHABAD, IRAN

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ABSTRACT

The simulation of urban growth can be considered as a useful way for analyzing the complex process of urban physical evolution. The aim of this study is to model and simulate the complex patterns of land use change by utilizing remote sensing and artificial intelligence techniques in the fast growing city of Mahabad, north-west of Iran which encountered with several environmental subsequences. The key subject is how to allocate optimized weight into effective parameters upon urban growth and subsequently achieving an improved simulation. Artificial Neural Networks (ANN) algorithm was used to allocate the weight via an iteration approach. In this way, weight allocation was carried out by the ANN training accomplishing through time-series satellite images representing urban growth process. Cellular Automata (CA) was used as the principal motor of the model and then ANN applied to find suitable scale of parameters and relations between potential factors affecting urban growth. The general accuracy of the suggested model and obtained Fuzzy Kappa Coefficient confirms achieving better results than classic CA models in simulating nonlinear urban evolution process.

KEYWORDS:
urban growth, simulation, cellular automata, artificial neural networks, Mahabad

## 1 INTRODUCTION

The irregular expansion of urban land use can be considered as one of the biggest problems for urban managers and policy makers in different fields. Nowadays investigating the trend of converting of noun-urban land use to urban land use and determining the parameters which influence this trend are of great importance in long-term decision making and planning. In this way, exploring the rules and relations which are effective in changing lands into urban area and also the predicting the trend of city development in the future through reliable and efficient methods have received significant attention in urban researches. Land use change models are considered to be among the tools for identifying land use change (Onishi and Braimoh, 2007). Also land use change models are not only considered as approaches for the purpose of improving the quality of change identification and predicting the regimes dominating development patterns (Turner, 1994; Bockstael et al., 1995), but are also of use when it comes to analyzing the factors affecting land use change and choosing the most suitable development strategy (Erfu and Shaohong, 2005). Moreover, spatial models are useful tools for the purpose of a better perception of urban development and are also of use as tools assisting policy making, urban management, and tools providing information for evaluating environmental effects (He et al., 2008).

Urban growth and its management are considered to be a multi-dimensional problem. Cities emerge as complex dynamic systems, with non-linear processes, which are unexpected and self-organizing (Allen, 1997; Portugali et al.1997; Batty, 2007). Additionally, most of the methods which have embarked on model making for cities have traditionally been static, linear, centralized, and based on simple systems theory with a top-down approach. Recent, improvements happened in urban simulation have been because introducing new approaches (techniques) such as CA Multi-agent Systems, Micro Simulation, and Connectionist Models. These all have turned the urban model making into a powerful tool to be used for the purpose of analyzing the complex structures of urban systems. In this paper, efforts have been taken to determine the dynamic land use change in the dimensions of time and space through the use of Non-linear modeling in hope of achieving the closest simulation to reality. Multi temporal images and zoning maps are among the main data of this study. GIS has been used in order to extract the spatial factors and analyze the data. Additionally, ANN algorithm has been used to determine the influential factors and to find suitable values of simulation parameters that can best fit actual development. In other hand Neural network can be used to replace the transition rules used by classical CA models. Therefore CA has been applied as the main simulation engine .

## 2 CELLULAR AUTOMATION AND URBAN GROWTH MODELING

Cellular automation (CA) has attracted the attention of the researchers significantly in the past two decades (Alkheder, 2006). CA has found a wide range of applications in predicting land use change due to its simple structure in modeling. CA is a discrete dynamic system in which the situation of each cell is determined in the time of t+1, and according to the neighbourhood situations in the time of t, corresponding with already-defined transition rules. CA possessing time-space dynamics is capable of simulating changes in two-dimensional aspects. This method has been used widely for many application areas specifically for urban growth and land use change. In other words, CA is a dynamic modeling technique which produces global patterns from local cells through the use of the four main elements of cells, states, neighbourhood, and transition rules (Batty et al., 1999). In a CA system, space is divided into a regular network of cells with the same form and size and generally in the shape of squares. Each cell possesses a value equal to 0 or 1 or a range of values in a scale from 0.0 to 1.0 and finds certain values in accordance with different uses (AL-Ahmadi et al. 2009). In an urban CA the situations or states can be as: a) binary values (urban, non-urban), b) discrete values which represent different land uses, c) quantitative values which can, represent for instance population density, the level of development (Li and Yeh, 2002), the building cost (Cecchini and Rizzi, 2001), or a vector (Santé et al., 2010) of a number of features. The

state for each cell includes a number of discrete time steps which are controlled by a set of transition rules. These rules are generally defined based on the initial state of the cell and the status of the neighbouring cells.
The competence and attractiveness of this approach can be considered to be because of CA’s ability in showing, simulating, and realizing the patterns and behaviors of complex geographical phenomena and self-organizing systems through the use of a number of somewhat simple rules (Torrens and O'Sullivan, 2001; Wu and Webster,1998).

## 3 ARTIFICIAL NEURAL NETWORKS AND URBAN GROWTH MODELING

One of the applications of Artificial Intelligence (AI), which has been studied in this study, is using AI techniques in optimizing urban growth modeling, specifically CA. Artificial Neural Network (ANN), as one of the components of computational intelligence has a structure including non-linear processing elements known as neurons which model the neural networks of human brain with connected weights. This network is a non-parametric algorithm and has characteristics such as learning, parallel processing, and the ability to generalize without needing an initial knowledge of the statistical distribution of data (unlike conventional statistical methods), which, This property is significant importance in space-time modeling.
Additionally, ANN is capable of recognizing and classifying patterns through training and learning urban growth processes. Therefore, ANN can be used as a simple and effective replacement for the Transition Rules from the classic CA models (Yeh and Li, 2001).
Capability and ability of applying ANN algorithm in urban development researches, is recently attracted some researches and scholars attention to itself. On the other hand, ANN are synthetically applied with other artificial intelligence techniques for urban modeling. Bilanowskia and his colleague assimilated an ANN with GIS to anticipate the earth control changes (Bilanowskia et al, 2002).
In this model, the role of ANN was learning of development patterns in the region and capacity test and the ability of anticipating model. Multi-Layer Perceptron (MLP) which be created by Ramelhart and his colleges (1986), are the most applicable ANN that be used. MLP was formed of three layers, input, hidden and output layers (Fig 1). As these nets are three-layers, there is the possibility of recognition of nonlinear communications existing in nature (Mahini and others, 2010).

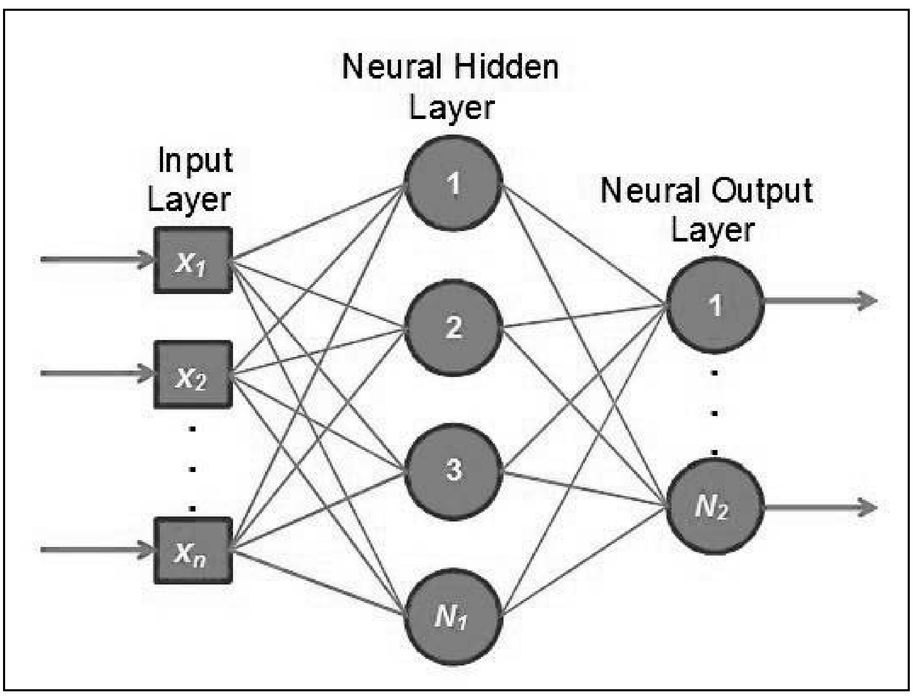


**Fig.1: The architecture of 3 layer MLP Network**

## 4 CALIBRATING THE CA MODEL USING ANN

Urban CA models are considered as tools highly capable of developing applied models for producing real urban patterns, hence it is possible to gain better comprehension of urban dynamics and theories. The majority of studies conducted on urban simulation through CA in the past three decades have focused on extracting or defining transition rules. In most of the cases, transition rules have been defined heuristically based on the realm of science and priority of the expert.

Therefore, one of the key points in simulating urban growth is calibrating the model in order to find the proper weights for the simulating parameters. It is obvious that in the process of simulation, calibration calls for finding those weights of the simulating parameters which can have the highest level of conformity with real development. However, after several decades of the application of this method in urban planning and the efforts of researchers in finding a globally applicable model for the purpose of predicting urban complexities, one can still feel some shortcomings in the calibration of the CA model.

In order to point to some studies conducted on the calibration of the CA model, one can mention the efforts of Wu and Webster (1998) in using multi criteria evaluation (MCE), Li (2006) in using the hierarchical analysis (AHP), Wu (2002) in regression logistics, AL-Ahmadi (2009) in fuzzy logic, and Li et al. (2008) in genetic algorithm, and Li and Yeh (2004) in decision making tree where CA produced different results.

The values of the effective parameters in simulation are determined by holding other parameters constant. Calibration and validation of CA models are the key to their successful implementation due to the fact that the quality of the urban CA model depends on the adequacy of the transition rules which usually include a number of parameters to be calibrated (Wu, 2002; Straatman et al., 2004). Moreover ANN has been used to recognize the patterns in different studies such as pictures analysis (Fukushima et al., 1983), weather forecast (Drummond et al., 1998), classification feature of the land (Brown et al., 1998), remote sensing (Atkinson & Tantall, 1997) and earth control changes (Pijanowski et al., 2002).

Based on these points and due to the non-linear and self-organizing nature of urban systems, the use of ANN for the purpose of calibrating the CA model has been examined in this paper.

## 5 CALIBRATING CA MODEL THROUGH ANN

Urban CA models are considered as tools highly capable of developing applied models for producing real urban patterns, hence it is possible to gain better comprehension of urban dynamics and theories.

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Therefore, one of the key points in simulating urban growth is calibrating the model in order to find the proper weights for the simulating parameters. It is obvious that in the process of simulation, calibration calls for finding those weights of the simulating parameters which can have the highest level of conformity with real development.

Calibrating CA model can be done in two ways (Li & Yeh, 2002).

A method is in base of statistical data such as Logistic Regression operation which is presented by WU (2002) and techniques such as genetic algorithm which is represented by Alkhadar (2008). The other method is calibrating in base of trial and error method such as visual tests (Clarke et al., 1997; Ward et al., 2000) computer simulation comparison (Clarke and Gaydos, 1998). Because of the absence of similar structures and objects, however, in these models, there is no popular method to calibrate CA model (Straatman et al., 2004).

In this paper, we were exploited from ANN algorithm to calibrate CA model. After calibrating, a set of optimized values have been allocated to simulator parameters (Fig 2).

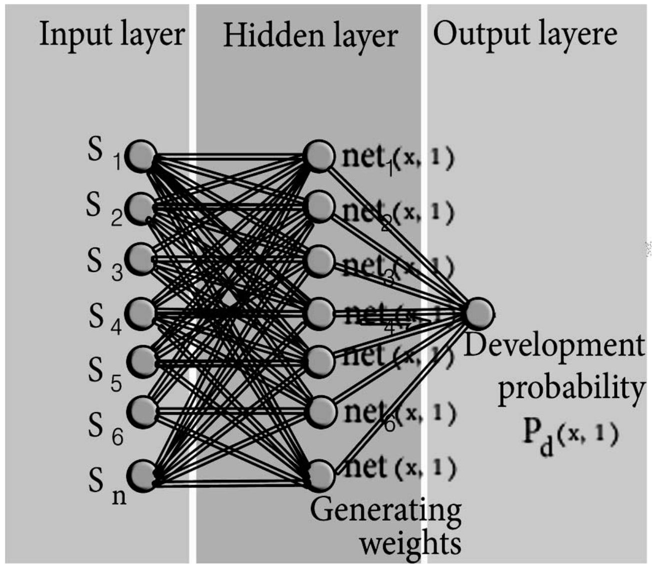



Fig. 2: Generating Weights and Development probability based on ANN

CA simulation is designed in base of ANN algorithm. At each of iteration of CA, ANN will recognize the development, which is subject to the input of site attributes and weights. A cell may be had $n$ characteristic:

$$(s_1, s_2, s_3, s_4, s_5, s_6 \dots, s_n) \qquad (1)$$

A neural network can be designed to estimate the probability of development in each period of CA iteration. In the ANN, three layers have been recognized: input layer, hidden layer and output layer.

Input layer has $n$ neurons in base of characteristics of site. Hidden layer may also have $n$ neurons, while in output layer; there is just one neuron which calculates the probability of development.

In each period, iteration of the characteristics of site for each cell is as the first layer input and ANN recognize the probability of development unto that layer.

Most of the basic data before entering in model as the ANN input, are scaled into domain of $[0,1]$. Scaling gives each cell same significance and creates the same numerical value in input data and causes the compatibility of these data with activation function:

$$s_i' = (s_i - min)/(max - min) \qquad (2)$$

The algorithm which is incorporated with CA model consists of a simple three-layer net. In ANN, received signal has been calculated by the neuron $j$ hidden layer of the first input layer for each cell as follow:

$$net_j(x,t) = \sum_i w_{i,j}\, s_i'(x,t) \qquad (3)$$

Where $x$ is a cell and $net_j$ is received signal by neuron $j$ belonging to $x$ cell in time, and $s_i'(x,t)$ is the characteristics of the slightly site for parameter (neuron) $i$.

Activation function of the hidden layer is:

$$\frac{1}{1+e^{-net_j(x,t)}} \qquad (4)$$

Probability of development ($P_d$) also defines for each $x$ cell as:

$$P_d(x,t) = \sum_j W_j \frac{1}{1+e^{-net_j(x,t)}} \qquad (5)$$

The simulation is loop-based. In each iteration period, probability of development has calculated by the ANN in base of the characteristics of the site attributes. Probable perturbation (error net) is an expression which can be applied for representation of unknown errors during simulation, that it seems necessary to generate patterns coincident to reality, the probability of variation each cell has recognized by the probability of development.
Error net (RA) has been determined by:

$$RA = 1 + (-Ln\gamma)^{\alpha} \qquad (6)$$

Where $\gamma$ is uniform random variable in domain of $\{0,1\}$, and $\alpha$ is a parameter to control the probable deviation scale and also can be used as dispersion factor in this simulation.
In this base, the probability of development function has been modified as:

$$P'_d\ (x,t) = RA \sum_j W_j \frac{1}{1+e^{-net_j(x,t)}} \qquad (7)$$

$$= (1 + (-Ln\gamma)^{\alpha}) \times \sum_j W_j \frac{1}{1+e^{-net_j(x,t)}} \qquad (8)$$

The probability of urbanizing of each cell is more probable in higher weight than probability of development during simulation process.
A threshold value is also defined by each cell before starting the process in order to accept the alteration. If a cell has higher probability of development than threshold value, the cell will change and expand. The number of expanded cell in defined neighborhood recalculates and the characteristics of site updates at the end of each iteration period. Simulation has maintained as long as the amount of total altered cells equal to amount of consumed land (Yeh And Li, 2002).

## 6 STUDY AREA AND DATA PREPARATION

The city of Mahabad in Western Azarbayjan province, Iran has been selected as the case study to simulate urban growth process. According to census, its population was 201,104, in 41,000 families. The city's population is predominantly Kurdish, with the city lying south of Lake Uremia in a narrow valley 1,300 meters above sea level in Iranian Kurdistan (fig. 3).

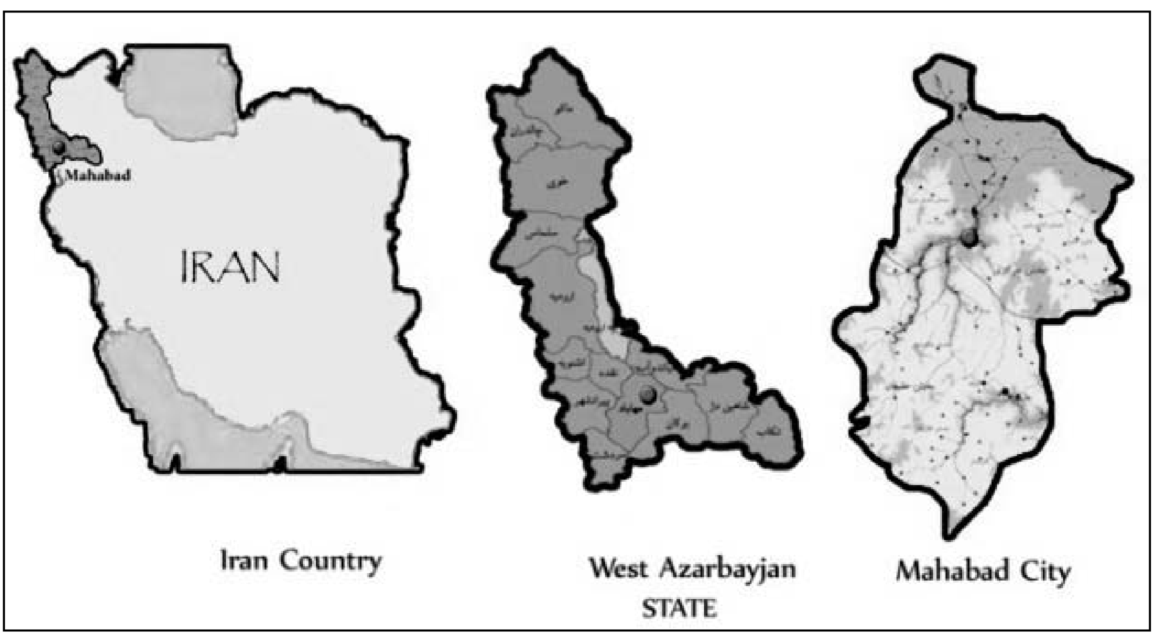



**Fig. 3: Case study area, City of Mahabad**

Mahabad with the area of 2‘541 square kilometers is the fifth county of this province.

Historical studies show that Mahabad is not a very old city and it was founded at the beginning of Safavi epoch.

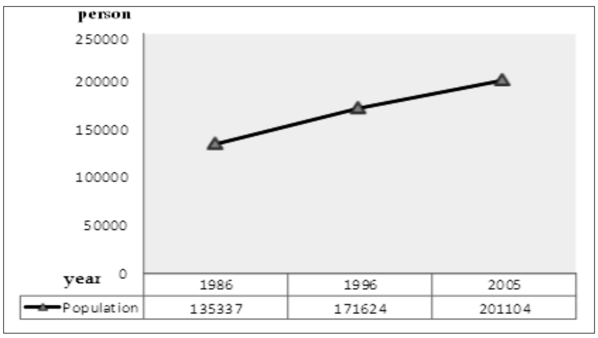
Mahabad which was called Mokri Savojbolaq in the past, started to grow since the beginning of this century and then was developing following the permanently settling the tribes and establishing modern organizations and gradually was added to the new districts.

After the Islamic Revolution (1978), it was faced with rapid unplanned development as the consequence of political and social transformation.

The city’s visage changed completely. At that time, eastern and southern areas of the city were developed irregularly. In 1989, Mahabad had an area of 591 hectares which is three times bigger than its area in 1966.

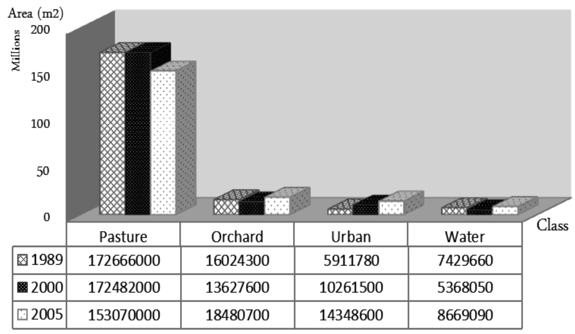
Between 1989 to 2005, city’s area reached to 1‘434 hectares that is two times of its area in 1989. In fact Mahabad is considered as one of very fast growing urban region of the country (fig. 4).

Over the past two decades, rapid urbanization has threatened the agricultural land and ecologically sensitive landscapes located around Mahabad (fig. 5). The rapid un- planned growth of Mahabad during recent decade makes it a suitable case for model growth.




| year | 1986 | 1996 | 2005 |
|---|---|---|---|
| Population | 135337 | 171624 | 201104 |

Fig. 4 The population growth of Mahabad 1986-2005.




| | Pasture | Orchard | Urban | Water |
|---|---|---|---|---|
| 1989 | 172666000 | 16024300 | 5911780 | 7429660 |
| 2000 | 172482000 | 13627600 | 10261500 | 5368050 |
| 2005 | 153070000 | 18480700 | 14348600 | 8669090 |

**Fig. 5: The land use change statistics of Mahabad**

In this study, remote sensing and GIS techniques were used to provide spatial parameters and land use data, to characterize the relationships exist between site attributes and urban growth. Satellite Images were acquired on 1989 (TM), 2000 (ETM+), and 2005 (ETM+).

The Minimum Distance Supervised Classification (MDSC) approach was employed for land use classification (fig.6).

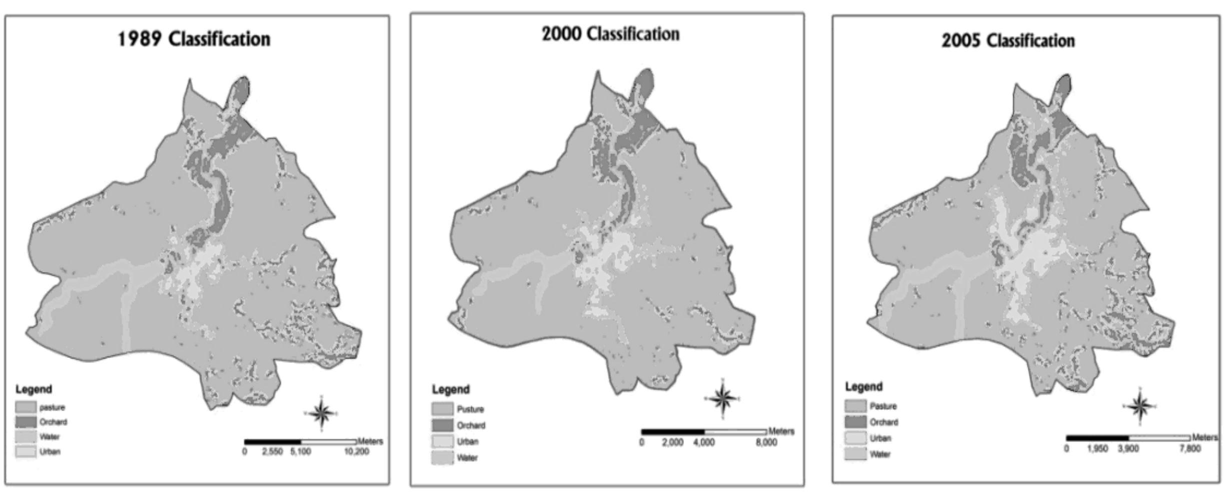



**Fig. 6: The classification of satellite images of 1989, 2000, 2005.**

To extract the land use layers, fuzzy logic was used for classifying images. For this purpose, fuzzy toolbox of MATLAB package was used.

The Mamdani's Fuzzy Inference method was applied to classify the images. Spatial parameters were calculated by use of Euclidean Function in Spatial Analyst Toolbox of ESRI ArcGIS9.3 (fig. 7).
To get target samples for the ANN training/learning process, the time-series land-use data of Mahabad City in 1989, 2000, and 2005 were used.
The neighborhood level of growth level was measured basing on the number of developed cells in the neighborhood of 10×10 cells adjacent to the central cell. The growth area of initial neighborhood of the model was computed using of binary image of 1989.

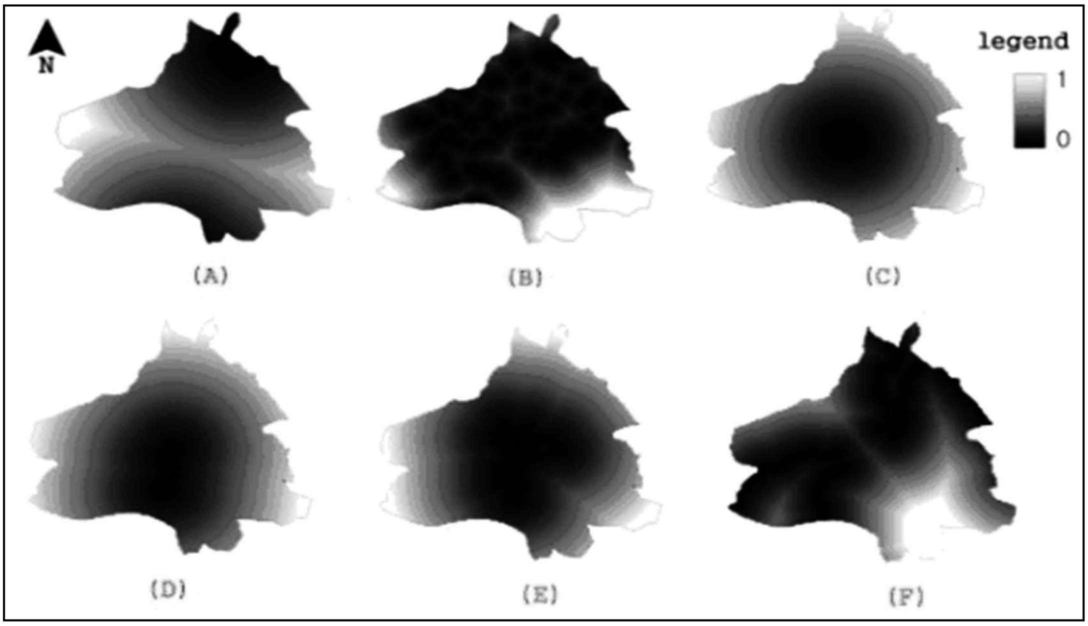



**Fig. 7: The spatial parameter of simulation**

## 7 TRANING

In order to use the ANN for prediction purposes, the ANN must be taught the characteristics of the dataset being processed. The training dataset consists of input values and the desired output values corresponding to these input values. The desired output values can be obtained from field, remote sensing data and other secondary sources (Maithani, 2009).
Training data for urban growth in case study area were obtained from satellite images including TM and ETM+ for time between 1989-2005. Although the ANN can be trained using a number of training algorithms, in the present study, the Back Propagation (BP) learning algorithm proposed by Rumelhart et al. (1986) was used for training the ANN due to its simplicity and wide applicability.
The training data can be used to calibrate the network to produce the realistic simulation of the study area. It is inappropriate to use the whole data set for training because the size is too large and the data may have spatial correlation. As mentioned above, a certain number of sample data is needed for the training/learning process of the ANN. So, a random-sampling method was applied to reduce the time and volume of computation.
Some 3'360 training samples were selected from urban growth maps belonged to 1989 to 2005 using ERDAS IMAGINE package.
The selection of samples was similar heuristic method of Kavzoglu and Mather (2003) which is as follow:

$$60N_i(N_i + 1) \qquad (9)$$

where Ni is number of input neurons.
In this study, four groups of data relating to physical attribute, accessibility and neighborhood and zoning as well as land use data for the period of 1989-2005 were manipulated (Table 1).

| Factor | Parameters |
|---|---|
| Physical attribute | Slope of the area<br>altitude model |
| Accessibility and Neighborhood | Accessibility to local road<br>Accessibility to main road<br>Accessibility to CBD<br>Accessibility to local centers<br>Accessibility to business and community centers |
| Zoning | Planed area<br>Protected area |
| Data related to land use | Land use classes:<br>Urban, arid, green, water |

**Table. 1: The explanation of the spatial factors and corresponding driving forces.**

## 8 SIMULATION OF URBAN DEVELOPMENT

The final step of modeling was prediction of urban growth. Based on the parameters and results of model validation, the prediction of future urban growth for 2025 was predicted (fig. 8).

The CA-ANN model using calibrated with the actual urban growth pattern between 1989 and 2005, and then used to predict urban growth in 2025.

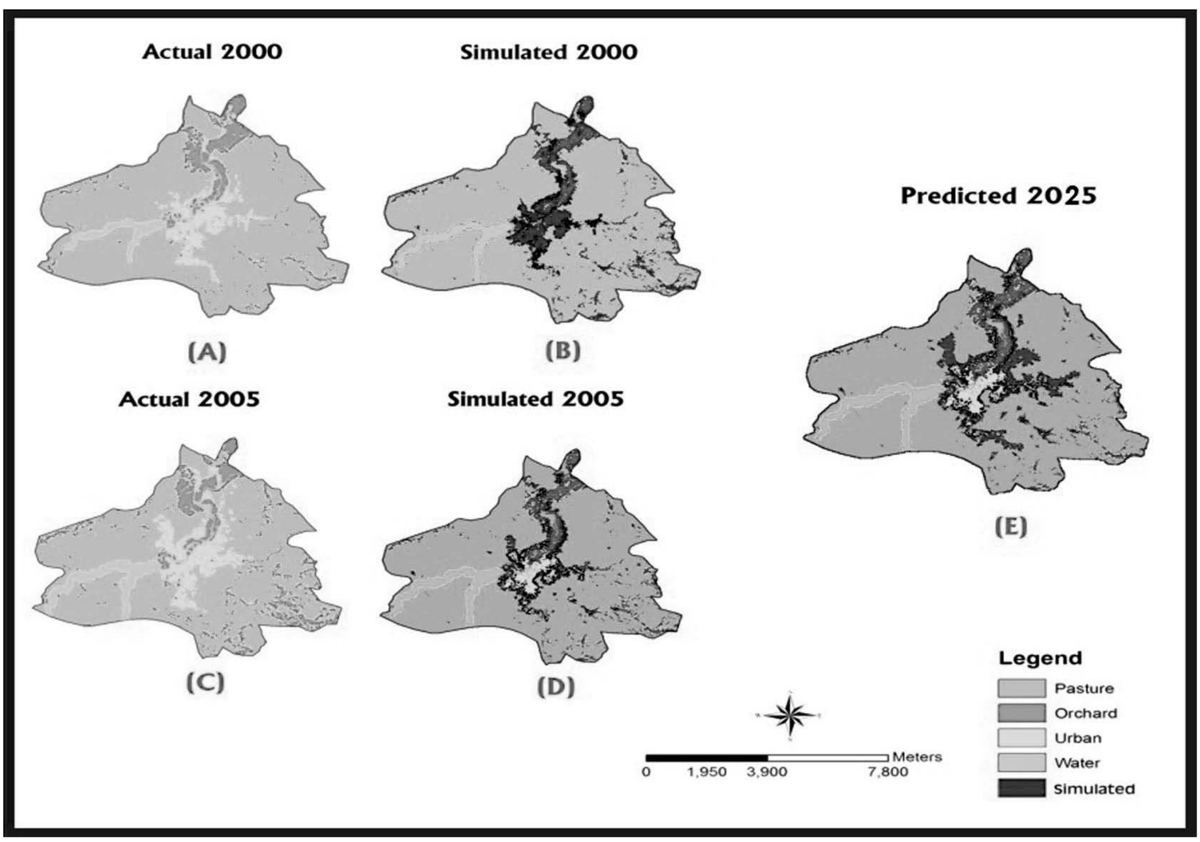



**Fig. 8: (A) Actual urban land use in 2000, (B) simulated urban land use, (C) actual urban land use in 2005, (D) simulated urban land use in 2005 and (E) predicted urban land use in 2025.**

## 9 DISCUSSIONS AND CONCLUSION

The result of the study showed that urban growth modeling through CA-ANN is an effective and useful way to analyze complex processes of urban evolutions. While classic CA model is associated with fixed transition rules and complicated calculation, this study was based on the growth of a procedure which calibrated the initial global probability surface from sequential land use data and then modifies the global probability with the local probability that was updated at each of iterations.

The applied approach of this study, integration of CA with ANN offers an easier and more flexible way instead. Because of the flexibility of the model with non-liner systems and uncertainty caused by spatial data, a higher level of confidence is achievable comparing to classic statistical model. In other hand, taking the advantage of ANN's capacity of dealing with nonlinear systems, this ANN-CA model can be calibrated without heavy computing overhead and subjective human interference.

This model can be considered as a helpful tool for policy making and planning. In fact, the results of this study can provide planners and decision-makers with influential information about alternative urban growth under various scenarios. Further, it can be easily combined with environmental models in hope of impact assessment. The model is reputable in other urban contexts using related data and circumstance.

This study can be improved in several ways. Since land use transformation is a multifaceted process, improving transition rules would enhance the classification accuracy and running efficiency.

Furthermore, if the CA simulation is calibrated through the desired pattern of changes, then the desired relationship can be incorporated into future growth evaluation for the purpose of simulating alternative scenarios. Furthermore, unsteadiness of the calibration process basing on ANN may bring superfluous parameters for the simulation model, which also points out the further research direction of this study.

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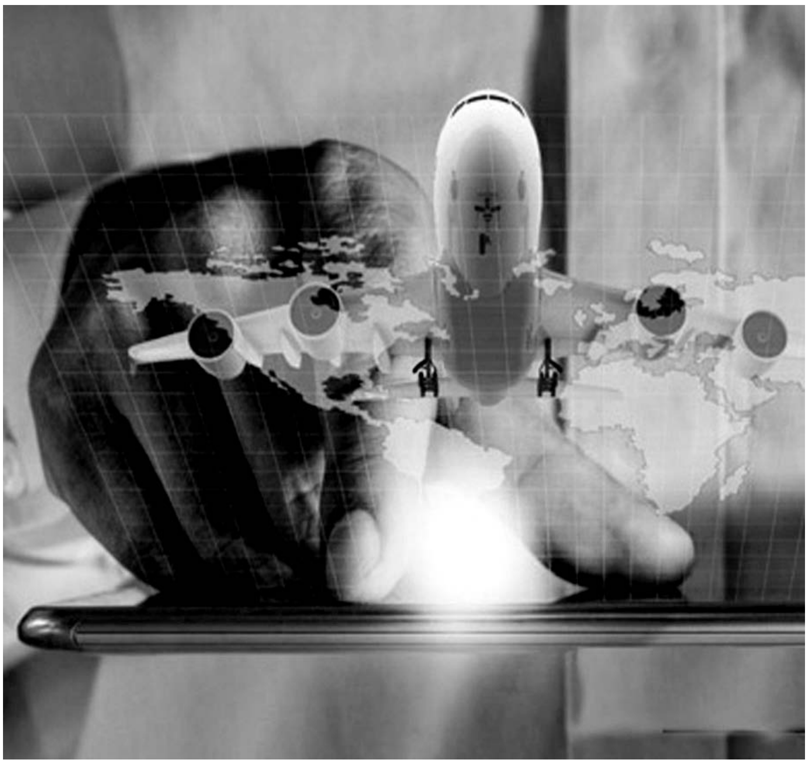
TeMA

Journal of
Land Use, Mobility and Environment

TeMA 2 (2013) 201-213
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1483

review paper received 15 February 2013, accepted 15 June 2013

www.tema.unina.it



# TOURISM AND CITY REFLECTIONS ABOUT TOURIST DIMENSION OF SMART CITY

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ABSTRACT

The city of the future seems to be forcibly "intelligent" both in physical and in the functional aspects. This paper starts from the consideration that the diffusion of new communication technologies (ICTs) are significantly changing the urban supply system of tourist services giving rise to new ways of enjoying the city. As tourism can be assumed as an urban activity, by a town planning point of view, the study of tourism is meaningful to identify development trajectories of the present cities oriented toward sustainable and smarter models. As a matter of fact, almost all the projects to get a "smart city" are based on the idea of joining the potentialities of ICTs and the needs of urban management through people living or using the city. In such a vision, "tourist dimension" of the city becomes fundamental in promoting urban image as well as in improving efficiency of the city. This efficiency also depends on the capability of each city to share historical and cultural heritage as "common good". As tourist demand has deeply changed also driven by technological development, this paper tries to investigate how will change the urban supply to meet the rising demand of quality and efficiency. The transition to smart tourist destination currently seems to be strongly connected with the number and the variety of apps to improve the "experiential component". A lack of interest there seems to be in finding strategies and politics oriented to plan the urban supply of services tourist or not. This consideration, if shared, opens up new perspectives for research and experimentation in which city planning could have a key-role also in proposing an holistic approach to city development towards smart city.

KEYWORDS:
Smart city, digital tourism, town planning

## 1 TOURISM AND CITY

At present, city has become one of the tourist destination par excellence (Page and Hall, 2003).

The presence of cities into the "tourist experience" shows the transformation that has been increasingly affecting the tourist demand. Indeed contemporary cities have become the object of tourist desire thanks to a renewed recovery of their condition of "being cities". It is no longer the city seen only as a container of precious objects and valuable sites that attracts tourists, but the *city system* (Amendola, 1999). In other words, the "tourist city" product is the privileged place that contains either elements with great artistic, architectural, historical, value, or the peculiar cultural and traditional characteristics, or the opportunities of enjoying and taking part in events and occasions that allow tourists (temporal user of the city) get involved in urban life.

This new demand for city use has activated several strategies of urban promotion also because tourism is one of the leading sector of our economy.The UNWTO data show an increase in this sector despite the crisis that has been affecting the most important west countries. In the last decade, in fact, the expense of international travels has doubled and it is expected to grow extra 50% in the next ten years (UNWTO, 2012). Therefore, the competition among cities will be based also on the capacity of attracting big tourist flows, because of the undeniable positive effects on economic development. In Italy, for example, tourism contribution to the gross national product is 130 billion euro (about 9% of national production) and consequently it is defined as the leading sector of investment also in the political strategies of the present government (WTTC, 2013). At the same time cities will have to be able to arrange adequate devices in order to contrast the negative effects produced by the uncontrolled development of tourism. The contradiction of tourism, indeed, consists in being contextually development factor and element which produces negative effects on urban liveability. The challenge that tourist cities have to face consists exactly in their ability to find a balance between promotion and safeguard of their (historical, cultural, architectural, territorial, environmental) resources. From a town planning point of view, this condition requires intervening through actions and policies targeted to the optimization of urban liveability. Moreover, a good quality of urban life is an unavoidable condition for building the future smart cities. At the same time, one of the factors of urban smartness consists exactly in making city attract tourists (investments, enhancement, image promotion, attractions of tourist flows, and so on). Tourism, then, seems to represent one of the factors that shows the real accomplishment of the possibilities offered by the smart city concept. Indeed, at a first glance, the attention in building the smart city seems to be paid only to the production of applications capable of improving the tourist experience also by involving the users in the mechanisms of city promotion. What seems to lack is an holistic vision which could allow, on the contrary, to face urban problems in an overall view. Starting from the above-said assumptions, this paper investigates the aspects regarding the relationship between city and tourism pointing out the need for integrating tourist development and urban management. The several opportunities given by the ITCs tools have greatly affected the communication mechanisms as well as the requirements of particular urban users represented by the tourist demand.

Cities will have to provide with structures and services for meeting this demand efficiently and effectively.

This paper aims to show that in order to pursue this target it is necessary to reorganize the urban supply, which should be able to join the several aspects of the tourist demand (safety, mobility, accommodation, and so on) with the organization and liveability of the urban system. Therefore, the paper is divided into three parts. The first part describes the elements which define a smart city, through a short review of the recent literature in order to stress that tourism is one of the smart city dimensions. The second part tackles briefly with the aspects regarding the changes of the tourist demand and urban supply in order to point out the present trends underway. The third final part includes some reflections on the possibility that the integration between tourist development targets and the town planning needs could offer in defining the urban smartness.

## 2 ALL THE CITIES AIM TO BECOME "SMART"

The huge amount of funds made available by the European Union (in 2009 through the European Community Smart City and Communities Initiative) and in Italy by MIUR (in 2012 through the announcement Smart Cities and Communities and Social Innovation) for working out "strongly innovating solutions" for the regions development and the enhancement of the quality of life in the cities, has attracted the attention of business, public research authorities, universities and public administration, who have been asked for integrating their respective competences in order to set up projects for developing "smart cities".

The challenge consists in making cities more efficient as regards better quality of services, reduction of environmental impacts (polluting emissions), control of energy consumption, by means of innovating technologies (ICTs) capable of supporting the management, monitoring and functioning of cities.

Actually, it could seem to be not different from what has been already affirmed by some scientists in the Eighties and Nineties about the crucial change that new information and technological technologies had produced, prefiguring the "death of distance" (Cairncross 1997), the transition from the "city of atoms" to the "city of bits" (Mitchell 1996) or the most futurist "anything-anywhere-anytime dreams" (Graham 2004).

Maybe what they miss was the complementary –more than the substitutive– role of new technologies in developing urban activities on several (economic, social and physical) levels.

On the contrary, this concept represents the essential innovation of the emerging idea of smart city, where citizens and city users play an active role both as "detectors" and "diffusers" of data and information.

Indeed, the interaction between users and decision-makers represents one of the key points on which the idea of smart city is based, even if an univocal and shared definition has not been reached yet in Europe and all over the world. For example, the report worked out by Cittalia titled *Smart cities in the world* collects twelve cases of innovative strategies activated by European and American cities, representing a "guide handbook" for technicians and decision-makers. Whereas, *The Top 10 Smartest Cities* on the planet is the classification worked out in 2012 by Boyd Cohen, researcher at University of Colorado. It is based on some indicators (economy, environment, government, way of living, mobility, people) that compare the most important cities of the world. Stand in the ranking six European capital cities (Vienna (1°), Paris (3°), London (5°), Berlin (7°), Copenhagen (8°), Barcelona (10°) where investments in innovation are mainly targeted to set up measures for reducing climate changes.

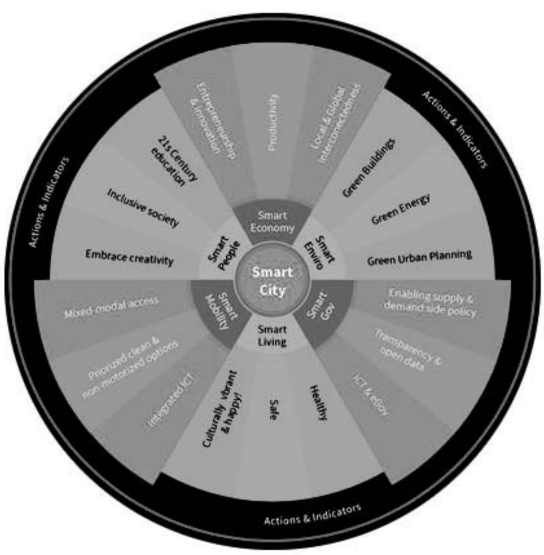


**Fig.1: The wheel of smart city elaborated by Boyd Cohen**

The recent report elaborated by European House Ambrosetti on *Smart Cities in Italy* shows that the definition of "smart city" can transform as the proponents change (fig. 2).
Sustainability is present in each proponents (institutions, academia, business) while the ICTs component is very significant for companies, which consider "smart cities" as an open lab for the application of innovative services and products. Even more, the attention to the "sensors" capable of making cities smarter seems to prevail, in spite of academics and professionals recommending not to underestimate the "smartness" concept by enhancing the role of technologies.
The "iceberg effect" (Bolici e Mora 2012) is a high risk, mostly encouraged by the ICTs leader companies which encourage the use of technology by standardized "smart" applications, lacking in a definite planning of development and application which should take local peculiarities into account (Townsend 2012).
The trend to encourage the operating implementation of technology is still predominant, also because a theoretical reference has difficulty in coming out (Fistola 2013).

| | **Mobility** | **ICTs** | **Environmental Sustainability (energy buildings ground water)** | **Quality of life** | **Smart society (education, health, governance)** |
|---|---|---|---|---|---|
| **Istitutions** | | | | | |
| EU SET plan | | | ● | | |
| EU SC and Communities Initiatives | ● | ● | ● | | |
| Italian Digital Agenda | ● | ● | ● | ● | ● |
| MIUR calls | ● | ● | ● | | ● |
| **University** | | | | | |
| Wien University | ● | ● | ● | ● | ● |
| MIT SENSEable City Lab | | ● | ● | ● | ● |
| Harvard | ● | ● | ● | ● | ● |
| **Companies** | | | | | |
| ABB | ● | ● | ● | ● | |
| Alcatel | ● | ● | ● | ● | |
| IBM | ● | ● | ● | | ● |
| Siemens | ● | ● | ● | | |
| Cisco | ● | ● | ● | ● | ● |
| Accenture | | ● | ● | | ● |

**Fig. 2: Definition/interpretation of smart city according to the typology of proponents, elaboration by ABB Ambrosetti (2012)**

Also the reference to sustainability, incited by the environmental emergencies to be faced everyday (energy crisis, climate changes, and so on could represent a "risk" of trivialization in a way.

Therefore, like the sustainable city also the smart city finds it difficult to define a global view that would not be applied only to single parts (smart building, smart district, smart street, smart infrastructure, etc.).

Nevertheless a point of convergence seems to be found in the idea that a "smart city" should refer inevitably to an holistic concept able to join the positive aspects issuing from technological development with the qualities of the "social capital" (Papa, Gargiulo and Galderisi 2013; Fistola 2013).

Indeed, more and more often the availability of a good level of human capital is considered as a factor of competitiveness and territorial capacity of attraction (Florida 2003).

The basic concept refers to the opinion that in a smart city the 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 andNijkamp 2011).

On an extreme level, it could be argued that in the definition of smart city there are two interpretative models: the *digital city* and the *eco-sustainable city*, which evolve, get stronger and integrate each others supported by a third element that is the *social capital.*

The active role of the human factor (the anthropic system: the urban actors, residents, city users, tourists) is becoming increasingly important also because it can significantly affect the "destiny" of a city.

Therefore, the challenge of the smart city seems to be once again the (intelligent) attempt to make a city more competitive basing on the presence of factors which contribute to its "smartness" (the presence of a creative class; high levels of multimodal accessibility; high quality of transportation network; great diffusion of ICTs; high quality of human capital).

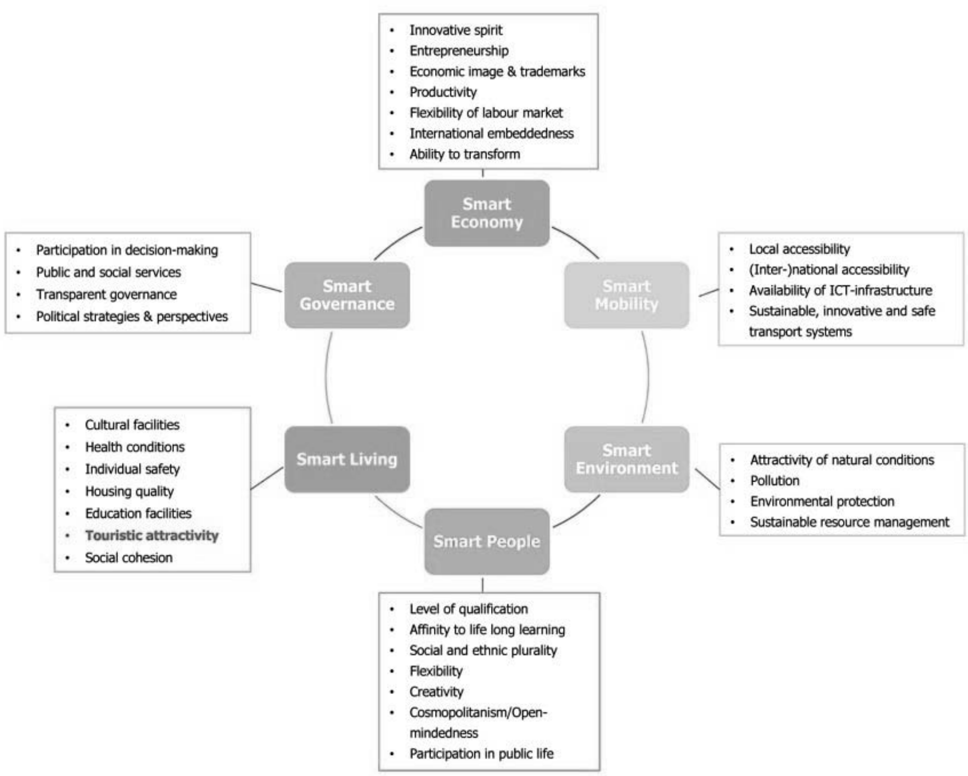


**Fig. 3: Factors and indicators of the Smart City Index elaborated by Wien University: touristic attractivity is one of the factors of the "smart living"**

*The Smart City Index* (fig.3), for example, promoted by the Wien University of Technology, University of Ljubljana and Delft University of Technology evaluates a sample of seventy European medium-sized cities characterized by: urban population between 100.000 e 500.000 inhabitants, presence of almost one university seat; catchment area less than 1.500,000 inhabitants (to exclude cities which are dominated by a bigger city). The ranking is based on the by now well known six dimensions of smart city: smart economy, smart mobility, smart environment, smart people, smart living, smart governance. These six dimensions have been built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens.

*Tourist attractivity* is one of the factors which define the "smart living". In the ranking, this factor characterizes the Austrian cities (Salzburg, Innsbruck, Graz, Linz) and the Belgian ones (Brugge, Gent).

Thus, tourism appears among smart city dimension and it is considered as a factor able to concur to a "smart living". Probably this is because tourism is a real economic resource for many city: it produces income, it generates jobs and skilled labour force, it is often the main element to activate projects of urban requalification, it attracts investments and stimulates local business entrepreneurship, and so on. Briefly there are a lot of positive effects of tourism development from an economic perspective.

At the same time, tourism has also negative impacts on urban life: environmental and noise pollution, over-load capacity, traffic congestion, functional mingling and so on. This dual aspect characterizes the tourist phenomenon and pushes the need to integrate tourism and town planning in order to maximize the positive effects in urban living. At the present, however, there seems to be still a lack of attention especially in town planning sector. In other words only if correctly planned, developed and efficiently managed, tourism can be a catalyst for a vigorous economic development and social progress in city. As shown in the next section, it seems that tourism destinations tend to use "innovation" almost entirely as a vehicle for developing new products or apps even though this is to upgrade the quality of urban services and improve competitiveness between cities. Within this context the concept of "smart city" seems to be reduced. On the contrary, cities have to recognize the changing occurring in tourism demand and set new priority areas for action.

In this sense urban planning research could give a valid contribution in building up tourist smart city where residents needs and tourist demand meet.

## 3 FROM TOURIST CITY TO "SMART DESTINATIONS"

Cities are going to become more and more the place of crucial challenges that human beings will have to face (Vianello 2013). It is in the cities that the most important challenges are played for hitting global targets such as the mitigation of climate change and the improvement of social inclusion (Testa 2012). It is from cities that the -energy, environmental, economic, cultural- crises have arisen and it is again in the cities that the possible solutions are to be found. Cities are both cause and solution of the crisis: they are the cause because they gather consumption and waste of energy and resources, and they are also the solution because they gather the research and experimentation activities.

Also in contrast with the most catastrophic expectations, according which cities would have been a "worthless heritage of the past" (Gilder 2000), cities still go on increasing their inhabitants and users.

The "city appeal" as place where all the opportunities for "being protagonists" is affecting also the choice of tourist destination: therefore cities have become one of the preferred places of the present tourist demand. As regards the peculiarities of the present tourist demand, in fact, the availability of attractions or amenities is not enough, but it is necessary to create an heterogeneous supply (resources, services, attractors, and so on) in order to meet the ever-increasing demand for quality characterizing the present tourist users (La Rocca 2003).

The "tourist product", in fact, consists in a structured system of interacting elements (goods, services, information, attractions, cultural elements, environmental emergencies and so on) that form the "supply system". The peculiarities and qualities of this system affect the choice of a destination and produce a competition among the different tourist destinations (La Rocca 2010).

The strategies for developing and promoting a region in tourist key are based just on the capability of organizing the supply of goods and services (for tourist support) according to a complex system able to improve the overall "tourist experience".

The reference to the city as experiential tourist product refers also to the systemic-dynamic dimension of tourism, mostly investigated by the European and Anglo-Saxon schools of thought.

According to the above said view, city has become one of the most favourite tourist destinations, thanks to the possibility of using, in the same place, a great variety of elements that increase tourist experience, namely, of meeting the emerging tourist demands (Spirou 2011).

The "experiential component" represents one of the latest evolutions within the disciplines which study tourist phenomenon. This component is represented by elements able to enhance the value and to differentiate the supply system, mainly in relation to those elements capable of "making tourist experience unique". Unlike the global tourist product, the "experience product" is not the sum of attractive factors, but the ability to make the holiday unique by producing emotions.

The challenge involving all the present cities that aim at being international tourist cities consists just in the capability of working out supply systems, which are more original than the traditional supply of goods and services.

In the smart city, this condition is strengthened by the attempt to enhance the supply tourism-supporting services through more and more innovative applications, which transform tourists from simple observers to the leading actors of their visiting experience.

The risk of trivialization and homologation is still lurking. Actually, it is possible that by attempting to make tourist supply spectacular, it could end up by standardizing it and by emphasising only some factors that have almost nothing to do with the enhancement of the city and its resources and culture heritage.

Nevertheless, the transition from the "vacation spot to smart destination" (Sanchez Chillon 2012) has already taken place.

There are infinite possibilities of innovative applications (apps) able to support the tourist in the use and knowledge of the city he wants to visit. Indeed, if the definition of smart city seems to be confused, the one regarding the smart destination is still less defined, where the technological factor seems to prevail on all the others.

At present the urban supply for tourists seems to be addressed almost only to enhance the technological applications to improve tourist experience. Many present cities are trying to put themselves as alternative tourist destination also because of the original supply of urban system use. They pass from the construction of dedicated routes "supported" by QR codes capable of recreating movies scenes (New York, London and Paris) to the applications of Augmented Reality allowing either to "travel across time" and to watch the original conditions of a monument or an archaeological site (Rome, Athens) or to recreate the atmosphere that have made some places famous (Paris, London), or to be virtually inside an open air museum (London and Barcelona).

Street Museum, for example, is the Augmented Reality (AR) app of the Museum of London that lay upon the real image some historical pictures of London streets, allowing the visitor to "live" some decisive moments of the city history, such as the Great Fire of 1666.

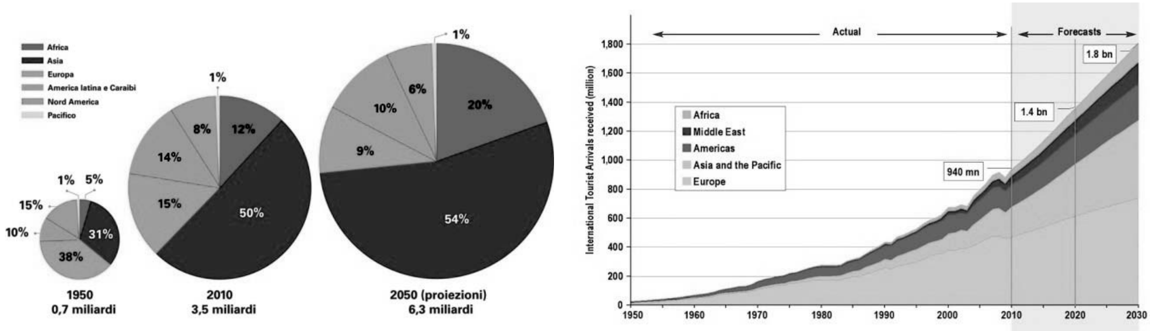


Fig. 4: The increasing urban population trend (left) and the tourism forecast 1950-2030 (right) by UNICEF and UNWTO

As previously said, the applications can be unlimited and they are undoubtedly changing the way of interpreting the supply of tourist-supporting services affecting also the ways in which visitors use cities.

The interest shown by market operators is extremely strong also due to the fact that market analyses allow to set up marketing strategies targeted to catch the user preferences and needs (fig 5).

On this subject there are many scientific studies that point out the interactions between intelligent systems and tourism (for instance the Laboratory for Intelligent Systems in Tourism – LIST University of Wollongong, Australia). In a recent study (Heather Kennedy-Eden and Ulrike Gretzel 2012), a taxonomy of mobile application in tourism has been proposed referring on one hand to service provided, on the other hand, to the level of user customization.

The study considers apps available prior to July 2011. By using a phonetic approach for building the taxonomy of service provided, seven categories of travel-related apps emerged: Navigation, Social, Mobile Marketing, Security/Emergency, Transactional, Entertainment, and Information. Each category is then subdivided into sub-categories made different according to the service provided by the app (fig. 6). Although being not exhaustive and susceptible to further improvements, this taxonomy allows to look at the way in which the tourist-supporting services are changing and how this element of the supply system strongly affects the visitor's choices. On the other hand the possibility of "making virtual" the tourist phase of travel planning is not new. The use and spreading of the internet, mainly during the Nineties, have greatly changed the development of the pre-travel steps (Maguer 2011). The immediate effect on tourist system has been the drastic change of all the market segment devoted to intermediation. Travel agencies, for example, had to transform their structure and are probably destined to play a marginal role in the future arrangement of tourist sector.

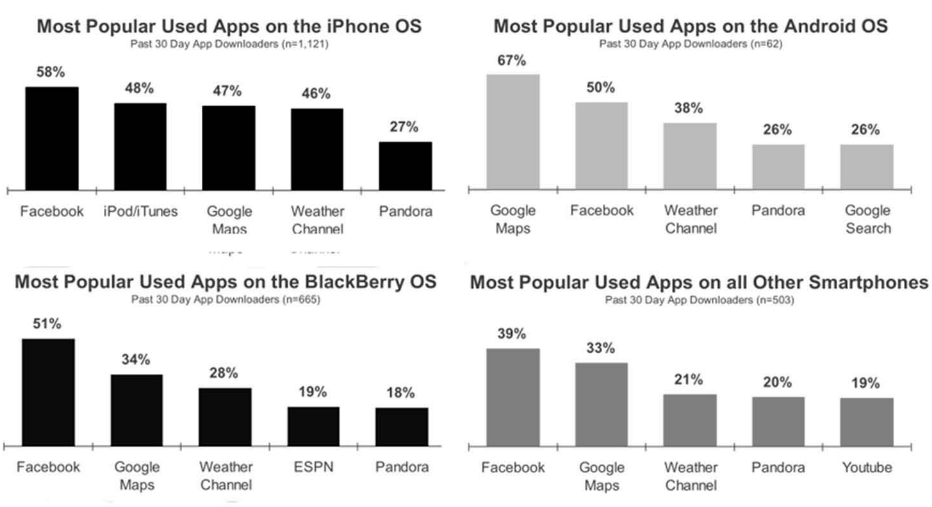


Fig. 5: Utilization rate of the most popular apps for smart phone

At the same time, tourist business had to change their promotion strategies in order to reach the ever-increasing demand segments. The cities aiming to become tourist destinations have been forced to join the network in order to become attractive and offer a charming representation of their resources in view of attracting tourist flows and competing on international level.

The e-tourism[1] phenomenon derives from the possibility of using a "virtual" dimension of a given region or a city before moving to it, which also characterizes the development of tourist activity.

The introduction of mobile technologies has indeed changed this condition too. In effect it is possible to use "virtually" the object of the tourist desire (a destination or a specific site) although being physically present in the desired place. The applications of the augmented reality consist just in the possibility of projecting oneself into a virtual dimension by pointing one's smartphone to the object "to discover" or to get information about what to visit, where to eat or to catch a bus and so on (fig. 7).

The internet connection does not require a physical place, but it can take place everywhere thanks to small devices available in every city (the wi-fi networks for example)

It is the transposition from *e-tourism* to *m-tourism*, a dimension where tourist becomes "mobile user", namely he can be continually connected with any place and/or any community to exchange data and opinions in real time, participating actively in the choice of one destination instead of another.

It is approximately the mechanism of social networks, of tourism 2.0 based on the culture of sharing and participation (web 2.0). This sharing takes place in real time, during the travel experience and has radically changed the role of the tourist: from "consumer" to ""evaluator". According to this view, the tourist's role entails greater responsibility and it is just starting from this condition that the supply system, by the side of private and public operators, is changing its ways of spreading in order to retain more aware, careful and ever-connected customers.

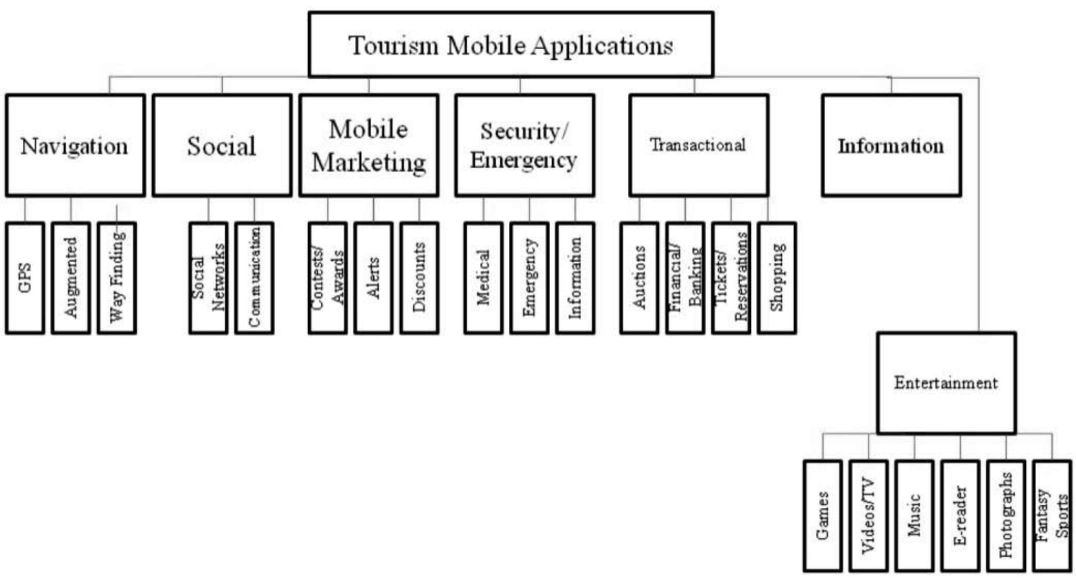


**Fig. 6: Taxonomy of tourism mobile application by service provided elaborated by Kennedy-Eden and Ulrike Gretzel**

[1] Born in the Ninety, the European project MOSAIC (Museums over States and Virtual Culture) within the programme TEN TELECOM of 1997 was targeted to realize the first network of virtual museums. The basic idea of the project consisted in making available, by using new technologies, also those parts of cultural heritage contained in few European museums not open to public.

In a short period of time, tourist demand has further increased: e-tourism has become "digital tourism[2]" (SO-LO-MO social local mobile). A typology of tourist that apart from planning holiday with remote assistance (network) shares and communicates them (SOCIAL) through several applications, which strengthen his role of decision-maker-actor (tripadvisor, zoover, hotpot, etc.), allowing him to appreciate the possibilities of using the place he stays in (geo- LOCAL) by means of mobile technology tools (smartphone, tablet, ecc.) which are going to become more and more unavoidable (MOBILE).

## 4 TOURISM AS PERSPECTIVE FOR FURTHER REFLECTION ON SMART CITY PLANNING REASEARCH

Tourism is one of the fields where the real achievement of the possibilities given by the paradigm of smart cities can compete. The competition among cities has to compare also with the ability of each city to attract tourist flows and investments in order to improve the supply system by exploiting new technologies.

What arises from the present scenario –characterized by radical changes both in the supply system and in the tourist demand one– is a substantial imbalance of the innovative element of the product (the apps) in improving the travel experience element. On the contrary there is a less clear and scarcely investigation of the factor regarding the possible applications of ITCs in the management and reduction of the impacts inevitably produced by tourist activity in the urban planning field.

The urban tourist dimension seems to be still considered as "other", namely not integrated in the organization of the city. Nevertheless "tourism and culture" are considered as one of the emerging dimensions of the smart city, apart from representing one of the research subjects promoted in Italy by the MIUR (Ministry of Education) to show the projects for Smart City and Communities (smart culture and tourism): "*A smart city promotes its tourist representation as an intelligent presence on the web; makes its cultural heritage and its traditions virtual and put them on the internet as "common goods" for its citizens and visitors; uses advanced techniques to create thematic routes and maps of the city and to make them be user friendly; promotes a coordinated and intelligent supply of its tourist supply on the Internet; gives tourists an easy access to the networks and online services according to their requirements".*

A strategy that is still targeted to enhance services supply for the use of a city, or rather the component of the supply system able to affect the attractive power of a territory, and then still linked to the research of elements and conditions that make a city more competitive, although the reference to the concept of "common good".


**Fig. 7: Augmented reality apps allow to interact with the object of the visit**

[2] Digital Tourism is defined as the digital support of the tourist experience before, during and after their tourist activity. http://sachi.cs.st-andrews.ac.uk/research/areas/digital-tourism/

In the strategic plan for tourist development "Italy 2020" worked out in January 2013 (fig. 8) among the primary actions there are the indications regarding the improvement of tourist flows distribution with priority to the "top cities" (Rome, Venice, Florence and Milan), in order to reduce the risk of saturation caused by the high tourist concentration in those cities (Action 26).

Nevertheless the interventions are based only on setting up measures for the selective reduction of the incoming flows in specific places (for ex. Entrance ticket) or for the best schedule of the events which mostly attract flows of visitors. While just a hint is given to the possibility of making tourist flows more sustainable for the functioning and organization of the city.

In this direction, the research of possible solutions seems to have still more chances of development, which should not be undervalued, since they allow to investigate aspects considered as marginal up to now in the field of urban disciplines.

The need for changing urban services supply, according to the emerging requirements expressed by an increasingly expert and qualified tourist demand, will inevitably ask for reconsidering the role of some urban functions modifying also the physical elements and the relationship with the urban context.

Railway stations, airports and ferry terminals, for example, represent the "new gates" to enter the city and are places meant to receive tourist flows and then to allocate them over the territory.

| ***Guidelines of the strategic plan*** | ***Targets-Actions in the sector*** |
|---|---|
| **Governance** | Enhancement of the central support and coordination |
| **Relaunch of the tourism national agency** | New project and reorganization of the mission |
| **Supply enhancement** | Definition of priority poles (30-40) |
| **Improvement of accommodation capacity** | Supply requalification and improvement |
| **Transport and Infrastructure** | Development and adaptation to the demand requirements |
| **Training and expertise** | Improvement of the supply quality carried out by the operators in the field |
| **Investments** | Setting up incentives and simplification of the procedures (zero bureaucracy) |

**Fig. 8: The Tourism Development Strategic Plan in Italy points out seventy actions clustered in seven guidelines targeted to recover the market shares of tourist demand**

Moreover in the urban area it could be possible to find some poles of excellence for delivering services to support tourists, which could be considered as "new poles of tourist reception", an advanced version of the tourist office, which will inevitably modify its role and function.

The enhancement of tourist supply represents the main target of the development policies aimed at improving the image of a city and its competitive relaunch, but it cannot be based only on the realization of a supply of advanced services (virtual tourist guides, augmented reality, and so on). On the contrary, it should be the result of an accurate project of new functionalization and organization of urban supply, which should be capable of integrating the several dirextrices of tourist needs (security, mobility, accommodation, and so on).

This consideration, if shared, opens up new perspectives for research and experimentation in which city planning could have a key-role also in proposing an holistic approach to city development towards smart city.

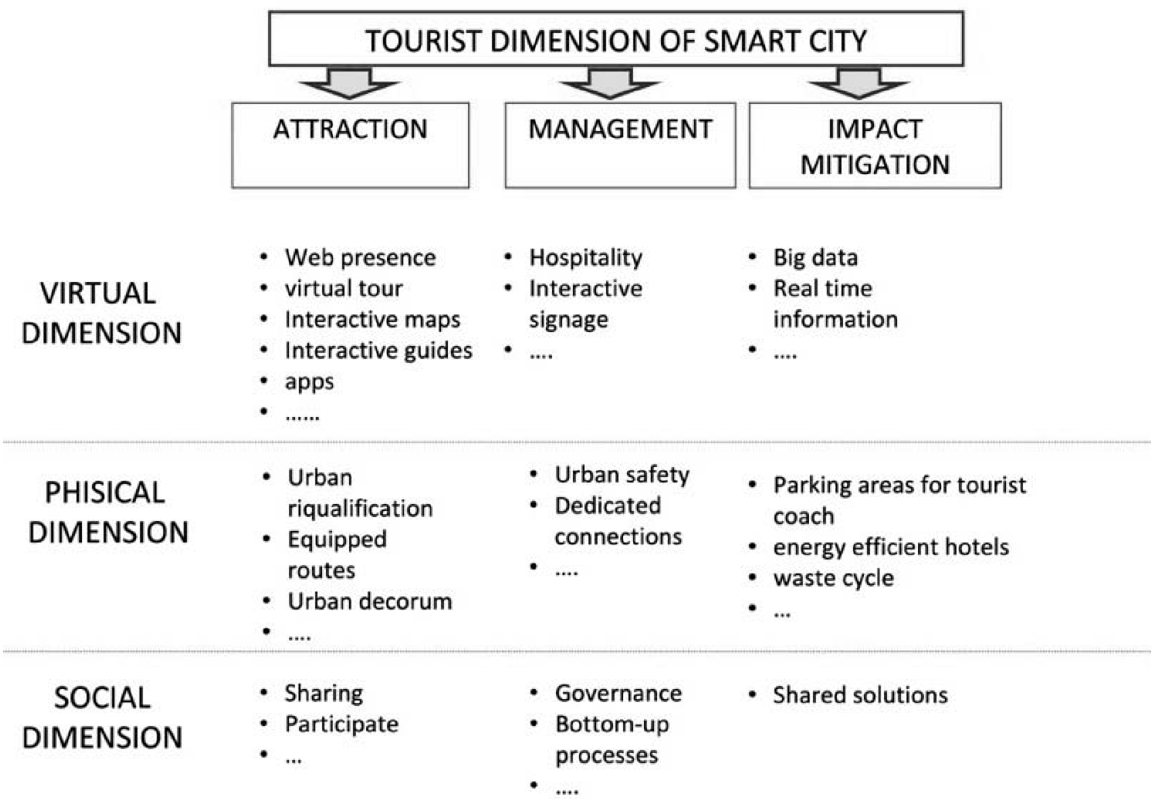


**Fig. 9 : Relations and impacts of tourist dimension on urban organization**

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# SMART CITY EXHIBITION 2014

## BOLOGNA 22 – 23 - 24 OTTOBRE 2014

In un contesto in cui il tema delle Smart City è posto al centro delle politiche europee ed italiane per lo sviluppo economico e sociale – come dimostrano i circa 5 miliardi che affluiranno alle città italiane dalla nuova programmazione europea e attraverso le forme di cofinanziamento nazionale – l'innovazione urbana ha un ruolo centrale: un'opportunità da cogliere e una sfida da non perdere.

SMART City Exhibition, promossa FORUM PA e BolognaFiere, è il luogo dove cogliere al meglio questa occasione. Nel 2013, SCE ha catalizzato l'attenzione di circa 100 investitori, 500 relatori nazionali ed internazionali e 6000 visitatori professionali che hanno partecipato ad incontri formativi ed occasioni di relazione e confronto: convegni, tavoli di lavoro e workshop.

La terza edizione della manifestazione, che si terrà a Bologna dal 22 al 24 ottobre 2014, tratterà i temi chiave per la costruzione delle città del futuro, dal rilancio dell'economia territoriale alla sostenibilità ambientale, dalla mobilità intelligente alle nuove tecnologie per l'analisi la comprensione e la valorizzazione dei flussi informativi, con una particolare attenzione alle persone e al nuovo welfare.

SMART City Exhibition rafforza nel 2014 la sinergia con il contemporaneo SAIE – 50° Salone dell'Innovazione Edilizia – organizzando il Forum comune "Costruiamo le città del futuro": sei grandi eventi nei quali politica, amministrazione, impresa, finanza, ricerca e cittadini si confrontano per la costruzione di uno sviluppo futuro abilitato dalle nuove infrastrutture sia fisiche che informatiche; un futuro contraddistinto dalla necessità di costruire nuovi modelli di comunità attraverso le potenzialità offerte dall'avanzamento tecnologico e dall'evoluzione dei modelli di citizenship.

La manifestazione sarà un'importante occasione per la condivisione, la formazione e il networking.

www.smartcityexhibition.it

TeMA

Journal of
Land Use, Mobility and Environment

TeMA 2 (2013) 215-234
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1457

review paper received 12 March 2012, accepted 10 April 2012

www.tema.unina.it

# INFORMAZIONI DIRETTE ED INDIRETTE

## NELL'ORGANIZZAZIONE DELLO SPAZIO URBANO

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ABSTRACT

The relationship between new technologies and urban space has become, especially with the introduction of the concept of smart city, the key in the definition of management options in the city itself.
The opportunities provided by the use of new technologies to manage the complexity of multiple aspects on the relationship between city and people can address strategies and innovation in order to improve the quality of life of the inhabitants. In smart cities different groups of people with different instances can be directly involved in the transformation process and the planners' choices can be supported by information that once would have required costly research. This possibility is granted by the availability of great quantities of data that can be collected and analyzed. Direct information can be gathered by multiple sensors (accelerometer, a geomagnetic sensor, and proximity sensor, etc.) that offer an immediate evaluation of a specific phenomenon. At the same time other aspects can be evaluated by information obtained in social networks: these can contribute to the definition of urban design as the result of a multi criteria analyses. The way to achieve these strategies is a process of interaction between spatial reality and perceived reality made available by passive forms of participation that can help planners in understanding territorial actors'/territorial users' needs and requirements.
Through this approach, the design and decisions about urban space are not to be indifferent to the needs expressed by various categories of population.

KEYWORDS:
Smart City, Pianificazione urbana, Senseable City

# 1 TECNOLOGIA E SPAZIO URBANO

Il tema del rapporto tra nuove tecnologie e spazio urbano è oggetto di discussione all'interno della comunità scientifica nazionale ed internazionale fin dagli anni novanta[1].

Il dibattito ha riguardato la configurazione dello spazio urbano così da coglierne le potenzialità nel rapporto tra opportunità digitali e realtà spaziale (da intendersi quale riferimento fisico a dinamiche materiali e non), ha cercato di interpretarne la sua evoluzione attraverso descrizioni ed interpretazioni in grado di cogliere, nella loro virtualità, la multidimensionalità delle dinamiche oltre al legame tra aspetti materiali ed immateriali[2], fino a supporre una smaterializzazione della città, sradicandola da qualsiasi luogo fisico e modellandola sulla capacità di connessione e ampiezza della banda[3].

In un caso il dibattito si è concentrato su aspetti progettuali connessi con la rappresentazione tridimensionale e virtuale dello spazio, creando un legame immediato tra la città progettata e la sua percezione, consentendo di percepirne la consistenza e l'organizzazione e di eliminare l'astrazione delle espressioni tecniche del disegno per coinvolgere direttamente il fruitore finale.

L'altro ha focalizzato l'attenzione sull'interpretazione delle dinamiche in atto, cercando degli strumenti di interpretazione della complessità spaziale e del suo continuo divenire, scegliendo di volta in volta punti vista differenti legati alle nuove tecnologie[4].

Tale filone rappresenta ancora oggi una sorta di avanguardia nella ricerca tanto che le innovazioni tecnologiche (come ad esempio la telefonia cellulare, l'utilizzazione dei sistemi GPS – Global Positioning System) vengono utilizzate quale strumento di valutazione delle dinamiche di maggiore attualità[5].

L'ultimo caso è forse quello più utopico perché, in una certa qual maniera, ha spinto a leggere l'innovazione tecnologica, parafrasando il concetto di scienza proposto nella Nuova Atlantide di Bacone, come una sorta di sperimentazione che consente all'uomo di dominare la natura piegandola ai suoi fini.

Questo presupponeva una sorta di sgretolamento della città fisica a favore di quella dei bit, immateriale, attraverso la nascita di un nuovo dialogo architettonico e urbanistico fra la dimensione fisica e quella virtuale della città: nascono le agorà digitali che dovrebbero contribuire alla ricostruzione del capitale sociale della città. Alla base di queste elaborazioni è possibile da un lato ravvisare la necessità di spiegare alcune delle dinamiche in atto attraverso il riconoscimento del legame tra trasformazioni territoriali e dinamiche immateriali, dall'altro è ipotizzabile una relazione tra la necessità di contrapporsi alla spinta prorompente della frammentazione e della disomogeneità, la quale caratterizza sia il mutamento delle strutture sociali e degli stili di vita che la trasformazione dei modelli insediativi e degli spazi urbani.

Oggi il fenomeno delle smart cities, come allora poteva essere quello della città cablata, delle innovazioni nelle telecomunicazioni e nell'informatica, può essere inteso legato solamente all'esigenza di impostare politiche lungimiranti per lo sviluppo sostenibile della città attraverso scelte che si rivolgono all'innovazione tecnologica, al corretto uso delle risorse, al risparmio energetico, alla partecipazione nelle scelte di governance ed all'utilizzazione delle Information Communication Technologies (ICT), riducendone quindi il significato intrinseco ad una dotazione di infrastrutture innovative a supporto della qualificazione dello spazio urbano.

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2 S. Sassen (2008), *Una sociologia della globalizzazione*, Einaudi, Torino.

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4 Si veda ad esempio AA.VV. (1992), *Telecomunicazioni e territorio: l'area centrale veneta*, Cleup, Padova, dove si è stato analizzato proprio il legame tra innovazioni tecnologiche e organizzazione territoriale.

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Può sembrare altresì che esso sottenda una vera e propria concezione antropologica volta a favorire un legame di interdipendenza tra l'uomo, lo spazio urbano e la macchina/il software.

In questo caso, come osservato da Rem Koolhaas rispetto al fenomeno della sostituzione opportunistica della città in favore della Bigness[6], la forma simbolica e autoconclusa dello spazio multiconnesso virtuale viene quasi a contrapporsi alle potenzialità relazionali dello spazio urbano, serializzando ed esaurendo all'interno del proprio meccanismo la complessità e l'imprevedibilità delle molteplici funzioni da esso un tempo esercitate.

Attraverso la smart city si realizza quindi una sorta di introspezione delle dinamiche urbane che pongono l'accento sul particolare, sul singolo oggetto, sull'individuo, in quanto le relazioni (fisiche), i rapporti (interpersonali) e gli spazi comuni assumono una dimensione non più solamente fisica, ma anche virtuale, effimera e dilatata. In tal senso la smart city è il frutto congiunto della tecnologia (hardware e software), della popolazione (in termini di coinvolgimento diretto e facilitato della stessa nelle questioni urbane) e di chi è chiamato a realizzare lo spazio urbano (ovvero le istituzioni che operano nella governance e nelle policies).

Alla luce di quanto esposto, al di là dell'aspetto squisitamente tecnologico che sempre più viene sottolineato in relazione al concetto di smart city, la città intelligente è il luogo dove tutti i processi relativi al vivere sociale possono essere raccolti ed analizzati attraverso l'innovazione tecnologica al fine di poter giungere ad un avanzamento complessivo in termini di capitale sociale.

La convinzione dunque è che la tecnologia sia uno strumento per facilitare il raggiungimento della qualità (intesa come prestazionalità, durabilità, coerenza, sostenibilità, ecc.) attraverso meccanismi di mutuo apprendimento, ossia attraverso un percorso che alle tensioni ed istanze spaziali e sociali presentate dal luogo dia vita a innovazioni urbane chiaramente percepibili e funzionali.

Come è possibile perciò coniugare comfort urbano e nuove forme di socialità con una maggiore qualità dello spazio urbano così da riuscire a rispondere sia alle esigenze formali della pianificazione che alla funzionalità delle relazioni?

Come è possibile utilizzare le tecnologie ed i principi delle smart cities per perseguire una progettualità dello spazio pubblico?

Come sfruttare l'integrazione, l'interfaccia, il dialogo, la condivisione di informazioni affinché si mettano in rete sensori, dispositivi, uomo e spazio pubblico?

Sicuramente il vantaggio di una smart city risiede nella possibilità di creare una visione olistica dei processi di uso del territorio, ovvero di spiegare le relazioni funzionali tra gli elementi che lo caratterizzano e quindi di agire attraverso scelte coerenti e complessive.

Allo stesso tempo, proprio in funzione della molteplicità delle relazioni offerta dalla smaterializzazione/virtualizzazione dei legami, è necessario comprendere e conservare la centralità del rapporto uomo – città, ovvero tutelare il modo di vivere e muoversi all'interno della città attraverso la comprensione delle visioni di chi ne vive gli spazi, sia esso visitatore occasionale o fruitore abituale.

La smart city attraverso la sua capacità di raccogliere informazioni diventa l'organismo in grado di coniugare le domande funzionali, i requisiti, i bisogni, gli standard prestazionali, i fatti, gli obiettivi ed i vincoli in un sistema ampio di elementi che vanno a costituire l'ecologia stessa del sistema: il benessere umano, l'economia, lo stato della tecnologia, il clima politico, senza porre alcun limite agli elementi utili per descrivere le proprietà di un problema (Alexander)[7].

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6 R. Koolhaas, B. Man (1995), *S, M, L, XL*, Monacelli Press New York.
7 C. Alexander (1977), *A Pattern Language: Towns, Buildings, Construction*, Oxford University Press, Oxford.

## 2 INTERAZIONI

Nella *smart city* è perciò possibile raccogliere informazioni, monitorare i fenomeni che in essa si verificano, si generano, evolvono, si spostano e terminano attraverso un sistema di sensori che la rendono un organismo sensibile (Ratti).

Le informazioni potranno essere raccolte attraverso un monitoraggio diretto, ovvero tramite strumenti in grado di raccogliere e descrivere lo stato del sistema urbano in tempo reale. Si tratta della capacità di leggere fenomeni specifici attraverso la raccolta di informazioni su particolari abitudini/consuetudini che possono descrivere implicitamente lo stato di un fenomeno.

Un possibile esempio è il caso del monitoraggio della distribuzione della popolazione e delle relative modalità di movimento all'interno dello spazio urbano attraverso la raccolta delle informazioni relative alle chiamate telefoniche mobili (Sevtsuk e Ratti).

Allo stesso tempo risulterà possibile raccogliere informazioni attraverso l'analisi dei contenuti dei commenti postati nei diversi *social network*, elemento pervasivo di partecipazione diretta supportata dell'utilizzazione della rete. Infatti, sempre di più, il *social network* rappresenta un bagaglio di informazioni che viene utilizzato per comprendere il gradimento di specifici fenomeni, prodotti o altro in quanto offre la possibilità di commentare direttamente, attraverso il tasto "mi piace", ogni evenienza quotidiana.

Allo stesso tempo i commenti postati all'interno dei *social network*, anche se non direttamente riferiti a fenomeni oggetto di studio, possono diventare la spia del gradimento o la richiesta implicita di intervento relativo a temi specifici. A dimostrazione di ciò ci sono le analisi di gradimento svolte durante le ultime campagne elettorali, dagli Stati Uniti all'Italia, che oltre a basarsi sui commenti postati, hanno valutato parametri impliciti quali la ricorrenza di argomenti specifici, delle vignette satiriche, ecc., raccogliendo queste informazioni proprio nei *social network*.

La *smart city* dunque si configura attraverso un processo di interazione tra realtà spaziale (monitoraggio diretto) e realtà percepita (monitoraggio indiretto), ovvero come il punto di incontro tra due dimensioni, sensibilità tecnologica e sensibilità sociale, che generano il cosiddetto *sensore antropico*[8], frutto dell'incontro tra popolazione e tecnologie gestite personalmente (*smartphone*, *tablet*, ecc.) che, dotate di strumenti di posizionamento e di adeguati *software* (applicazioni), possono monitorare specifici caratteri relativi ai luoghi dove si trovano e condividerli in tempo reale (attraverso il *social network*, una sorta di piazza/luogo di incontro virtuale) con gli appartenenti alla comunità, i quali non necessariamente si trovano nello stesso luogo, ma condividono le stesse esigenze o interessi.

Nello specifico l'informazione acquisita potrebbe anche non fornire dettagli riferiti alla gestione / pianificazione dello spazio urbano, ma contenere dati che, opportunamente raccolti ed analizzati, consentono all'istituzione / al pianificatore o progettista di ottenere delle suggestioni circa possibili modalità di intervento in questioni relative proprio allo spazio urbano.

Si è perciò convinti che, grazie all'individuazione di esigenze specifiche che vengono espresse implicitamente per mezzo degli strumenti tecnologici di condivisione, sia possibile dirigere le valutazioni circa l'uso dello spazio urbano verso quegli elementi che costituiscono un'estrinsecazione ed un potenziamento dei percorsi di pianificazione urbana centrata sulla persona.

## 3 SPORT APP E GESTIONE DELLO SPAZIO URBANO

Quanto in premessa è stato il punto di partenza per svolgere una semplice valutazione circa le esigenze di chi affronta attività sportive all'interno dello spazio urbano e non in strutture appositamente destinate.

[8] Cfr.: Fistola R. (2013), Smart city. Riflessioni sull'intelligenza urbana, TeMA – Journal of Land Use, Mobility and Environment, 1/2013, pp. 47-60.

L'idea è partita dal rapporto dell'ISTAT[9] sulle abitudini degli italiani circa l'attività sportiva, da cui emerge che la pratica sportiva agonistica tradizionale (ossia quella legata ai modelli culturali degli sport olimpici) è in una situazione che potremmo definire di stallo, se non di aperta flessione, mentre è sicuramente in aumento la pratica sportiva intesa come *loisir*, come ricerca del benessere fisico, cura del proprio corpo, come rapporto immediato con la natura. Tali dati sono stati ulteriormente specificati in altri studi[10] e hanno mostrato come nel Nord – Est e quindi anche a Padova, esemplificazione di questo contributo, le persone che praticano un'attività sportiva, sia essa saltuaria o continuativa, raggiungono una punta a livello nazionale del 36,5%. Altro dato interessante mostra che il 43,3% di chi svolge attività sportiva lo fa in spazi aperti. In particolare il 17,2% lo svolge in spazi attrezzati, mentre poco meno del 30% lo svolge in aree non attrezzate. Inoltre di questi l'8,9% pratica attività quali corsa, *jogging* e *footing* ed il 7,6% il ciclismo, con un'incidenza complessiva sul totale del 16,5 %.

Si è poi osservata la proliferazione di applicazioni per il cellulare che consentono di monitorare la propria attività sportiva raccogliendo informazioni che riguardano il percorso affrontato, la sua caratterizzazione altimetrica, il tempo impiegato, la velocità mantenuta, la frequenza dell'attività, l'orario di svolgimento dell'attività, oltre a consentire di caricare delle immagini dei luoghi frequentati. Attorno a queste applicazioni sono stati creati dei veri e propri *social network,* dove le informazioni vengono caricate e condivise con gli altri appartenenti alla *community* con la finalità di confrontare le proprie esperienze.Tramite dunque la raccolta dei dati provenienti da queste *community* ed associandoli alla valutazione delle caratteristiche dei luoghi è possibile svolgere tutta una serie di considerazioni che riguardano la correlazione tra modi d'uso dello spazio urbano da parte dell'uomo e destinazioni/caratteristiche dell'area in chiave progettuale.

La procedura utilizzata ha riguardato la raccolta delle informazioni circa i percorsi di allenamento utilizzati per le sole attività di corsa, *jogging* e *footing*, in quanto, pur essendo evidente in alcuni casi la sovrapposizione con percorsi ciclistici, questi ultimi molto spesso assumono una dimensione di tipo sovra-urbano, che nel caso in oggetto potrebbero addirittura definirsi metropolitani[11].

I dati sono stati mappati associando ad ogni segmento del percorso le sue caratteristiche specifiche in relazione alla fruizione sportiva. Nella fattispecie si sono valutati parametri quali sicurezza e protezione degli utenti (ovvero se il percorso si svolge in sede propria, pista o marciapiede, o in sede promiscua, ossia in commistione con il traffico veicolare), quelli riferiti alle caratteristiche del terreno (asfalto, *macadam*, manto erboso, ecc.) e la presenza di eventuali servizi (fontanelle, stazioni per percorso vita, ecc.).

Rispetto ai punti di arrivo e partenza è stato possibile valutare se l'area necessiti o meno di punti di sosta (parcheggi auto o bici) o di servizi (chioschi) in quanto la presenza di queste caratteristiche è elemento di attrazione per lo svolgimento di queste attività.

Altro dato rilevante nello studio è stata l'osservazione della lunghezza del percorso ed il tempo destinato all'attività fisica. Tramite tali informazioni è possibile definire una sorta di profilo medio dell'utente e cercare di comprendere il rapporto esistente tra localizzazione del percorso e tipologia di accessibilità allo stesso (posso raggiungere l'area di allenamento a piedi o in bicicletta o devo utilizzare l'automobile?).

Circa la validità dei dati raccolti essa è garantita dal fatto che sono stati ottenuti tramite tracciamento con strumenti GPS e ad essi è stato associato un rilievo diretto delle caratteristiche sopra riportate, ripetibile ed aggiornabile al fine di ottenere anche una variazione temporale delle caratteristiche del suolo.

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[9] Istituto Nazionale di Statistica – ISTAT, Lo sport che cambia. I comportamenti emergenti e le nuove tendenze nella pratica sportiva in Italia, 2005

[10] Istituto Nazionale di Statistica – ISTAT (2010), I cittadini e il tempo libero.

[11] P. Boschetto, A. Schiavon (2011), *L'immagine del territorio metropolitano. La città metropolitana di Padova*, Cleup, Padova.

Il periodo di rilevamento è stato di tre mesi (maggio – luglio) e coincide con la maggior diffusione delle attività sportive all'aperto, con il maggior numero di allenamenti caricati nella community e con la maggior frequenza di attività sportiva svolta all'interno del mese. Sono stati quindi individuati 20 profili di atleta con almeno 10 allenamenti (per un totale di 300 percorsi) all'interno del territorio del Comune di Padova e con questi dati è stato costruito un database che raccogliesse le informazioni necessarie per comprendere le dinamiche d'uso dello spazio urbano e gli elementi utili alla qualificazione dei percorsi in relazione alla persona. Il rilevamento sembra essere limitato in termini di profili di utilizzatori (20), ma è stato ritenuto importante selezionare quei profili che indicassero una continuità nella pratica sportiva all'interno del territorio per comprendere al meglio le abitudini e le relazioni tra il percorso scelto e la modalità di accesso allo stesso.

Infatti valutare attività non sistematiche avrebbe inserito dei dubbi circa le motivazioni nella scelta di quel percorso, risolvibili solo associando alla raccolta dei dati forniti dallo strumento tecnologico le risposte ad un questionario compilato da parte di ogni atleta. Inoltre si è scelto di utilizzare i dati raccolti da un'unica applicazione per cellulare, che è risultata essere molto diffusa a livello nazionale in quanto disponibile per ciascuno dei sistemi operativi degli *smartphones* in commercio.

Non si è infine valutato l'aspetto relativo al sesso in quanto ritenuto ininfluente per la tipologia di valutazioni che si sono sviluppate. L'analisi dei dati raccolti ha consentito di svolgere le seguenti valutazioni:

– Tipologia del percorso svolto (tavole 1, 1/A ed 8). La distinzione è stata articolata in: percorso circolare, che ha messo in evidenza se il punto di partenza è relativo ad esempio ad un luogo di lavoro/residenza; percorso d'area, che fa riferimento ad un percorso che inizia e finisce in un parcheggio ovvero nei casi in cui ci siano molteplici percorsi che iniziano e finiscono in quel punto.
– Densità dei passaggi per singolo percorso (tavola 2). Misura il numero di volte che un determinato tratto di territorio viene percorso da diversi atleti per svolgere l'allenamento. Tale densità aumenta generalmente laddove ci sono aree che mostrano requisiti di sicurezza per il transito pedonale, dotazione di servizi e, molto probabilmente, anche attrazione sociale in quanto l'approccio del social network tende proprio ad enfatizzare quelle aree considerate qualitativamente migliori per l'attività specifica. In particolare risulta evidente come i percorsi maggiormente utilizzati sono posizionati lungo le aree verdi che lambiscono le vie d'acqua cittadine attorno alle mura.
– Tipologia del terreno (tavole 3, 4 e 5). Il suolo ideale per l'attività sportiva sicuramente è la terra battuta o lo sterrato, superfici generalmente difficili da trovare in ambito urbano e che quindi necessitano di essere realizzate ad hoc. Tali superfici sicuramente garantiscono una minore sollecitazione dei legamenti, che è una condizione ottimale per l'allenamento soprattutto degli amatori. Inoltre, qualora il percorso presenti una pavimentazione di tipo permeabile, essa è generalmente stata realizzata in aree con elevati livelli di naturalità (argini nel caso di studio, ma potrebbero essere anche parchi) che offrono all'atleta una percezione migliore rispetto alla corsa lungo le arterie di comunicazione o in quartieri residenziali marginali. Diversa, molto probabilmente, risulta essere la possibilità di correre all'interno del centro urbano (percorso di Prato della Valle ad esempio), dove la cornice urbana è fonte di emozione.
– Rapporto con la struttura urbana. Le osservazioni riguardano principalmente la valutazione della qualità del disegno urbano in relazione allo svolgimento dell'attività sportiva e della dotazione di servizi. I servizi considerati potranno essere di tipo diretto, qualora espressamente realizzati per lo svolgimento dell'attività sportiva (le stazioni dei percorsi vita o le fontanelle ad esempio), od indiretti, se utilizzabili anche per attività non connesse con la sola pratica sportiva (ad esempio i parcheggi o la presenza di chioschi e punti di ristoro). Inoltre è stato possibile svolgere alcune osservazioni circa il rapporto tra la localizzazione del percorso e la destinazione d'uso da Piano Regolatore Generale.

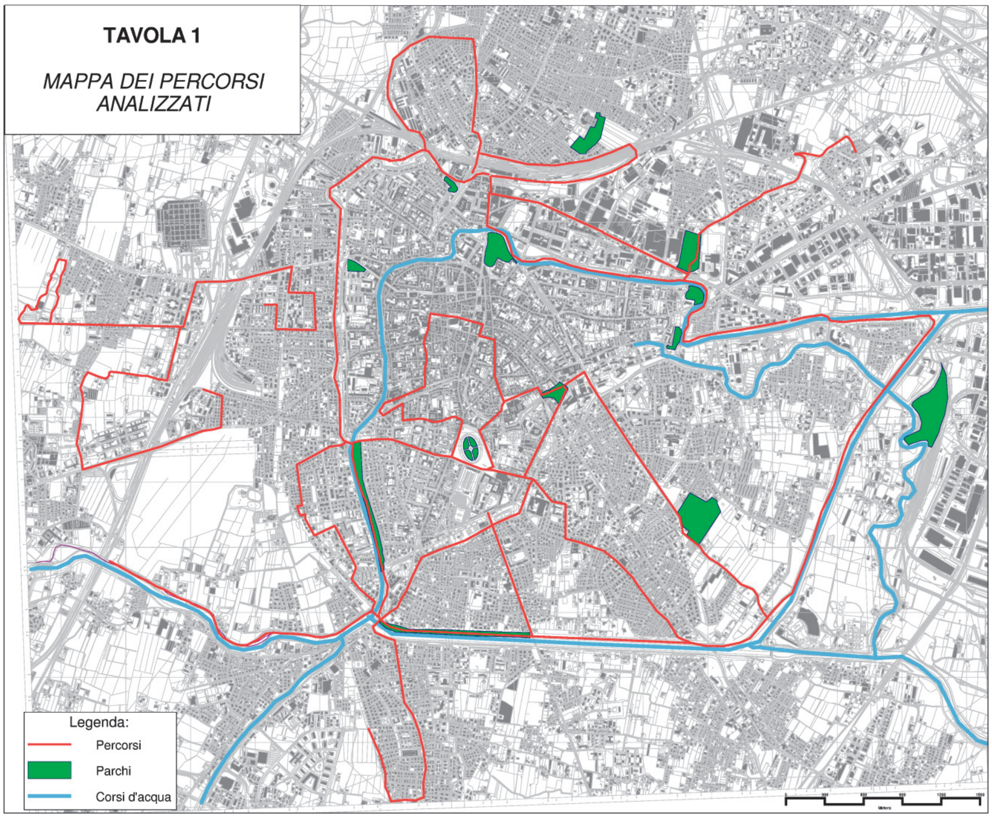


**Fig. 1: Tavola 1 - Rappresentazione grafica dei percorsi analizzati e delle invarianti**

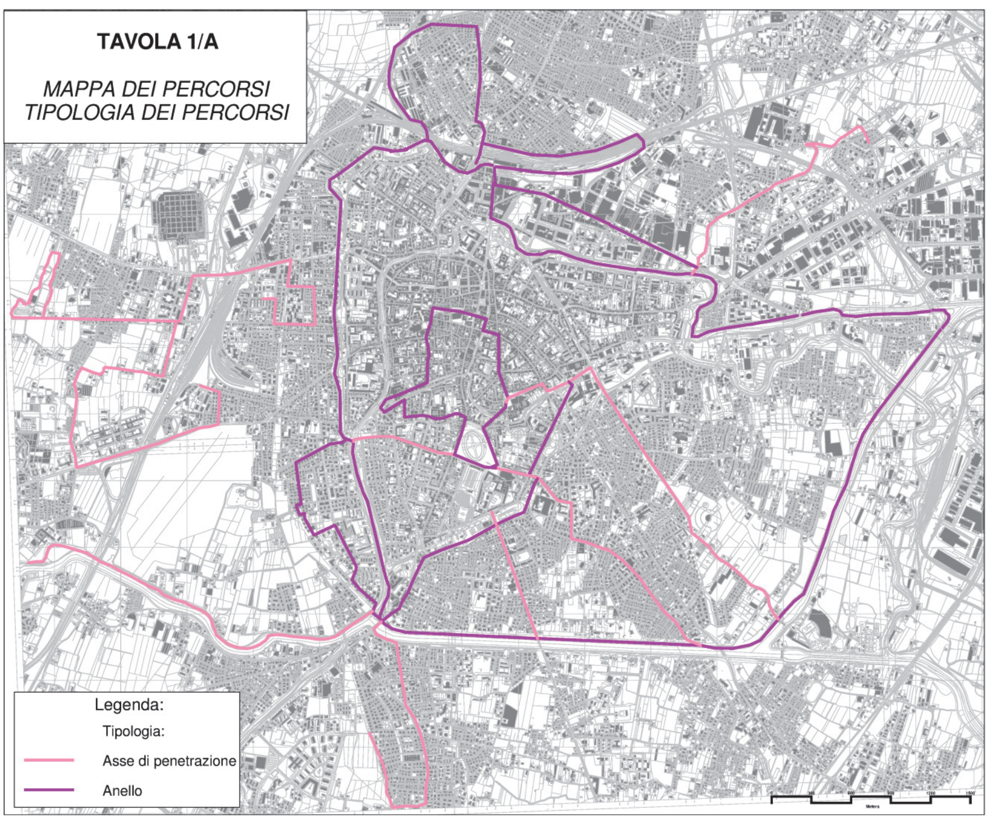


**Fig. 2: Tavola 1/A - Rappresentazione grafica delle tipologie dei percorsi analizzati**

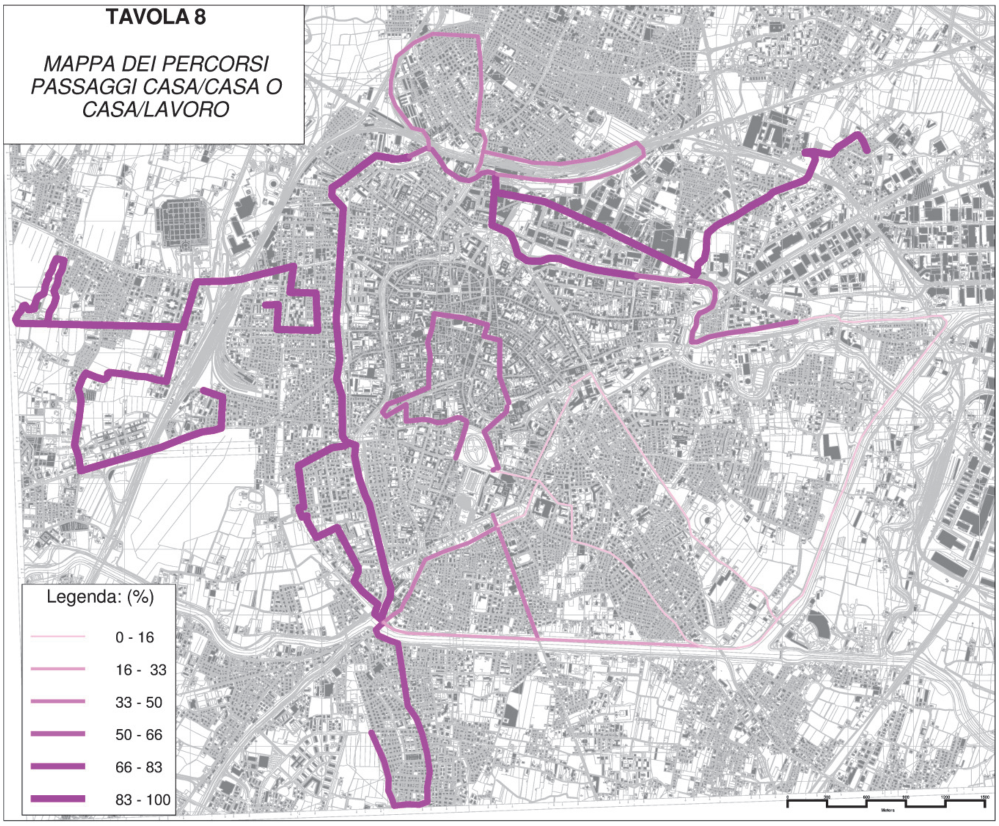


Fig. 3: Tavola 8 - Rappresentazione grafica dei passaggi di tipo casa/casa o casa/lavoro. Valori in % sul numero totale di passaggi analizzati per singolo segmento di percorso

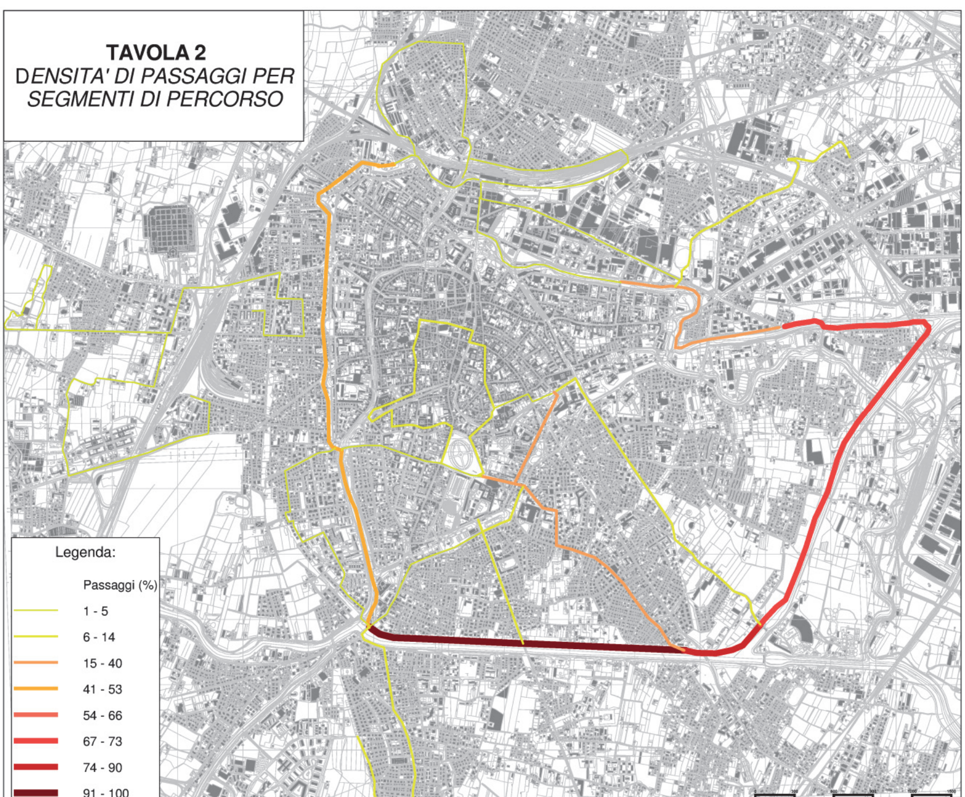


Fig. 4: Tavola 2 - Rappresentazione grafica della densità di passaggi per un certo segmento di percorso. Valori in % sul totale dei passaggi analizzati

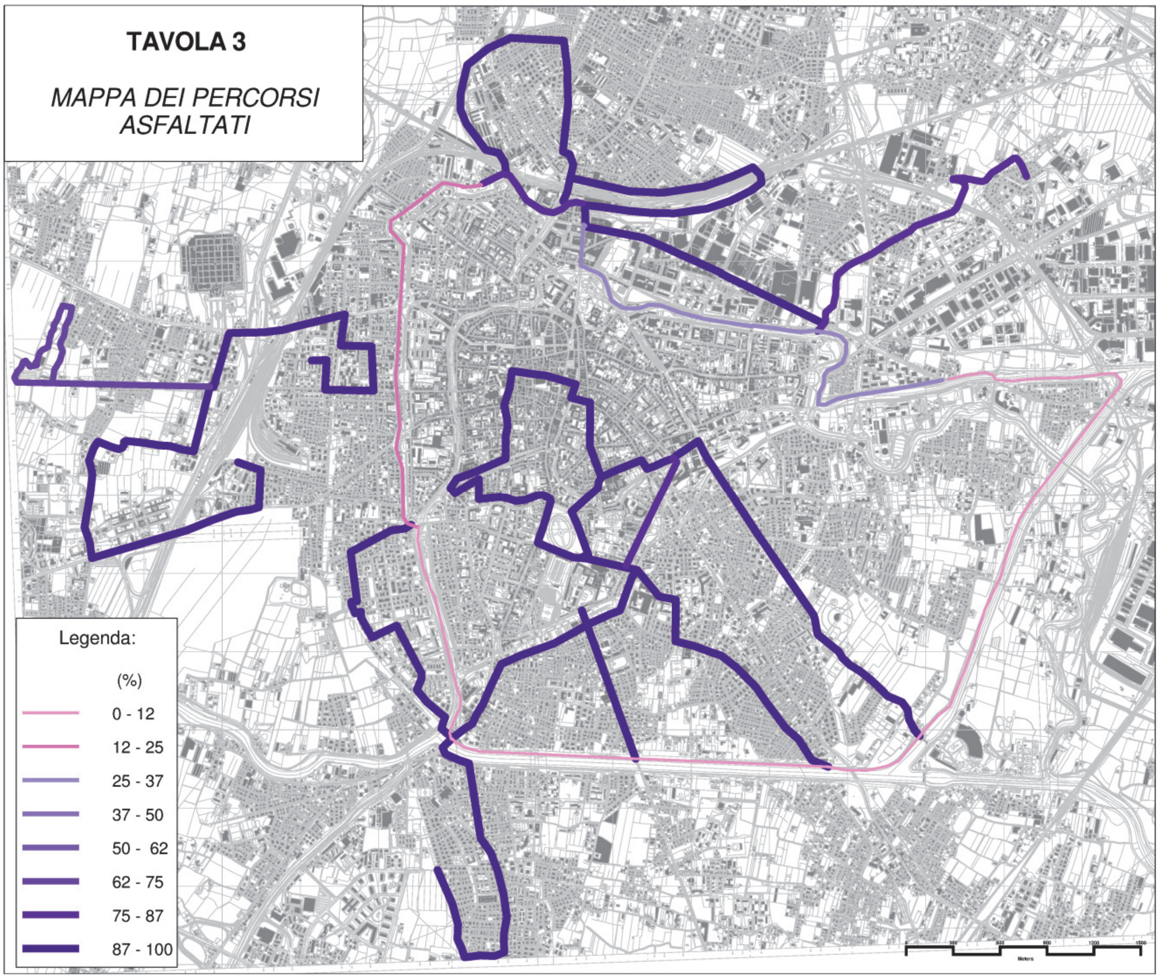


**Fig. 5: Tavola 3 - Rappresentazione grafica della presenza di zone asfaltate all'interno dei percorsi. Valori in % sul totale della superficie del singolo segmento di percorso.**

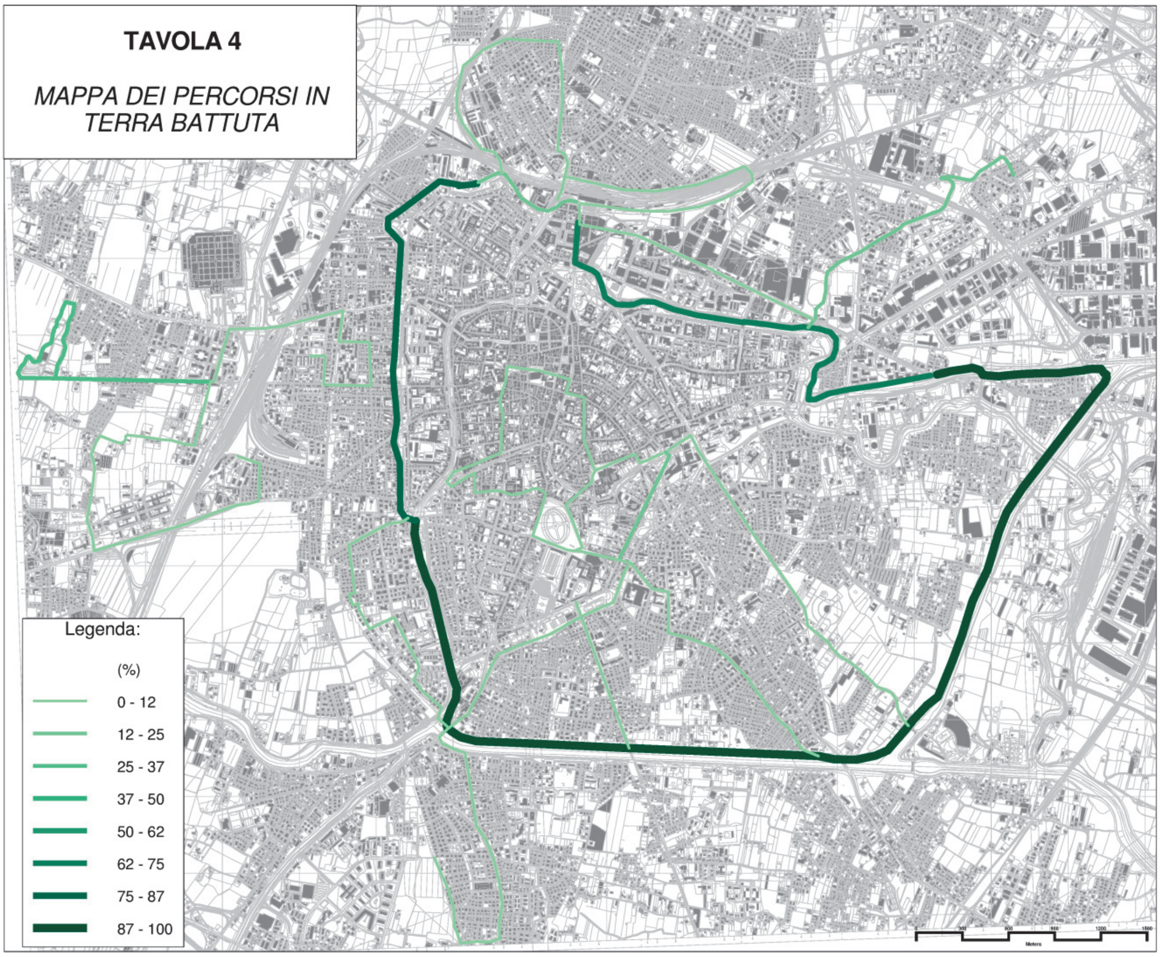


**Fig. 6: Tavola 4. Rappresentazione grafica della presenza di zone con terra battuta all'interno dei percorsi. Valori in % sul totale della superficie del singolo segmento di percorso.**

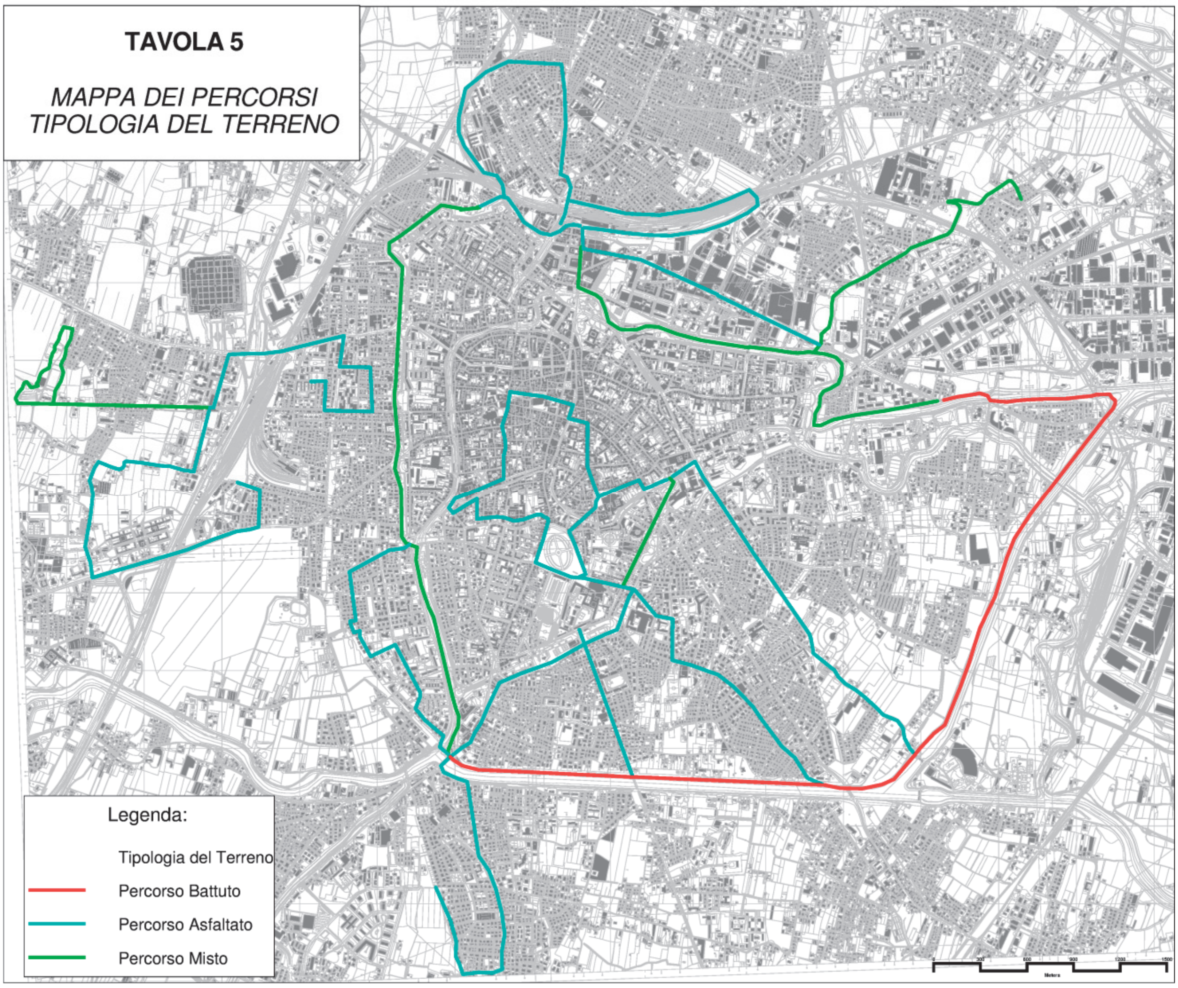


**Fig. 7: Tavola 5 - Rappresentazione grafica delle tipologie di terreno per ogni segmento di percorso analizzato.**

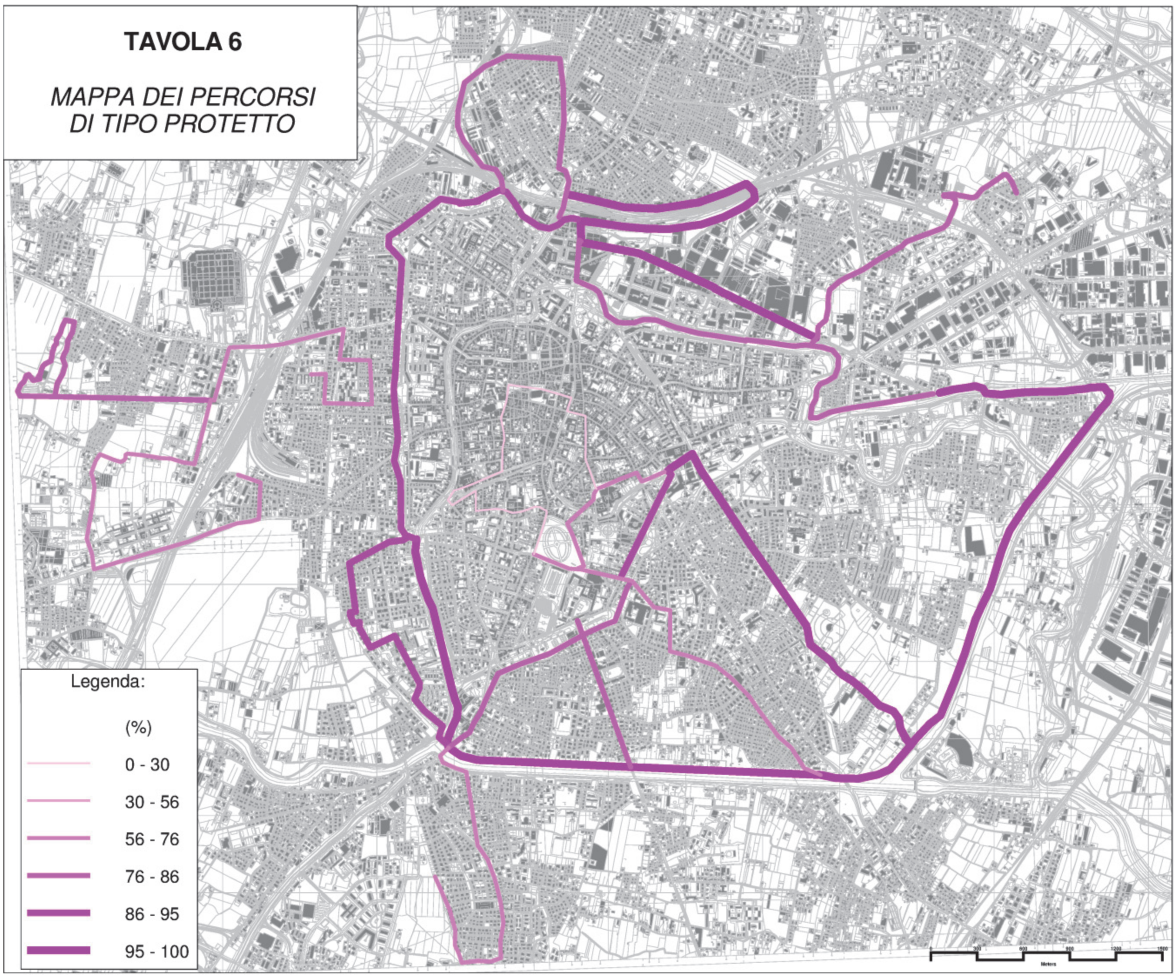


**Fig. 8: Tavola 6. Rappresentazione grafica della presenza di zone di tipo protetto (percorsi in sede propria). Valori in % sul totale della superficie del singolo segmento di percorso.**

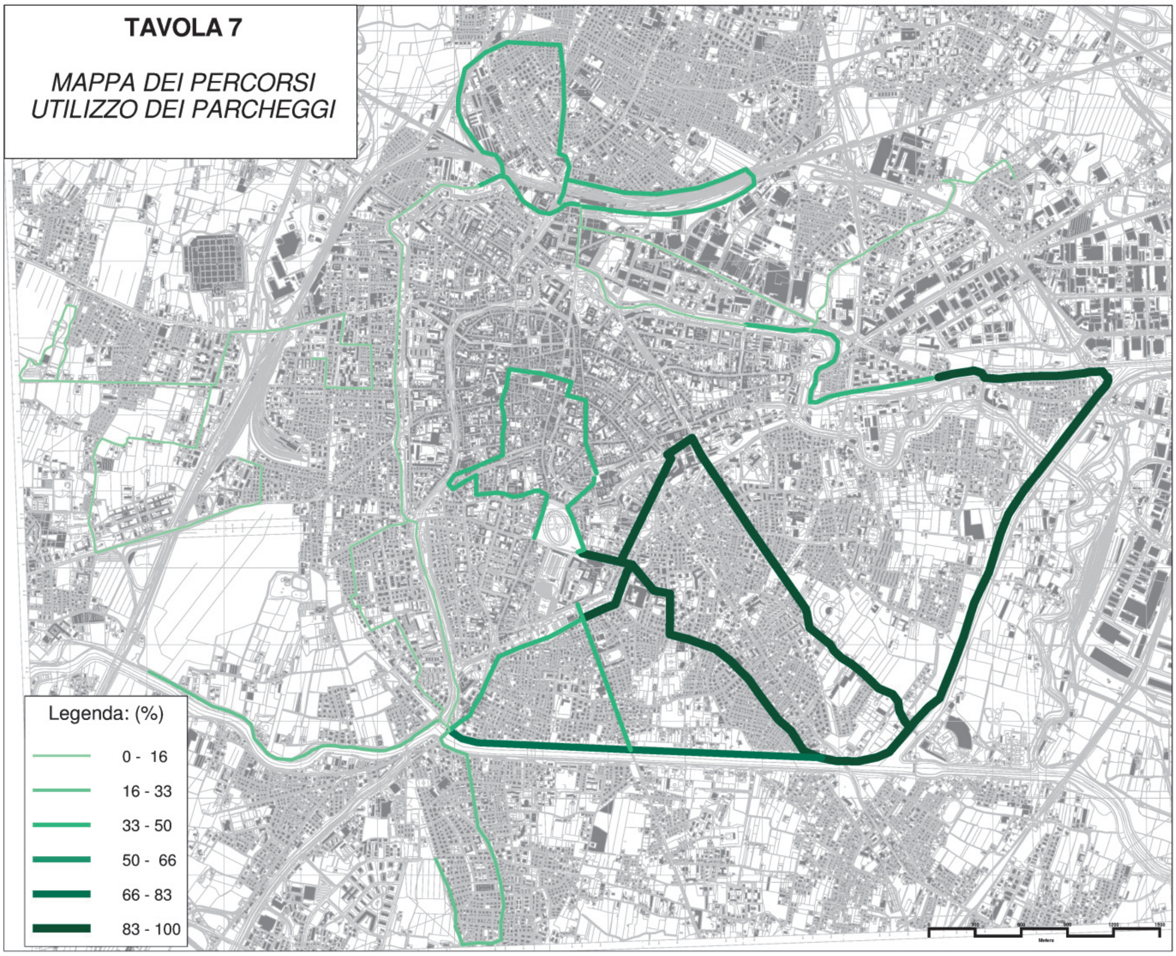


**Fig. 9: Tavola 7- Rappresentazione grafica dell'utilizzo di parcheggi di sosta da parte degli utenti. Valori in % sul numero totale di passaggi analizzati per singolo segmento di percorso.**

## 4 LA CITTÀ: I RISULTATI DELLE ANALISI

I risultati ottenuti dall'analisi delle tavole ci mostrano da un lato che la città è riuscita, attraverso degli interventi mirati, a creare delle aree di *attrazione* per l'attività sportiva realizzando dei percorsi protetti, dotati di servizi diretti ed indiretti, in un ambiente che offre un'alta qualità percettiva dal punto di vista ambientale. In quest'area si riscontra la maggior parte dei passaggi anche per chi, eseguendo un percorso circolare, si trova ad inserire questi ambiti nel proprio allenamento solo in parte.

L'area con più passaggi è il lungo argine del Bassanello e di Terranegra, percorso compreso tra le propaggini meridionali della città ed il fiume Piovego. Quest'ultimo funge da margine verso i quartieri residenziali urbani posti a sud del centro.

Tale percorso è ben strutturato in quanto offre un'oasi verde/parco lineare all'interno della città, facilmente raggiungibile da aree densamente abitate. Il possibile bacino di utenza, calcolato considerando un *buffer* di 800 metri attorno all'asse del percorso, ci mostra delle aree residenziali ad alta densità e altezza contenuta degli edifici che hanno portato a stimare un bacino potenziale di utenza attorno ai 20.000 abitanti.

A questa popolazione insediata, considerato il dato ISTAT12 sul numero di persone che svolge attività fisica all'aperto all'interno dei centri urbani che è pari all'8,6%, corrisponde quindi un bacino reale di utenza pari a 1720 utenti, oltre alle persone che provengono da zone esterne al buffer di analisi, e che raggiungono i luoghi di attvità tramite mezzi di trasporto (pubblici o privati).

Tra i due tratti del percorso arginale quello del Bassanello è più frequentato in quanto compreso tra zone residenziali, mentre il tratto di Terranegra confina da un lato con un quartiere residenziale e dall'altro con la zona industriale (tavola 2).

Ad ovest della città sono stati realizzati altri percorsi protetti, ma con frequentazione più limitata.

Questi valori sono ampiamente giustificabili dal fatto che la zona non presenta lo stesso grado di servizi di quella precedente: mancano i parcheggi, ad esclusione di quelli a raso dislocati lungo la circonvallazione; sono presenti attraversamenti pedonali critici relativi ad assi viari di penetrazione urbana (SS 11 Vicenza – Padova, SS 250 Colli Euganei – Padova, ecc.); i percorsi sono limitrofi alla circonvallazione interna della città tanto che lo spazio dedicato all'attività sportiva è diviso dalla strada solamente da un filare di alberi; infine l'orientamento non è dei migliori (ovest – nord/ovest rispetto a sud/est del lungo argine Bassanello e Terranegra). Sempre tra i percorsi attrezzati, ce ne sono alcuni che dal rilevamento virtuale mostrano un'incidenza di utilizzazione notevolmente inferiore perché si spingono verso quartieri (la Zona Industriale Nord di Padova o l'area del Portello, dove però si concentra buona parte delle facoltà scientifiche) non dotati di servizi (innanzitutto posti gratuiti per la sosta delle automobili) e quindi obbligano l'atleta ad allungare il percorso per riuscire a soddisfare l'esigenza di lasciare l'auto in un posto idoneo e sicuro e lo costringono ad attraversare zone di degrado urbano e sociale per giungere al percorso attrezzato.

Altri elementi interessanti risultano essere dei percorsi *a dente,* che penetrano nel tessuto urbano da sud, generano un flusso pari a 1/3 di quello del lungo argine Bassanello e Terranegra. Di fatto sono percorsi in ambiente protetto e in sede propria, che permettono agli utenti una relazione diretta tra centro città ed aree marginali.

Proprio per la conformazione dei percorsi che tendono a penetrare nelle zone con maggiore densità abitativa della prima periferia cittadina e in taluni casi a giungere fino all'interno della città storica, il bacino potenziale di utilizzatori cresce notevolmente e ne consegue anche in questo caso la creazione di percorsi sportivi ad alta densità.

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[12] Op. Cit.

Tutti i percorsi sopra definiti rientrano essenzialmente nella categoria dei percorsi d'area in quanto iniziano e finiscono per lo più in un punto di interscambio modale.
Si tratta di percorsi che risultano essere appetibili per un mix di utenze: i residenti (che raggiungono l'area a piedi o in bicicletta in quanto prossima alla residenza) e gli utenti esterni (i quali ricercano percorsi protetti e inseriti in un contesto naturale oppure la possibilità di incontrare altri utenti, ma che necessitano di parcheggi dove lasciare l'automobile).
Tali valori consistenti di utenti non vengono raggiunti in altre zone a causa di una molteplicità di fattori, che spaziano da una minore densità di popolazione residente ad una mancanza di servizi diretti ed indiretti all'attività sportiva fino alla scarsa attrattività dell'area, come, ad esempio, nel caso del quartiere Arcella, dove a fronte di una popolazione attorno ai 40.000 abitanti l'incidenza dei percorsi è molto contenuta.
Tra i percorsi circolari ci sono quelli di Prato della Valle e delle Piazze, in pieno centro urbano, in zone a traffico limitato, ma su fondo meno idoneo per la corsa amatoriale, i quali sono frequentati prevalentemente dai residenti e da utenti esterni che sfruttano i parcheggi di Prato della Valle.
Assumono poi rilevanza quelli all'interno del quartiere San Lazzaro (zona residenziale con traffico limitato) e quelli lungo l'arco di Giano, che sfruttano i due nuovi ponti (quello denominato "Ponte Sarpi Dalmazia" ed il "Ponte Verde"), i quali sono attrezzati con spazi protetti ciclo-pedonali.
In entrambi i casi, però, si ravvisano una minore qualità percettiva e difficoltà di movimento legata al fatto che i marciapiedi spesso sono parzialmente occupati da auto in sosta, cassonetti, ecc..
Ulteriore spunto di riflessione riguarda il rapporto tra i percorsi rilevati ed i parchi urbani.
Infatti questi ultimi non vengono mai toccati dai tracciati scelti dagli atleti molto probabilmente in relazione a diverse motivazioni. Innanzitutto si tratta di aree che vengono chiuse all'imbrunire e quindi offrono una fruibilità limitata visto che la maggior parte delle attività viene svolta ad attività lavorativa conclusa; sono poi posizionati in prossimità dei percorsi, ma non li intersecano mai, costringendo eventualmente ad una deviazione per il loro raggiungimento; infine i parchi non sono dotati di elementi di attrazione (chioschi, fontanelle, attrezzi per lo stretching, ecc.) che potrebbero interessare il podista.
Da quanto descritto emerge che la sicurezza nello svolgimento dell'attività sportiva è elemento di forte attrazione e qualificazione del luogo, oltre che principio chiave secondo il quale vengono scelti i percorsi. Questa conclusione, peraltro prevedibile, mostra però come sia necessario molto spesso dover raggiungere le aree in oggetto utilizzando un mezzo di trasporto, l'auto, per la quale raramente sono previsti idonei spazi di sosta tanto che queste vengono *abbandonate* lungo strade secondarie.
La mancanza di una rete sufficientemente capillare di percorsi protetti all'interno dello spazio urbano costringe così il cittadino/atleta ad utilizzare l'automobile anche per svolgere l'attività sportiva, diventando così generatore di traffico e di inquinamento.
Tra gli elementi che è possibile integrare con il sistema dei percorsi ci sono i parchi, che sono una risorsa all'interno della città e potrebbero diventare una sorta di nodo di servizio, restituendoli così alla città attraverso un processo di utilizzazione/salvaguardia.
Attraverso un monitoraggio più lungo che garantisca una casistica più articolata, comprendente sia atleti occasionali che coloro che si trovano in città per turismo o lavoro, ed attraverso un approfondimento sulla lunghezza/tempo di percorrenza, sarà possibile pervenire ad una mappa virtuale per migliorare e definire gli interventi di pianificazione spaziale, dettagliando aspetti quali il rapporto tra localizzazione dei percorsi e densità urbana, destinazioni d'uso, permeabilità dell'insediamento (un reticolo denso di strade disperde il

traffico e rende la mobilità dolce più piacevole oltre a facilitare gli attraversamenti, ma, allo stesso tempo, poche strade consentono di avere percorsi protetti più lunghi), continuità dei percorsi, caratterizzazione degli attraversamenti e degli elementi di separazione e protezione, presenza di nodi di servizio.

Emergono, dalle analisi svolte e dalle osservazioni desunte, due differenti scale nella progettazione dello spazio urbano connesso con l'attività sportiva.

La prima, a livello macro ossia di intero sistema urbano, è rivolta alla realizzazione di una rete di percorsi che, racchiudendo il centro della città all'interno di una sorta di anello verde, si diffonde nei quartieri marginali attraverso delle dita verdi che fungono da veri e propri assi di penetrazione rivolti allo svolgimento di attività sportiva o per la mobilità dolce. Nel caso di Padova l'anello attorno alla città dovrebbe coincidere con il sistema delle mura bastionate che, per la loro conformazione, rappresentano un'occasione di valorizzazione del bene culturale attraverso una sua riscoperta ed utilizzazione.

Il sistema degli assi che si irradiano verso i quartieri potrebbe poi essere sostenuto attraverso la valorizzazione degli argini della fitta rete di corsi d'acqua che caratterizzano il territorio padovano.

Laddove questi non sono presenti, si potrà ricorrere alla progettazione di percorsi pedonali protetti caratterizzati da continuità, intersezione con spazi pubblici con differenti destinazioni d'uso, con attraversamenti delle strade protetti e segnalati dalla presenza di alberature o siepi.

In questa maniera sarebbe possibile perseguire sia una maggiore sostenibilità degli spazi urbani che una loro qualificazione percettiva. A questa scala dovranno riferirsi anche le dotazioni di servizi diretti ed indiretti definiti precedentemente.

La scala territoriale richiede un approccio sostanzialmente indiretto, ovvero mediato completamente dalla tecnologia sia nella mappatura del territorio che nell'individuazione dei percorsi maggiormente significativi e funzionali alle necessità espresse attraverso l'utilizzazione degli spazi da parte della popolazione.

La seconda, a livello di dettaglio, dovrebbe corrispondere alla caratterizzazione dello spazio urbano attraverso i suoi elementi di qualificazione come l'arredo, la sua disposizione all'interno dello spazio urbano, la dotazione di servizi complementari, la valorizzazione degli elementi identificanti il luogo, la corretta scelta delle tipologie arboree in maniera tale da garantire l'ombreggiamento, una facile manutenzione e il miglior assorbimento della $CO_2$.

Questa seconda scala invece dovrà essere affrontata attraverso un approccio indiretto, rivolto ancora una volta alla mappatura del territorio attraverso la raccolta di parametri misurabili univocamente (numero delle alberature, delle panchine, distanza tra i servizi, ecc.) ed uno diretto, partecipato, ovvero l'espressione da parte dell'utente di un giudizio di qualità per ciascuna tipologia di spazio pubblico e per precise variabili qualitative così da consentire la comparazione tra i giudizi. Lo spazio per la partecipazione potrà essere proprio la *community,* che viene a rappresentare una sorta di piazza virtuale oltre che un luogo di aggregazione e scambio di informazioni e suggestioni.

## 5 OSSERVAZIONI CONCLUSIVE

A conclusione dell'esperienza effettuata è possibile svolgere alcune riflessioni circa il ruolo della *smart city* all'interno del futuro delle nostre città.

La prima riguarda innanzitutto il ruolo delle informazioni nella gestione e pianificazione dello spazio urbano. La diffusione della tecnologia consente infatti di raccogliere e valutare una moltitudine di informazioni che possono consentire di individuare *just in time* le migliori scelte/strategie volte alla gestione/trasformazione dello spazio urbano.

Tali informazioni sono fortemente differenziate e supportano direttamente e/o indirettamente la definizione delle politiche, sottolineando la necessità di un approccio olistico al tema della pianificazione.

Il secondo ci mostra ancora una volta che, pur a fronte di continui processi di innovazione tecnologica, non può esserci città senza la città, ovvero non può esserci innovazione se si perde la centralità dell'uomo e dello spazio nelle valutazioni e nelle scelte strategiche e progettuali.
Questo ci porta a considerare che forse la *smart city* non è altro che una proiezione tecnologicamente innovata della città storicamente consolidata. Infatti le considerazioni che emergono dall'esperienza di studio svolta ci mostrano come l'intelligenza della città dipenda più dalla possibilità di raccogliere, verificare e valutare delle informazioni e di creare delle interazioni tra gli individui che dal modo con cui queste vengono svolte. In tal senso Kevin Lynch[13] aveva sottolineato la relazione fondamentale tra conoscenze umane e forma urbana espressa attraverso delle mappe che ciascuno di noi crea nella propria testa.
Queste mappe mentali, insieme con i punti di riferimento e con le delimitazioni che permettono l'orientamento nel tessuto urbano, rappresentano ciò che rende la città familiare e comprensibile.
Oggi, però, queste mappe sono sostituite da strumenti artificiali per orientarci nel tessuto urbano, per captare ed elaborare la conoscenza di ciò che ci circonda e per portarci dove vogliamo andare e la città è famigliare a tutti.
A fronte perciò della maggiore complessità delle relazioni sottese dalle attuali configurazioni delle reti sociali e dello spazio urbano è necessaria una capacità computazionale più elevata e capace di cogliere e leggere aspetti che prima non erano presenti o che non erano raccoglibili.
Infatti ai fini sociali un gruppo di persone, affinché possa interagire, non è necessario che operi a contatto fisico, ma quel che conta è che le interazioni e le azioni che in quel gruppo si producono generino nuove conoscenze e informazioni e producano effetti concreti sulla società e sullo spazio, sia che esse siano dirette che indirette. Inoltre non assumono importanza il modo e il mezzo con cui avvengono.
In ogni momento della storia la città è stata il luogo di incontro di flussi di cose, persone, informazioni in relazione alle attività che in essa venivano svolte, quali il mercato, la produzione, la politica, la costruzione dello spazio pubblico.
Tutte queste attività venivano svolte in spazi ben precisi come la piazza, il mercato, l'area industriale, ecc..
Con l'avvento della tecnologia essi non vengono necessariamente sostituiti dalla virtualità e dall'incorporeità in quanto pur nell'aumentata complessità le scelte rimangono riferite alla realtà fisica.
Oggi come oggi si tratta quindi di

> *«… ridefinire la città come un'ecologia di circostanze, come un ordinamento di incertezze capace di produrre linee di potere e come un'arena politica ricca di potenzialità che possono essere mobilitate per competere e per affrontare i problemi. Stiamo cercando di ridisegnare la mappa della città cercando di mettere nuovi canali per l'acquisizione (o la non acquisizione) di poteri. Questo comporta la rappresentazione di spazialità che oltrepassino i vecchi stereotipi territoriali, in cui una scala si interseca o si impila dentro l'altra».*[14]

A cambiare è il concetto di relazione che diventa multidimensionale. Con ciò si intende che alla gestione/pianificazione dello spazio urbano partecipano porzioni sempre più ampie di popolazione con aspettative fortemente differenziate tanto che le stesse, in mancanza proprio di un approccio olistico, rischiano di favorire interventi slegati creando uno spazio urbano *patchwork* di necessità e rappresentazioni.
La forma dell'aggregazione e la dimensione delle relazioni cambieranno in funzione del tema specifico trattato. Si tratta quindi di saper individuare le categorie analitiche corrette, le quali necessariamente devono

[13] K. Lynch (1964), L'immagine della città, Venezia, Marsilio.
[14] Cit: A. Amin, N. Thrift (2005), *Città. Ripensare la dimensione urbana*, il Mulino, Bologna, p. 115.

essere messe in gioco al fine di giungere e di comprendere quali siano le categorie sociali coinvolte o coinvolgibili nel progetto dello spazio urbano e quale sia la configurazione spaziale che meglio soddisfi la molteplicità delle esigenze.

La *smart city* diventa così la città della gente la quale può esprimere le opinioni sull’organizzazione spaziale secondo sistemi di valori che superano, quelli sì, la scala dei valori locali. Categorie diverse con istanze diverse possono essere coinvolte nel processo e le valutazioni possono godere di informazioni che un tempo avrebbero richiesto onerose ricerche ed oggi sono disponibili facilmente.

Quello che però può venire a mancare è il rapporto tra l’immediatezza dell’informazione e la capacità del luogo di adattarsi alle mutate necessità.

I tempi della città sono infatti tempi lunghi, dettati da una struttura complessa di governo urbano e di trasformazioni fisiche che richiedono iter di attuazione lunghi e difficoltosi. Forse proprio l’integrazione della valutazione dei tempi necessari per intervenire nei diversi aspetti funzionali e fisici della città potrebbe diventare un indicatore per la *smart city* del futuro (dove essere *smart* o intelligente sta nella capacità di dare priorità ed attuazione alle richieste di trasformazione), proiettando le informazioni *ex ante* nella dimensione attuativa e del monitoraggio *ex post* delle trasformazioni al fine di mantenerle adeguate al continuo divenire delle esigenze.

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## FONTE DELLE IMMAGINI

In copertina: percorso arginale protetto ciclo pedonale a ridosso della Zona Industriale Nord di Padova (foto Filippo Ghelli).

Fig. 1: Tavola 1 - Rappresentazione grafica dei percorsi analizzati e delle invarianti.

Fig. 2: Tavola 1/A - Rappresentazione grafica delle tipologie dei percorsi analizzati.

Fig. 3: Tavola 8 - Rappresentazione grafica dei passaggi di tipo casa/casa o casa/lavoro. Valori in % sul numero totale di passaggi analizzati per singolo segmento di percorso.

Fig. 4: Tavola 2 - Rappresentazione grafica della densità di passaggi per un certo segmento di percorso. Valori in % sul totale dei passaggi analizzati.

Fig. 5: Tavola 3 - Rappresentazione grafica della presenza di zone asfaltate all'interno dei percorsi. Valori in % sul totale della superficie del singolo segmento di percorso.

Fig. 6: Tavola 4 - Rappresentazione grafica della presenza di zone con terra battuta all'interno dei percorsi. Valori in % sul totale della superficie del singolo segmento di percorso.

Fig. 7: Tavola 5 - Rappresentazione grafica delle tipologie di terreno per ogni segmento di percorso analizzato.

Fig. 8: Tavola 6 - Rappresentazione grafica della presenza di zone di tipo *protetto* (percorsi in sede propria). Valori in % sul totale della superficie del singolo segmento di percorso.

Fig. 9: Tavola 7 - Rappresentazione grafica dell'utilizzo di parcheggi di sosta da parte degli utenti. Valori in % sul numero totale di passaggi analizzati per singolo segmento di percorso.

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TeMA

Journal of
Land Use, Mobility and Environment

TeMA 2 (2013) 235-250
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1484

review paper received 16 February 2013, accepted 15 June 2013

www.tema.unina.it

# MODELING THE TRAVEL BEHAVIOR IMPACTS OF MICRO-SCALE LAND USE AND SOCIO-ECONOMIC FACTORS

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ABSTRACT

The effects of neighbourhood-level land use characteristics on urban travel behaviour of Iranian cities are under-researched. The present paper examines such influences in a microscopic scale. In this study the role of socio-economic factors is also studies and compared to that of urban form. Two case-study neighbourhoods in west of Tehran are selected and considered, first of which is a centralized and compact neighbourhood and the other is a sprawled and centreless one.

A Multinomial Logit Regression model is developed to consider the effects of socio-economic and land use factors on urban travel pattern. In addition, to consider the effective factors, cross-sectional comparison between the influences of local accessibility and attractiveness of the neighbourhoodcentres of the two case-study areas are undertaken. Also the causality relationships are considered according to the findings of the survey. The findings indicate significant effects of age and household income as socio-economic factors on transportation mode choice in neighbourhoods with central structure. One the other hand, no meaningful association between socio-economic or land use variables are resulted by the model for the sprawled case. The most effective land use concept in micro-scale is considered to be satisfaction of entertainment facilities of the neighbourhood. Also the descriptive findings show that the centralized neighbourhood that gives more local accessibility to shops and retail generates less shopping trips. In considering the causal relations, the study shows that providing neighbourhood infrastructures that increase or ease the accessibility to neighbourhood amenities can lead to higher shares of sustainable transportation modes like walking, biking, or public transportation use.

KEYWORDS:
LUTI, sustainable urban form, travel behaviour, Multinomial Logit Model, Iran.

## 1 INTRODUCTION

In contrast to the sprawled patterns, the sustainable urban forms like compact developments have been claimed to have the capabilities to decrease car dependence and improve sustainable transportation (Cervero, Radisch, 1995; Khattak, Stone, 2003; Khattak, Rodriguez, 2005). To find the relations between the built environment and the travel behaviour, different aspects of the urban form have been examined. Density has been one of the urban form factors that have gained great attention. Large amount of research has been done on the effects of density (Pushkarev, Zupan, 1977; Holtaclaw, 1990, 1994, 2002; Cervero, Kockelman, 1997; Greenwald, Boarnet, 2001), land use mix (Hare, 1993; Ewing et al. 1994; Cervero, Radisch, 1995) and design (Kitamura et al. 1994). Such studies cover a wide range from region and city scale to neighbourhood. A number of researches related to this subject is done in neighbourhood scale (micro) and include a general topic of design. These studies consider the role of neighbourhood attitudes, neighbourhood street structure, sidewalks quality and design, bike routes, walkable distances, etc. on local travels (Ryan, McNally, 1995; Crane, 1996; Plaut, Boarnet, 2003). Although in 1993 Cervero had come to the conclusion that the micro-factors like travel costs and density are more effective than the micro-factors like design, but the number of studies that give better understanding of how and in what scale can design influence travel have increased during the recent years. For example Handy (1993) found the possibilities of neighbourhoods to increase walking trips while the trip lengths to other places in the city would not be affected. Another study of this kind is done by Crane and Crepeau (1998), who showed that fewer car trips are generated by neighbourhoods with special design concepts like high street connectivity. However they emphasize that the role of land use in micro scale is little.

The present paper investigates the above effects of land use and also socio-economic trends in the context of Iranian cities. Most of the existing literature about this subject comes from North America, Australia and Western Europe. The volume of similar studies on the Middle Eastern cities is very small and does not let decision making based on scientifically demonstrated conclusions that show what can make urban transportation more sustainable. The limited research that has been done about the Iranian cities shows that the socio-economic issues are of special importance in defining the travel behaviour. This has been discussed in city and regional level (Arabani, Amani, 2007; Soltani, Zamiri, 2011; Mirmoghtadaee, 2012; Shokoohi et al, 2012) and on zone/district level (Soltani, Esmaeili-Ivaki, 2011; Soltani et al. 2012). However the smallest scale, which is the neighbourhood level, has gained the least attention. It is not exactly known if the Iranian neighbourhood, which has strong roots in the traditional Iranian urbanism has capabilities of promoting sustainable mobility. Developing such studies can connect the Iranian studies to the international research going on about local accessibility and its advantages for sustainable mobility.

During the past decade the Iranian city has experienced inclusive transformations. After 1930s the city form was changed to let cars move freely in the texture of the cities. Therefore the compact cities were cut through to construct streets. The result was that the bazaars, neighbourhoods and their centers lost importance and instead the streets become the destination of urban travels (Masoumi, 2012a). Consideration of the physical form of the traditional neighbourhood shows that it had a distinct center with local public facilities within the walking distance of the houses (Masoumi, 2013a). Nonetheless the urban transformations of after 1970 and 1980 have led to urban sprawl that has made the destinations far away. The automobile-oriented planning has changed the form of the cities, especially in the peri-urban areas (Masoumi, 2012b). The centralized form that is explored in the traditional neighbourhood is not any more seen in the modern quarters. The basic difference is lack of powerful local centers that draw the urban trips to themselves. The most influential qualities of such neighbourhood centers are attractiveness and accessibility. Theoretically, it seems that people must be eager to walk to attractive public spaces and

facilities that are located in the vicinity of their houses. This accessibility is satisfied in the neighbourhood scale, when there is a reasonable level of centrality of facilities like retail, shops, grocery stores, urban parks and green spaces, open spaces, etc.
The present paper attempts to measure the above in District 5 of Tehran. The main questions meant to be answered are 1) Which measures are more important in defining the travel behaviour circumstances? The socio-economic factors or land use and design?; 2) Is there any usable differences in the land use and form of centralized neighbourhoods that have a center to promote sustainable transportation? 3) What causality relationships are there between land use and mode choice of the home-based urban travels?
To answer the mentioned questions, firstly the methodology including case-study areas, survey and sampling, and modelling are described. Then findings comprised of descriptive analysis, mode choice, and causality relationships are explained. Finally the concluding remarks are presented.

## 2 METHODOLOGY

The study employs empirical research methods to explore the differences in travel habits in the two selected neighbourhood types. The observation also has a comparative nature. Two neighbourhoods are selected; one represents the centralized compact neighbourhoods with a distinct center (Keyhan) and the other neighbourhood is an example of sprawled quarters located on the periphery of many Iranian cities (Bahar). The urban forms of the selected areas are meaningfully different. Cross-sectional analysis is conducted on the travel behaviour, demographic and socio-economic factors and the attitudes of people in the two neighbourhoods.

### 2.1 CASE-STUDY NEIGHBORHOODS

Both neighbourhoods are located in Region 5 of Tehran in west and north-western part of the city (Fig. 1). The distance between the borders of the neighbourhoods is about 500 meters. In 2006, Region 5 had a total population of 677085 people accommodated in 5287.1 hectares. That makes a gross population density of 128.1 persons/hectare and net population density of 162.1 persons/hectare. The dominant land use of the region is residential use which makes 26.4 per cent of the whole lands. Other large uses are street networks and open spaces with 20.7 per cent, unbuilt lands with 16.5 per cent, gardens with 9.8 per cent and green space with 9.6 per cent. The region includes 7 zones and 27 neighbourhoods (Tehran Master Plan, 2006).
The definition of neighborhood in the master plan is different from the one that is applied in this paper. In this study, the traditional area, size, arrangement of neighborhood units is taken as the standard neighborhood form. The best way to define the neighborhood boundaries is based on the perceptions of people. According to a recent study, the traditional Iranian city consisted of a number of neighborhoods and neighborhood units. The neighborhood units had an area of less than 30 or in larger cases 35 hectares (Masoumi, 2013a). In contrast, the administrative divisions of the Iranian cities are based on regions and zones. Recently neighborhoods are added to this division system, but the areas of such neighborhoods are so large that they are often not human-scaled. They lack a unique center and the distances are not walkable. To make a comparison between the travel behaviors generated by the centrally-structured, compact neighborhoods with the sprawled ones, it is not meaningful to use the administrative boundaries of the neighborhoods, because they are so large that the pedestrian mobility is not significant. Instead two small areas as large as the traditional neighborhood units are selected.
Keyhan presents the traditional form of neighbourhood units. Although it is not old but it has apparently a center with a local urban park including playground for children and a number of local shops including grocery stores, fruit shop, barber, etc. Also the situation of the houses is in a way that the

neighbourhoodhas a compact formation. The form of the selected area is in accordance with the traditional units that are comprised of about 300 buildings in small areas that let the residents access the Neighbourhood Unit Centers' (NUC) facilities easily. The short way to the center of the traditional neighbourhood units provides walkable distances that are mainly less than 670 meters (Masoumi, 2013a). The same is seen in Keyhan. The distance between the farthest houses of Keyhan to the center is 540 meters calculated on a street network basis.

Bahar is a neighbourhood that represents dispersed and sprawled urban patterns that have emerged in Iranian cities during the past four decades. Leapfrog development is seen in the development pattern of Bahar. This urban pattern is a basic characteristic of Iranian urban sprawl along with lack of public open spaces, less compact form, and low density (Masoumi, 2012b). In large and medium-sized Iranian cities, the density of recently built quarters is less than the city centers and the historical cores (Masoumi, 2013b). In other words when the distance of the quarters with the city center increases, the population density drops. Another specification of Bahar that exemplifies the sprawling areas is lack or dispersal of local public facilities like retail. The shops found in Bahar are not located centrally so it does not give the visitor the impression that the neighbourhood has a center.

The two selected areas have similarities that make the comparison meaningful. Firstly, the areas are both about 35 hectares. Secondly the distance between the areas are so short that the socio-economic factors such as household income, car ownership, household size, education, etc. are more or less alike. Thirdly, accessibility to public transportation and other transportation infrastructure like highways and main streets are in the same level. Finally, the distance to the central city of Tehran is the same.

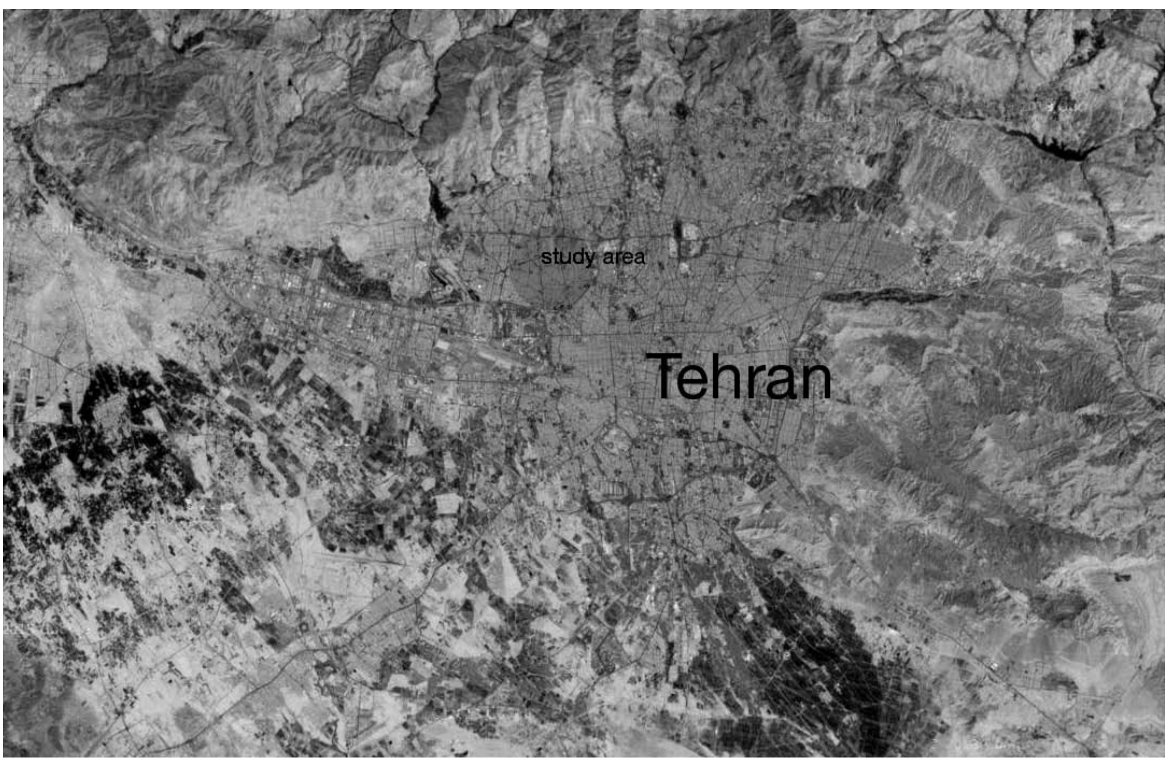


Fig. 1: Tehran and the location of the observation areas within the urban context


**Fig. 2: Location of Keyhanand Bahar in Region 5 of Tehran**


**Fig. 3: The Bahar and Keyhan areas, with the location of the KeyhanNeighborhood Center. Lack of public spaces and neighborhood amenities is notable in Bahar**

**Fig. 4: There is an urban park in Keyhan neighborhood (left). A highway with bus lines passes from the north of Bahar (right)**

## 2.2 SURVEY AND SAMPLING

This paper shows the results of an empirical comparison between the travel attitudes of residents of the two mentioned neighbourhoods. A survey was conducted in autumn 2012 by face-to-face interviews with the residents. Based on the interviews the questionnaires were filled out by the interviewers. The sample number was calculated according to Cochran (1963, 75):

$$\mathrm{n}_0 = {z^2pq}/{e^2} \tag{1}$$

The above is used to define the sample size, where Z^2 is the abscissa of the normal curve, p is the estimated proportion of an attribute, e is the level of precision which is here taken as 10%, and finally q is equal to 1-p. The result is adjusted by the following relation

$$n \quad = {n_0}/{1+\frac{(n_0-1)}{N}} \tag{2}$$

Whereas n is the sample size. Since the data derived from the detailed plan of Tehran is based on the administrative neighbourhoods and this study uses smaller areas, it was not possible to apply the existing neighbourhood populations. Therefore the number of buildings, the average residential units per building, and the household size were applied to calculate the case-study neighborhood population. There is 600 buildings in Keyhan and 400 in Bahar. The household size of Region 5 in the year 2011 has been 3.37 persons. Assuming 9 residential units per building for Keyhan and 7 for Bahar, the neighbourhood population will be 18,000 and 9,500 persons in Keyhan and Bahar respectively (N). For precision of ±10%, the sample size should be 95.53 for Keyhan and 95.09 for Bahar. As a result 96 questionnaires were filled out for each of the neighbourhoods.

## 2.3 MODELING

As a discrete choice model approach, Multinomial Logit Regression modeling (MNL) is applied to examine the transportation mode choice decisions of the interviewees. This type of modeling is selected because of its capabilities for analysing personal choices that are not in relation with each other. The effects of socio-economies and urban form characteristics on mode choice are investigated. It is also meant to compare these effects in the two selected neighbourhoods. In general 7 explanatory variables are tested. Five socio-economic measures including, age, household income, gender, owning a driving license, and household car ownership are analysed as explanatory variables. Two independent variables representing neighbourhood amenities are evaluation of neighbourhood retail and public space as well as satisfaction of neighbourhood entertainment facilities. All the mentioned independent variables are employed as categorical variables.

Socio-economic characteristics: gender, holding a driving license, and household car ownership are defined as dummy values. Age is a basic social specification that is distributed into 5 categories. Another seemingly influential factor is household income. A 6-point scale is used to show the amounts. The respondents have been asked if the monthly income of their family lies in "no income", "less than 11,000,000 Rials", "11,000,000-17,000,000 Rials", "17,000,000-22,500,000 Rials", 22,500,000-33,500,000 Rials", or "more than 33,500,000".

The land use factors that are discussed here are the ones that are in relation with what the residents perceive about the attractiveness of the neighbourhood retail, shops, entertainment facilities of the neighbourhoods, etc. They were asked about their evaluation of the quality of their neighbourhood shops and public spaces on a 5-point scale including "very weak", "insufficient", "average", "good", and "very good". They were also asked about their evaluation of the entertainment facilities of their neighbourhood. They answered the question by selecting among "not satisfied at all", "not satisfied", "average", "satisfied", and "very satisfied". The above data were applied to the MNL model to indicate differences in the two case-study neighbourhoods.

# 3 FINDINGS

## 3.1 DESCRIPTIVE ANALYSIS

Keyhan and Bahar have been selected in a way that there are large similarities between their socio-economic characteristics. The average age, daily activity pattern, and car ownership rates are largely alike in Keyhan and Bahar. The female interviewees in Keyhan have been more than in Bahar. However the effects of the difference in gender ratios do not have any important effect on the daily activity (p-value= 0.313). As seen in Table 1, although 57 % of the respondents of Keyhan are women (compared to 36 % in Bahar), but difference in the percentage of working individual in the two neighborhoods is only 2 %. Also the household income in Keyhan is slightly more, but the difference is negligible because no significant difference is seen (p-value= 0.509). Table 1 shows the findings of the survey in section 1 of the questionnaires.

| PERSONAL AND HOUSEHOLD CHARACTERISTICS | KEYHAN (N = 96) | BAHAR (N = 96) | p-VALUE |
|---|---|---|---|
| Gender | | | |
| Female | 57 (59.4%) | 36 (37.5%) | 0.313 |
| Male | 39 (40.6%) | 60 (62.5%) | |
| Age | | | |
| Mean | 34.86 | 35.80 | |
| Min | 18 | 20 | |
| Max | 64 | 62 | |
| Standard deviation | 10.21 | 9.59 | |
| Daily activity | | | |
| Work | 71 (74.7%) | 73 (76%) | 0.509 |
| Education | 12 (12.6%) | 7 (7.3%) | for "working" |
| Work at home | 12 (12.6%) | 16 (16.7%) | |
| Car ownership | | | |
| Own driving license | 86 (89.6%) | 80 (84.2%) | 0.612 |
| Personally own a car | 39 (40.6%) | 43 (44.8%) | 0.846 |
| The family owns a car | 74 (77.1%) | 66 (68.8%) | 0.412 |
| Household income | | | |
| No income | 0 (0%) | 0 (0%) | |
| < 1,100,000s Rials[1] | 28 (29%) | 37 (39%) | |
| 11,000,000-17,000,.000 Rials | 39 (41%) | 41 (44%) | 0.288 |
| 17,000,000-22,500,000 Rials | 16 (17%) | 14 (15%) | |
| 22,500,000-33.500,000 Rials | 11 (11%) | 2 (2%) | |
| >33,500,000 Rials | 2 (2%) | 0 (0%) | |

**Tab.1: Key socio-economic characteristics in the two neighbourhoods**

1 Rial is the official currency of Iran. One US Dollar was unofficially equal to 40.000 Rials on 2 Feb. 2013. In 2012 and 2013, due to political conflicts the conversion rate of Rial to other currencies has fallen rapidly and remained unstable. Therefore the reader probably cannot use the above conversion rate in the time of reading this paper.

Compared to 82.3% in Bahar, 85.3% of residents of Keyhan commute to their work or education place in a daily manner. While the number of people who commute daily as well as the share of public transport modes and slow modes are similar in the two neighborhoods, car use of Keyhan is 10 % more. Most of the people who drive to work place from both areas use cars because of more comfort, safety and security. Among the 192 people who were interviewed, no one commutes by bike. The time duration of commute travels do not show any significant difference. The main reason can be the similar distance to the central parts of Tehran that contains most of the employment centers and jobs.

The centralized local shops of Keyhan and the dispersed ones in Bahar equally attract shoppers. No difference is seen in the mode choice of either neighborhood level non-commute travels or travels to outside. The dominance of personal cars in non-work travels to outside of the neighborhoods is obvious (54.8% for Keyhan and 55.7% for Bahar). The important point is that the public space and neighborhood amenities are more attractive for the residents of Keyhan (64.6%) compared to those of Bahar (51.6%). The satisfaction of the people from the shops and public spaces of their neighborhood is also tested in another way, which shows they are more pleased in Keyhan. 60 % of the respondents of Kayhan evaluate the shops and open spaces of that neighborhood as very good or good, while the same figure is 32.3% for Bahar.

The results of the survey indicate a uniform attitude about public transportation use in the two neighborhoods. The most apparent difference is about the negative effect of poor accessibility on public transportation use. 33.3% of the respondents of Bahar have declared that the main reason for not using public transportation is "Little accessibility to stations, long distance between the stations", while only 20.4% have given such an answer in Keyhan (Table 2) .

| PUBLIC TRANSPORT USE CHARACTERISTICS | KEYHAN | BAHAR | P-VALUE |
|---|---|---|---|
| **Number of times of public transport use** | | | |
| Every day | 30 (31.3%) | 38 (39.6%) | |
| A couple of times per week | 12 (12.5%) | 12 (12.5%) | |
| A couple of times per month | 17 (17.7%) | 17 (17.7%) | 0.0014 |
| Seldom | 31 (32.3%) | 28 (29.2%) | |
| Never | 6 (6.2%) | 1 (1%) | |
| **The main reason for public transportation use** | | | |
| It is cheaper | 12 (24.5%) | 16 (30.8%) | |
| It is faster | 20 (40.8%) | 18 (34.6%) | |
| It is safe and secure | 6 (12.2%) | 5 (9.6%) | |
| It is more comfortable | 3 (6.1%) | 6 (11.5%) | |
| Because of no access to car | 8 (16.4%) | 7 (13.5%) | |
| **The main reason for not using public transportation** | | | |
| It is not comfortable | 20 (40.8%) | 17 (37.8%) | |
| It is expensive | 4 (8.2%) | 4 (8.9%) | |
| Little accessibility to stations, long distance between the stations | 10 (20.4%) | 15 (33.3%) | |
| No access to public transportation at all | 8 (16.3%) | 8 (17.8%) | |
| Because of social and cultural problems | 7 (14.3%) | 1 (2.2%) | |
| **Public transportation system privileged** | | | |
| Metro | 33 (35.5%) | 31 (34.8%) | |
| Bus or Minibus | 8 (8.6%) | 6 (6.8%) | |
| Taxi | | | |
| Line Taxi | 20 (21.5%) | 21 (23.6%) | |
| Passenger Taxi | 17 (18.3%) | 21 (23.6%) | |
| Telephone Taxi | 15 (16.1%) | 10 (11.2%) | |

**Tab.2: The characteristics of public transportation use**

What connect Bahar to the central parts of the city in the east are urban highways in the north and south of the neighborhood. Only one bus station covers a part of each of the two neighborhoods. That is why the bus/minibus is not a popular option. Apart from accessibility the most important reason for not using public transport is low comfort. This option received 40.8 % of the responses in Keyhan and 37.8 % in Bahar.

While sense of belonging in the two neighborhoods is in the same level, people in Keyhan are more satisfied of their living environment (41.1 % satisfied or very satisfied) than those who live in Bahar (26.6 % satisfied or very satisfied). Apart from neighborhood satisfaction, Table 3 indicates notable difference between the circumstances of residential self selection in Iran with that of Western Europe and North America. What we see here is that most of the people choose their living places based on economic factors rather than mobility-related reasons. The reasons given by the respondents for selecting their living location are 68.7 % related to economy (affordability or rise of the prices in the future) in Keyhan and 69.2 % in Bahar. In contrast, the reasons in connection with transportation, including commute travels or proximity to the relatives make 19.8 % in Keyhan and 15.9 % in Bahar. This meaningful difference shows how the residential self selection functions under the effect of economic factors.

| FACTORS RELATED TO PERCEPTIONS AND SELECTIONS | KEYHAN | BAHAR |
|---|---|---|
| SENSE OF BELONGING TO THE NEIGHBORHOOD | | |
| Yes | 77 (80.2%) | 77 (82.8%) |
| No | 19 (19.8%) | 16 (17.2%) |
| SATISFACTION OF THE NEIGHBORHOOD ENTERTAINMENT FACILITIES | | |
| Very satisfied | 9 (9.5%) | 4 (4.3%) |
| Satisfied | 30 (31.6%) | 21 (22.3%) |
| Indifferent | 27 (28.4%) | 31 (33%) |
| Not satisfied | 25 (26.3%) | 35 (37.2%) |
| Dissatisfied | 4 (4.2%) | 3 (3.2%) |
| THE PLACE PREFERRED FOR ENTERTAINMENT AND SOCIAL ACTIVITIES | | |
| Inside the neighborhood | 41 (43.2%) | 31 (34.4%) |
| Out of the neighborhood | 54 (56.8%) | 59 (65.6%) |

**Tab.3: Human perceptions and selections**

## 3.2 MODE CHOICE

To consider the relationships between different factors and transportation mode choice, a Multinomial Logit Regression Model is developed. The general model output such as model fitting information, likelihood ratio tests, pseudo R-square, and Nagelkerke R-square are illustrated in Table 4 and Table 5. The model generally shows good fit. Although some of the variables for Keyhan and all of them in Bahar have high p-values. The result of this model gives the opportunity to study the association of several variables with mode choices. Table 4 indicates the results of the model for the two case-study areas.

| | KEYHAN | | | | BAHAR | | | |
|---|---|---|---|---|---|---|---|---|
| Model | Model Fitting Criteria | Likelihood Ratio Tests | | | Model Fitting Criteria | Likelihood Ratio Tests | | |
| | -2 Log Likelihood | Chi-Square | df | Sig. | -2 Log Likelihood | Chi-Square | df | Sig. |
| Intercept Only | 317,903 | | | | 305,598 | | | |
| Final | 61,672 | 256,231 | 84 | ,000 | 72,004 | 233,594 | 76 | ,000 |

**Table 4: Model fitting information for the two neighbourhoods**

The model is meant to, firstly, show the association of different variables with mode choice in general and, secondly, provide with data usable for making comparison between the two neighborhoods. The output shows significant (p-value< 0.05) association between satisfaction of entertainment facilities, age, and household income with transport mode choice in Keyhan. This result is presented in Table 6 for selection of car, bicycle, motorbike, and pedestrian trips. The significant and insignificant statistical outputs of all the seven 7 independent variables are presented this table to give better insight to the reader. Public transportation including bus/minibus, taxi, and metro are not seen in the model because it only takes into account the intra-neighborhood trips and public transportation is not used in the very small limitation of the neighborhoods. "Car" is taken as reference in the calculations because it is the strongest variable in the model. Therefore higher values of coefficients show higher pedestrian, bike, or motorbike trips. The model results for the pedestrian travels are of absolute importance; in Keyhan satisfaction of entertainment facilities can lead to increase in pedestrian travels (B=4.584, P=0.038).

Age has a positive effect on walking trips (B=26.248, P=0.000). The findings show that older people in Keyhan are more willing to walk to their non-work destinations inside the neighborhood. The influence of income is negative (B=-39.618, P=0.000). In other words, more affluent people walk less and use more cars. In Bahar the null hypothesis is not rejected for any of the explanatory variables, so they are not significant. This shows that the modes are selected randomly and there are no relationships between the variables and the decisions. Three socio-economic traits, namely gender, owning a driving license, and household car ownership, have not produced significant relationships with mode selection in both neighborhoods. Surprisingly, the evaluation of people from local retail is significant neither of the neighborhoods. More studies seem to be needed for examining the role of accessibility to local shops.

Significance of three variables out of seven in Keyhan while none of them are meaningful for Bahar shows that the difference in the urban structure of Keyhan has something to contribute to sustainable transportation and this can be used by urban policy makers. Providing with attractive urban spaces and local facilities can attract people in quarters that have and accessible local center such as a neighborhood center.

| | KEYHAN | | | | | BAHAR | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Effect | Model Fitting Criteria | Likelihood Ratio Tests | | | | Model Fitting Criteria | Likelihood Ratio Tests | | | |
| | -2 Log Likelihood of Reduced Model | Chi-Square | df | Sig. | Nagelkerke | -2 Log Likelihood of Reduced Model | Chi-Square | df | Sig. | Nagelkerke |
| Intercept | 61,672a | 0,000 | 0 | | 0,928 | 72,004a | 0,000 | 0 | | 0,901 |
| RETEV | 71,069b | 9,397 | 16 | ,896 | | 80,823b | 8,819 | 16 | ,921 | |
| SATISENT | 72,310b | 10,638 | 20 | ,955 | | 77,573b | 5,569 | 16 | ,992 | |
| AGE | 166,129b | 104,457 | 16 | ,000 | | 80,744b | 8,740 | 12 | ,725 | |
| INCOME | 833,501b | 771,829 | 16 | ,000 | | 80,077b | 8,073 | 16 | ,947 | |
| FEMALE | 67,307b | 5,635 | 4 | ,228 | | 74,185b | 2,181 | 4 | ,702 | |
| DRIVINGLIC | 68,400b | 6,728 | 4 | ,151 | | 74,664b | 2,660 | 4 | ,616 | |
| COHOUSE | 225,522c | 163,850 | 4 | ,000 | | 75,336b | 3,332 | 4 | ,504 | |

**Table 5: Likelihood ratio tests and Pseudo R-squared results**

| Mode Choice | Independent Variable | Description | KEYHAN B (COEFFICIENT) | KEYHAN STD. ERROR | KEYHAN WALD | KEYHAN SIG. (P-VALUE) | BAHAR B (COEFFICIENT) | BAHAR STD. ERROR | BAHAR WALD | BAHAR SIG. (P-VALUE) |
|---|---|---|---|---|---|---|---|---|---|---|
| | [RETEV= ] | Retail evaluation | 10,042 | 221,266 | ,002 | ,964 | 23,049 | 168,989 | ,019 | ,892 |
| | [SATISENT= ] | Satisfactionofentertainmentfacilities | 24,297 | 1,391 | 304,945 | ,000 | 9,042 | 77,879 | ,013 | ,908 |
| | [AGE= ] | Age | 356,382 | 1,415 | 63419,821 | 0,000 | 20,098 | 70,403 | ,081 | ,775 |
| | [INCOME= ] | Household Income | 63,325 | 1,180 | 2881,815 | 0,000 | 5,023 | 20,403 | ,061 | ,806 |
| | [FEMALE= ] | Gender | 22,530 | 100,523 | ,050 | ,823 | 22,741 | 109,812 | ,043 | ,836 |
| | [DRIVINGLIC = ] | Own a drivinglincense | 20,863 | 56,567 | ,136 | ,712 | 20,914 | 67,407 | ,096 | ,756 |
| | [COHOUSE= ] | Householdcarownership | 21,012 | 57,079 | ,136 | ,713 | 23,112 | 109,362 | ,045 | ,833 |
| Bicycle | [RETEV= ] | Retail evaluation | ,000 | 386,049 | ,000 | 1,000 | ,000 | 229,833 | ,000 | 1,000 |
| | [SATISENT= ] | Satisfactionofentertainmentfacilities | 12,186 | 798,284 | ,000 | ,988 | 11,006 | 0,000 | | |
| | [AGE= ] | Age | 338,724 | 7,289 | 2159,439 | 0,000 | 10,056 | 312,304 | ,001 | ,974 |
| | [INCOME= ] | Household Income | 47,004 | 5,983 | 61,728 | ,000 | ,000 | 72,047 | ,000 | 1,000 |
| | [FEMALE= ] | Gender | 10,488 | 0,000 | | | -,511 | 0,000 | | |
| | [DRIVINGLIC = ] | Own a drivinglincense | ,000 | 255,524 | ,000 | 1,000 | ,000 | 258,103 | ,000 | 1,000 |
| | [COHOUSE= ] | Householdcarownership | ,000 | 255,524 | ,000 | 1,000 | -,069 | 0,000 | | |
| Motorbike | [RETEV= ] | Satisfactionofentertainmentfacilities | ,000 | 650,775 | ,000 | 1,000 | 11,006 | 528,455 | ,000 | ,983 |
| | [SATISENT= ] | Satisfactionofentertainmentfacilities | 22,704 | 5,398 | 17,694 | ,000 | ,000 | 152,104 | ,000 | 1,000 |
| | [AGE= ] | Age | 353,431 | 5,221 | 4583,138 | 0,000 | -,629 | 85,304 | ,000 | ,994 |
| | [INCOME= ] | Household Income | 60,374 | 3,548 | 289,585 | ,000 | ,000 | 39,250 | ,000 | 1,000 |
| | [FEMALE= ] | Gender | -1,299 | 303,986 | ,000 | ,997 | -,511 | 230,331 | ,000 | ,998 |
| | [DRIVINGLIC =] | Own a drivinglincense | 0 | - | - | - | ,000 | 140,631 | ,000 | 1,000 |
| | [COHOUSE= ] | Householdcarownership | ,000 | 184,569 | ,000 | 1,000 | ,219 | 230,331 | ,000 | ,999 |
| Pedestrian | [RETEV= ] | Retail evaluation | -9,273 | 185,646 | ,002 | ,960 | ,236 | 114,308 | ,000 | ,998 |
| | [SATISENT= ] | Satisfactionofentertainmentfacilities | 4,584 | 2,212 | 4,294 | ,038 | -8,136 | 70,026 | ,013 | ,908 |
| | [AGE= ] | Age | 26,248 | 1,322 | 394,489 | ,000 | ,706 | 42,832 | ,000 | ,987 |
| | [INCOME= ] | Household Income | -39,618 | 1,198 | 1094,273 | ,000 | -4,113 | 18,087 | ,052 | ,820 |
| | [FEMALE=] | Gender | 0 | - | - | - | -,009 | 113,333 | ,000 | 1,000 |
| | [DRIVINGLIC = ] | Own a drivinglincense | ,152 | 60,979 | ,000 | ,998 | ,204 | 70,607 | ,000 | ,998 |
| | [COHOUSE= ] | Householdcarownership | ,331 | 60,979 | ,000 | ,996 | ,412 | 113,332 | ,000 | ,997 |

**Tab. 6: Multinomial Logit Regression model for transportation mode choice in Keyhan and Bahar**

## 3.3 SHOPPING ACTIVITY

As a continuous variable, the number of times that each individual in Keyhan and Bahar goes shopping in is compared by t-test. The number of shopping per week is asked from every interviewee during the direct questioning. The statistical test (Table 7 and 8) shows that Keyhan (Mean= 2.719) has significantly less number of shopping trips. Bahar (Mean= 2.958) produces higher number of shopping travels including pedestrian or motorized trips. The t-value of 0.000 shows rejection of null hypothesis and a meaningful difference between the means of shopping frequency in the two neighborhoods. Less shopping travel generation of Keyhan can be in relation with high accessibility to retail and shops inside the neighborhood. In fact people feel that the shops are within their reach so less shopping trips are generated.

| | N | MEAN | STD. DEVIATION | STD. ERROR MEAN |
|---|---|---|---|---|
| Shopping per Week in Keyhan | 96 | 2,72 | 1,351 | ,138 |
| Shopping per Week in Bahar | 96 | 2,96 | ,994 | ,101 |

**Tab. 7: One-sample statistics for shopping per week in the case-study areas**

| | TEST VALUE = 0 | | | | | |
|---|---|---|---|---|---|---|
| | t | df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| | | | | | Lower | Upper |
| Shopping per Week in Keyhan | 19,717 | 95 | ,000 | 2,719 | 2,45 | 2,99 |
| Shopping per Week in Bahar | 29,165 | 95 | ,000 | 2,958 | 2,76 | 3,16 |

**Tab. 8: One-sample test for shopping per week in the case-study areas**

## 3.4 CAUSALITY ANALYSIS

Studying the causal relations between different issues with travel behavior is another objective of this paper. Because of better attractiveness of the places of Keyhan for entertainment, the residents are willing to stay in their own neighborhood about ten % more than what the respondents of Bahar declare (Table 9). There is the same good evaluation about the better quality of the retail and public spaces of Keyhan, but there is no sign of higher percentages of walking in Keyhan. The reason behind little walking or biking can be sought at the first step in the socio-economic trends. The cultural problems and lack of bicycle infrastructure are the main reasons for little biking (93 % in Keyhan and 88 % in Bahar). Many people like to drive rather than walk to show the affluence or social class. This can be seen in many cultures from developing to developed countries. The situation for improving biking is even more difficult than that of walking. Methods for removing such cultural barriers against biking, especially biking of women, can be a special topic for the Iranian researchers in the future. As a side strategy to encourage people to use more alternative transportation modes, this paper suggests methods to increase local accessibility and attractiveness. The logic can be found in the responses of people in the observation areas. Far-away destinations are declared as the main reason for not walking in both neighborhoods, but the difference between the percentages is considerable. 52 % of people in Keyhan say the destinations are far away, so they cannot walk to them, while this amount is 35 % more in Bahar. The reason can be found in the central structure of Keyhan that gives more accessibility to the neighborhood amenities.

| FACTORS RELATED TO PERCEPTIONS AND SELECTIONS | KEYHAN | BAHAR |
|---|---|---|
| THE MAIN REASON FOR NOT TO PARTICIPATE IN SOCIAL ACTIVITIES AND SHOPPING INSIDE THE NEIGHBORHOOD | | |
| Lack of suitable facilities, retail, and shops | 6 (17.1%) | 16 (32%) |
| Lack of suitable spaces such as streets and allies | 8 (22.9%) | 9 (18%) |
| Absence of suitable social environment | 7 (20%) | 10 (20%) |
| Expensive services and materials | 11 (31.4%) | 12 (24%) |
| Lack of safety and security | 0 (0%) | 2 (4%) |
| Personal reasons | 3 (8.6%) | 1 (2%) |
| THE MAIN REASON FOR PUBLIC TRANSPORTATION USE | | |
| It is cheaper | 12 (24.5%) | 16 (30.8%) |
| It is faster | 20 (40.8%) | 18 (34.6%) |
| It is safe and secure | 6 (12.2%) | 5 (9.6%) |
| It is more comfortable | 3 (6.1%) | 6 (11.5%) |
| Because of no access to car | 8 (16.4%) | 7 (13.5%) |
| THE MAIN REASON FOR NOT USING PUBLIC TRANSPORTATION | | |
| It is not comfortable | 20 (40.8%) | 17 (37.8%) |
| It is expensive | 4 (8.2%) | 4 (8.9%) |
| Little accessibility to stations, long distance between the stations | 10 (20.4%) | 15 (33.3%) |
| No access to public transportation at all | 8 (16.3%) | 8 (17.8%) |
| Because of social and cultural problems | 7 (14.3%) | 1 (2.2%) |
| THE MAIN REASON FOR NOT BIKING INSIDE THE NEIGHBORHOOD | | |
| Cultural problems | 51 (59.3%) | 31 (41.3%) |
| Lack of biking routes and infrastructure | 29 (33.7%) | 35 (46.7%) |
| High price of bike | 6 (7%) | 9 (12%) |
| THE MAIN REASON FOR PREFERRING CAR TRAVEL TO PEDESTRIAN TRAVEL INSIDE THE NEIGHBORHOOD | | |
| The destinations are not near the living place | 26 (52%) | 20 (87%) |
| No attractive and beautiful streets and spaces are on the route | 7 (14%) | 2 (8.7%) |
| Lack of safety/security in the streets | 6 (12%) | 1 (4.3%) |
| Because of social problems | 11 (22%) | 0 (0%) |

**Table 9: Causality relationships: reasons for poor sustainable mobility behavior**

Although the central urban structure of Keyhan provides better accessibility and attractiveness (for entertainment and shopping), but still significantly higher percentage of walking is not seen in the modal split of the neighborhood compared to that of sprawled Bahar. According to the survey results, people evaluate the neighborhood amenities and entertainment facilities of Keyhan more attractive. However attractiveness and accessibility must work together. According to the survey, a major part of the respondents of Keyhan prefer to stay inside the neighborhood for entertainment activities. This provides an opportunity to localize the travels and as a result increase the share of pedestrian and bicycle trips. Nevertheless this opportunity has not been used because there is not a huge difference between the share of slow modes in Keyhan and Bahar. When the respondents are asked about the reason for not walking, their main reason is "the destinations are not near the living place". The accessibility-related reasons include 52 % of the responses. While the same option makes 87 % of the responses in Bahar that has less accessibility. 35 % difference between the responses of the two neighborhoods show that people believe the facilities for entertainment, being with friends and passing time in Keyhan is more accessible while other options like lack of safety/security and social problems can also stop people from walking to their destinations. In Keyhan, one third of people have selected these problems as obstacles of walking. Considering the above, the reason for the approximately equal shares of walking in the two neighborhoods is not clear. On the other hand 65.3%in Keyhan has said that they use public transport because it is cheaper or faster. This amount is 66.4% for Bahar. This shows how it is possible to add to the privilege of public transport over car by enhancing the quality and accessibility of the metro, bus and Taxi systems.

## 4 CONCLUSIONS

This paper shows that the socio-economic factors like age and household income have strong effects on travels in compact neighborhoods. This finding is consistent with the result of the previous works done by Iranian scholars. In connection to previous studies (such as Handy et al. 2005), here we find that the built environment cannot individually solve the transportation problems without socio-economic factors. The urban design elements can improve the sustainable transportation, but they are not the most effective factors. Nevertheless this study also demonstrates that the phenomena connected to urban form are not completely ineffective in changing travels. Positive association of presence of entertainment facilities within the neighborhood centers with pedestrian trips has been also shown. It has been also shown in this paper that residential self selection is not so important in defining the urban travel patterns in Iranian cities in contrast to the western countries. That is because people usually do not select their living location due to transportation-related reasons.

Despite uniform techniques applied to the two areas and also similar socio-economic qualities in the two studies neighborhoods, the dispersed and centerlessneighbourhood showed weak capacity to change the travel patterns by means of land use characteristics. In contrary, the compact and central neighborhood form indicated signs of capabilities that can affect urban travels positively. Such potentials can be used in urban planning and design in order to localize the non-commute trips including shopping and entertainment travels. The present study emphasizes on planning accessible local centers to present entertainment facilities and attractive retail. This method is in line with promotion of local accessibility.

According to descriptive findings of this article, the attractiveness of the local centers can urge residents to have their non-work trips (entertainment, social behavior, shopping, etc.) inside the neighborhood. However this can only be done when there are enough infrastructures for walking and biking. Providing such infrastructures can complete the attractiveness and accessibility of the local facilities. The causality study done in this research shows that the existence of neighborhood infrastructures and facilities has a strong effect on the travel behavior of people.

Like the previous Iranian literature that pointed out that socio-economic characteristics are important in defining the nature of the urban travels, this study finds some of these factors like age and income important. However there are two main differences; firstly, approximately all of the mentioned studies take medium and large scale, while this article is zoomed on neighborhood. Secondly, the present study finds only age and income effective on mode choice. For finding association between other factors and travels more observations seem to be needed.

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TeMA

Journal of
Land Use, Mobility and Environment

TeMA 2 (2013) 251-263
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1524

review paper received 28 March 2013, accepted 15 June 2013

www.tema.unina.it

# RESILIENCE IN THE TRANSITION TOWNS MOVEMENT

## TOWARDS A NEW URBAN GOVERNANCE

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ABSTRACT

Resilience, a concept typical in the natural sciences, has for some years been part of vocabulary of spatial planning but it is as yet relatively unexplored. Its common definition still represents resilience as the capacity of a system to absorb disturbances and to reorganize itself, by returning to the original state. Complexity theory shows that resilience is a bottom-up process, closely related to self-organization of a system, which could change the role of institutions and community in urban governance. Recently, the concept of resilience has been associated with the Transition Towns movement, a bottom-up initiative promoted by civil society. Better known as "urban initiatives for the transition", they are a set of bottom-up practices of urban management, aimed at achieving a self-sufficient and "zero impact" model of urban development.
In this perspective, the research question is: could this new paradigm of development and spatial organization really be a new approach in urban governance?
The paper focuses on the implications of the concept of resilience in spatial planning. The purpose is to understand the extent of innovation in planning practices and urban governance. In particular, the first part of the paper provides a review of the theoretical framework of resilience and the second analyzes the Transition Towns movement, with particular reference to the role of stakeholders.

KEYWORDS:
Resilience; Transition Town movement; Urban governance.

## 1 RESILIENCE. DEFINITION, ORIGIN AND EVOLUTION

The concept of resilience has been widely studied in many disciplines (Seyfang, Haxeltine, 2009). First formulated in ecology (in the 1960s-1970s), this concept has influenced many other research fields including anthropology, human geography and other social sciences (Folke, 2006). Recently, it has also been discussed in the urban and regional planning sector becoming part of the vocabulary of spatial planning and entering debates in planning theory and practice (Davoudi and Porter, 2012; Papa, 2012).

The first theoretical approach defined it as «*the capacity of a system to absorb disturbance and reorganize while undergoing change, so as to still retain essentially the same function, structure, identity and feedback*» (Walker *et al.,* 2004, p. 5). This definition is used in the spatial metaphor of "resilient city" (Newman *et al.*, 2009; Otto-Zimmermann, 2011; Pickett *et al.*, 2004).

A more thorough inquiry (Folke, 2006) into the adaptive capacity of social-ecological systems underlined the real innovation of the concept of resilience (Papa, 2012). This second approach implies that cities are open adaptive complex systems (Portugali, 1999), that are able to self-regulate and create innovative solutions for urban development. This point of view allows the study of implementation of the concept of resilience in the Transition towns movement (Hopkins, 2008 and 2011). This movement has already spread into several contexts. Despite its phenomenal growth and the wave of positive publicity has received, there has to date been very little empirical research into the development and character of these initiatives, or the impact they have achieved (Seyfang, 2009).

### 1.1 THE ORIGIN OF THE CONCEPT IN ECOLOGY

According to Pickett et al. (2004), there are two distinct research phases in scientific studies on the concept of resilience: (i) one based on balance and (ii) one based on imbalance. In the first, resilience is the system's ability to return to the starting point by overcoming a period of crisis; in the second – which is more inclusive - it is the system's ability to adapt to external disturbance, not necessarily returning to a steady-state (Gunderson, Holling, 2002; Gunderson et al., 2010).

Early studies in the Sixties and Seventies[1], essentially based on empirical analysis of ecosystem dynamics through mathematical models, focused on resilience as the capacity to absorb shocks and still maintain its functions. This engineering approach, named by Holling (1973), implies the ability of systems to return to equilibrium or steady-state and the return time is the measure of resilience[2]. In this theoretical perspective, the consequent policies relating to natural resource management were "linear approach" types (Folke, 2006).

Since the Nineties[3], when ecosystems analysis on a large scale included the social sphere (institutions and people), the focus was on the necessity to manage by change rather than simply to react to external shocks. This ecological approach, named by Holling (1973), implies resilience is the ability of systems to overcome external shocks and move to a new equilibrium stage. In other words, it is the capacity to adapt to external shocks. The related policies therefore implied uncertainty and surprise[4], useful to adapt to the external disturbances.

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1 See in particular Holling (1961), Lewontin (1969), Rosenzweig (1971) and May R.M. (1972).

2 Holling (1973, p. 17) states «resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist».

3 Especially after the publication of the volume *Barrier and Bridges to the Renewal of Ecosystems and Institutions* by Gunderson et al. (1995).

4 For a further discussion, see: Carpenter and Gunderson (2001), Berkes, Colding and Folke (2003).

This second view has led to the study of the concept of resilience in socio-ecological systems (Folke, 2006; Gallopin, 2006), which are conceptualization models of linkage between the human and ecological spheres, useful to identify practices of adaptive management. In this socio-ecological approach, resilience shifts from a capacity of system which maintains its original status towards a capacity of system to adapt, innovate and transform, under certain conditions, into new more desirable configurations. Innovation and transformation concern the capacity «for renewal, re-*organization and development.* […] *In a resilient social-ecological system, disturbance has the potential to create opportunity for doing new things, for innovation and for development*» (Folke, 2006, p. 259).

Following Carpenter *et al.* (2001), Folke (2006) summed up the characteristics of socio-ecological resilience as follows:

- the amount of disturbance a system can absorb while still remaining within the same state or domain of attraction.
- the degree to which the system is able to self-organize (versus lack of organization, or organization forced by external factors).
- the degree to which the system can build and increase its capacity for learning and adaptation.

Absorbing, self-organization and learning/adaptation appear to be the three key elements related to the concept of resilience. Folke (2006, p. 258) adds that resilience «e*mphasizes non-linear dynamics, thresholds,uncertainty and surprise, how periods of gradual change interplay with periods of rapid change and how such dynamics interact across temporal and spatial scales*». Starting from this dynamic perspective, he proposed a modified Panarchy model, a heuristic model of nested adaptive renewal cycles (Gunderson and Holling, 2002) emphasizing cross-scale interplay. The adaptive renewal cycle is divided into four phases of system development driven by discontinuous events and processes: exponential phases of change (the exploitation or r-phase), stasis phases of growing (the conservation or K-phase), readjustments and collapse phases (the release or omega-phase) and re-organization and renewal phases (the alpha-phase) (Folke, 2006). The modified model explicitly takes fast/slow dynamics and cross scale interactions and interdependencies into account. The panarchy is therefore «*both creative and conservative through the dynamic balance between rapid change and memory, and between disturbance and diversity and their cross-scale interplay*» (Folke, 2006, 259).

## 1.2 THE EVOLUTION OF THE CONCEPT IN SPATIAL

Even today, resilience is defined in planning literature as the ability of a system to absorb external disturbances and reorganize itself on the basis thereof to return to the same function, structure and original identity (Walker et al., 2004). As shown by Funfgeld (2012), this engineering approach is quite often used in the field of climate risk management. In order to conserve the status quo - protect existing assets, people and places from the impacts of climate change - the adaptation measures are designed as thresholds (on the metaphor of "resilient city"[5] see, for example, Musacchio and Wu, 2002; Newman et al., 2009; Otto-Zimmermann, 2011). As Porter and Davoudi (2012) confirm, this perspective adopts a managerial, command-and-control understanding of systems. This view looks at the city as a linear system.

In line with Folke's theory of the Panarchy model, the reaction of systems to external disturbances depends on a certain degree of their self-organization and creativity. This definition adapts to peculiarities of the

[5] It's interesting to note that ecology and spatial planning share both the use of metaphor and the relationship between structure and function (Pickett et al., 2004). In spatial planning, metaphor has traditionally had a particular appeal; the most famous is Howard's Garden City but there are also the first hypotheses of bioregionalism formulated by Geddes and Mumford at the beginning of the Twentieth century. Today, the new metaphor of "resilient city" could be the synthesis between ecology and spatial planning.

complex systems «because it is more dynamic and evolutionary» (Pickett et al. 2004, p. 373). According to Davoudi (2012, p. 303), this socio-ecological approach considers resilience «not as a fixed asset, but as a continually changing process; not as a being but as a becoming». Davoudi (2012) called this approach as "evolutionary resilience" and the authors agree with that designation. It enables the use of the concept of resilience in spatial planning, the complexity theory indeed argues that cities are non-linear systems. Translating the concept of resilience from the field of ecology into spatial planning therefore poses some critical issues[6], the most important being the intentionality of human actions.

Cities, by their nature, are open complex systems and are thereby subjected to constant external disturbances (Portugali, 1999) and characterized by self-organization. Considering the notion of self-organization in the human domain of cities means adding to the list of the main characteristics of open complex systems: human intentionality[7], hermeneutics and memory. As Portugali (1999, 77) asserts, «individuals in the city act and behave intentionally, they need information about the city. This information they subjectively extract from what they see and experience in the city. They extract this information by means of logic, imagination, past experiences, knowledge and other tools commonly assumed to form the content of the individual's memory. This process by which the individual extracts information by means of memory, and by so doing in fact creates and constructs his/her own and other's city, is termed hermeneutics. And to complete the picture and the feedback loop one should add that memory is also the place were intentions are created, represented and stored».

Accordingly, in order to propose a comprehensive definition of the resilience concept in spatial planning, it is useful to study empirical experiences which also take these aspects into account. Examples include the recent experiences of transition towns (Hopkins, 2008 and 2011, Hopkins and Lipman, 2009). Rob Hopkins, founder of the first transition town in the UK, proposed the original use of the concept of resilience as a reaction to the external disturbance of peak oil.

## 2 RESILIENCE IN THE TRANSITION TOWNS MOVEMENT

The concept of resilience is the main principle of the experiences of the Transition Towns movement. We will understand how it is used in recent international experiences. According to the main definition, we can list four characteristics that allow the use of the concept of resilience for urban systems, as indicated below:

- *Socio-ecological systems*. The first element concerns the linkage between the ecological and social dimensions of systems. Urban systems are based on the close relationship between environmental resources and human capital, they are socio-ecological systems. This is particularly clear in the Transition Towns movement, the new paradigm of urban development that they propose indeed refers to primary resources (eg. energy and food supply).
- *Complex systems.*The second element concerns entirety of the system (Folke*et al.,* 2010). Cities are indeed complex systems wherein several subsystems interact (Portugali, 2000). The transition town model proposes a new paradigm of urban development which is a comprehensive strategic vision of the city and does not just consider a single subsystem (Brangwyn and Hopkins, 2008).
- *Adaptive renewal cycles*. The third element concerns the adaptive renewal cycle theory. It is composed of the sequence of several status phases. Each status phase involves the loss of resilience and the consequent vulnerability of the system. In the transition town model the sequence is clear and closely linked to the widespread use of oil; the peak oil – or at least its shortage - is the external disturbance

6 The critical issues that Davoudi (2012) lists are: intentionality of human actions; outcome or purpose of resilience; system's boundary; resilience for whom?

7 Jane Jacobs yet argues that citizens have spontaneous and self-organised behaviors (Jacobs, 1961).

which involves the loss of resilience and the consequent vulnerability of the system (Hopkins, 2008). Following this approach, the urban system has passed the period of growing - K-phase - and is now going through the readjustment and collapse period – Omega-phase. The transition town model proposes overcoming the current phase of crisis and reaching the last phase of renewal and re-organizing – alpha-phase. Each transition initiative takes into account that «[...] life with dramatically lower energy consumption is inevitable and it's better to plan for it than to be taken by surprise and our settlements and communities presently lack the resilience to enable them to weather the severe energy shocks that will accompany peak oil» (Hopkins 2008, p. 134). The adaptive renewal process also has memory ability. The memory of the urban system is a key feature of the transition town model (eg. key role of the elders knowhow and wisdom, in terms of lifestyle not yet dependent on oil) (Brangwyn and Hopkins, 2008). Self-organizing capacity. The fourth and final element is the self-organizing capacity of complex systems. Folke's theory (2006) proves that complex systems are in a continuous adaptive renewal cycle, which never stops but is able to react creatively to external disturbances. The Transition Towns movement is a practical example. It is a bottom-up movement, it is part - even without knowing it - of the alpha-phase of the cycle and so it is an example of the reaction of the urban system to external disturbances. The movement proposes a new paradigm of urban development and a consequent social organization model.

## 3 THE IDEA OF TRANSITION

Transitioning is a key assumption of the Transition Towns movement. A relevant topic to discussions on sustainability is the research on transition in socio-technical niches[8], «[...] *protected spaces where new social and technical practices can develop*» (Seyfang and Haxeltine, 2009, p. 3). This concept has been the subject of numerous scientific projects and debates with reference to its innovative solutions and alternatives to the sustainable development topic (Foxon *et al.,* 2008, Smith and Stirling, 2010).

Extending this concept into the social economy, Seyfang and Smith (2007, p. 3) propose a model of grassroots innovations to describe «*community-led, value-driven initiatives for sustainability, which respond to local problems and develop innovative socio-economic arrangements as much as (or in preference to) new technologies*». The benefits of grassroots innovations for sustainable development derive principally from their creation of a space for the development of new ideas and practices, for experimenting with new systems of provision, and for enabling people to express their alternative green and socially progressive values, and from the tangible achievement of environmental and social sustainability improvements, albeit on a small scale (Seyfang and Smith, 2007; Seyfang *et al.,* 2010).

In line with the socio-technical niches theory, the Transition Towns movement proposes a bottom-up paradigm of urban development which comes from the creativity of the urban community. In other words, this movement is a civil society movement which brings together «*diverse parts of a community to act and* produce change and innovation at the whole systems level» (Seyfang and Haxeltine, 2009, p. 21). Creativity means generating new ideas, practices and policies for urban management.

8 On Strategic Niche Management (SNM) see, for example, researches by Smith A., Stirling A. and Berkhout F. (2005), "The governance of sustainable socio-technical transitions", Research Policy, 34, 1491-1510; Geels F.W. (2005), Technological transitions and system innovations: a co-evolutionary and socio-technical analysis, Elgar, Camberley; Loorbach D. (2007), Transition management: new mode of governance for sustainable development, International Books, Utrecht.

### 3.1 ORIGINS AND QUALITATIVE CONSISTENCY

The Transition Towns movement was founded in 2005 in Kinsale, Northern Ireland, by Rob Hopkins, a permaculture teacher[9].
The first transition town initiative involved the small town of Totnes (2006), in south-west Britain.

| REGION | FORMAL INITIATIVES (JULY 2009) | MULLERS (SEPT 2008) |
|---|---|---|
| UK and Ireland | 119 (83) | 496 |
| Continental Europe | 4 (1) | 48 |
| North America (of which) | 37 (5) | 143 |
| USA | 33 (5) | 113 |
| Canada | 4 (–) | 30 |
| Latin America | 1 (1) | 7 |
| Asia | 1 (1) | 4 |
| Australasia (of which) | 24 (15) | 100 |
| Australia | 17 (9) | 54 |
| New Zealand | 7 (6) | 46 |
| Total | 186 (106) | 802 |

Tab.1: Geographical distribution of Transition Towns

Starting from this initial experience, which actively began in 2009, the Transition Towns movement quickly spread, firstly in the UK and then in other European and non-European countries (Seyfang and Haxeltine, 2009).
To date, we could list hundreds of initiatives[10] worldwide. According to recent researches, the transition towns are located in Europe (about 50% in the UK and the remainder in Ireland, Germany, the Netherlands and Italy), but also in Oceania (Australia, New Zealand) and North and South America (the USA, Canada, Brazil and Chile) (Hopkins and Lipman, 2009; Smith, 2011).
As other current grassroots movements, the Transition Towns movement is a socio-technical niche that involves a small part of society. A recent survey on Uk transition initiatives (Smith, 2011), shows that 86% of respondents are well-educated to post-graduate level. It is not possible to determine whether this trend is valid for all initiatives, but we can stress that - at least according to recent researches - the phenomenon is progressively spreading. This trend also depends on the different kinds of initiatives, in terms of location (urban, rural and island) and extent (local transition initiatives, regional transition networks, regional hubs,

9 Permaculture, another key assumption of the transition initiatives, is not discussed here. For a discussion of this concept, see Holmgren (2002).
10 It seems difficult to determine a list of the initiatives currently active in the world. The literature shows a lack of data: according to Bailey et al. (2010), on July 2009, the phenomenon involved more than 186 cities, while according to Seyfang and Haxeltine (2010), on January 2010, it involved 156 cities in the UK and 109 in the rest of the world.

national transition support organisations/networks, temporary groupings of local initiatives to carry out particular projects, as well as other manifestations) (Hopkins and Lipman, 2009).

## 3.2 PURPOSE AND PRINCIPLES

Hopkins and Lipman (2009) define the transition initiatives as «[...] *an emerging and evolving approach to community-level sustainability*» (Hopkins, 2008, p. 134). Bailey *et al.* (2010, p. 601) complete this definition by considering the Transition Towns movement as «*an environmental movement that has both drawn extensively on the perspectives and techniques of its predecessor and peer environmental movements, and adapted these to the specifics of peak oil, climate change and relocalisation*».

The formation process of each transition initiative follows seven principles[11], twelve steps[12] (Connors and McDonald, 2011) and three stages[13]. Although this set of guidelines, listed by the Uk Transition Towns Network, should only provide directions for the process (Hopkins and Lipman, 2009), in some cases it is considered quite binding and prescriptive (Connors and McDonald, 2011).

Following the concept of resilience, the purpose of transition initiatives is «*to support community-led responses to peak oil and climate change, building resilience and happiness*» (Hopkins and Lipman, 2009, p. 7). In line with socio-technical niches theory, these initiatives are virtuous examples of interplay between system supply/use of resources and new models of social institutions and regulation, especially in terms of their influence on sustainable lifestyle (Seyfang and Haxeltine, 2009).

At national level, these collect and monitor all the initiatives (eg. UK and USA)(Hopkins and Lipman 2009). At regional level, the best practices in the transition initiatives are shared in order to support those that are newly active and those in the process of formation and to manage partnership with private or public corporations. At local level, transition initiatives concern crosswise all fields of urban governance, with particular reference to oil-led ones (such as food and energy supply).

For each field there is an organization subgroup that deals with strategic and propositive activities. The final goal is to outline the Energy Descent Action Plan (EDAP). In this view, two other assumptions of the movement are: «*we have to act collectively, and we have to act now and by unleashing the collective genius of those around us to creatively and proactively plan our energy descent*» (Hopkins 2008, p. 134).

The EDAP anticipates three phases of aims (Brangwyn and Hopkins, 2008): a local resources framework, a transition timeline and a set of resilience indicators (such as the percentage of food grown locally, the amount of local currency in circulation, the number of businesses owned locally, the percentage of energy produced locally, the quantity of renewable building materials, and so on).

The Energy Descent Action Plan constitutes a strategic urban plan of a future vision to be carried out through specific practical activities. It differs from traditional strategic planning for a voluntary and shared community-led vision.

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11 The seven principles are: positive visioning, help people access good information and trust them to make good decisions, inclusion and openness, enable sharing and networking, build resilience, inner and outer transition, subsidiarity (Hopkins and Lipman, 2009).

12 According to Brangwyn and Hopkins (2008), the 12 steps of transition initiative are: set up a steering group and design its demise from the outset; awareness raising; lay the foundations; organise a great unleashing; form working groups; use open space; develop visible practical manifestations of the project; facilitate the great reskilling; build a bridge to local government; honour the elders; let it go where it wants to go; create an energy descent plan (EDAP).

13 According to Hopkins and Lipman (2009), each transition initiative should follow a succession of stages: the initial stage (meeting and gathering around the principles of the transition), the mulling stage (contacting and joining the Transition Network Ltd) and the formal transition initiative (declaration of intention).

| WORKING GROUP | MAIN ACTIVITIES |
|---|---|
| Building and housing | Eco-construction<br>Cohousing |
| Economics and livelihoods | Local currency: the Totnes pound<br>ATMOS: sustainable business park<br>Oil vulnerability audits with local companies |
| Education | Transition tales with local schools<br>Public future scenario workshops |
| Energy | Totnes renewable energy supply company<br>Solar water heater challenge<br>Partnership with good energy |
| Food | Garden share project<br>Sustainable fisheries<br>Seed and plant swaps<br>Allotments association |
| Health and well-being | Directory of complementary health practitioners<br>Collections of illness-to-wellness stories<br>Discussion group on national health service and sustainability |
| Heart and soul | Meetings to discuss events and experiences<br>Meditation meetings |
| Local government | Building of links with town, district and county councils to support and encourage inclusion of climate change and peak oil in decision-making |
| The arts | Events utilising the arts to explore peak oil, climate change and transition |
| Transport | Totnes cycling group<br>Totnes rickshaw company |

Tab.2:Main activities of Transition Town Totnes

The public sector role, especially of local government, is still central but it has to support - not to drive - transition initiatives, as happened in the Transition Towns Totnes, Lewes, Stroud, Penwith (Brangwyn and Hopkins, 2008).

## 3.3 COMMON CHARACTERISTICS

The comparison of the main international transition towns enables the common characteristics, both in terms of promoter organizations and initiative typologies[14], to be listed as follows. In regard to the first term, the main characteristics are:

– *voluntarity*[15]. Unlike traditional strategic planning for urban sustainable development, the transition initiatives focus on community-level action, essential to the success of the initiative (Seyfang and

[14] On this topic there are no surveys, the only exception is the work of Seyfang and Haxeltine (2009) about the British case studies.

Haxeltine, 2009). Common action implies the voluntarity of community members towards a shared goal.

- *common mission*. The common mission is building local self-reliance[16], shared by all community members at the time of agreement.
- *legal form*. The legal form ensures greater legal credit to organizations' actions and facilitates external partnerships. Different contexts affect the legal form of the transition organizations.
- *internal network*. The internal network is made up of working groups and subgroups. There is no leadership, but network organization. Interplay between members is inclusive and participative (Hopkins, 2008).
- *external network*. The Transition Towns movement is not isolated but it interacts with other local and pre-existing social organizations[17] (Seyfang and Haxeltine, 2009). The goal is to focus the actions of civil society on a common aim, without losing the identity and specificity of each initiative. The network organization also avoids the risk of excessive localism. At the same time, there is a network between all the transition initiatives (eg. sharing best practices).

In regard to the second term, the transition initiatives are characterized by:

- *same strategic actions*. The strategic actions concern fields of energy (renewable resources), transport (sustainable mobility), open space (community gardens) and building planning (eco-compatibility), urban economy (food supply, local currency) and community (learning, sense of community, human capital)(Hopkins, 2008; Bailey *et al.,* 2010). Local currencyisnot a necessary criteria.
- *relationship with the public sector*. The relationship with the public sector is usually promoted by transition organizations but it may be the case that local governments are interested in the transition initiatives in terms of forms of cooperation (Bailey *et al.,* 2010).
- *EDAP as final goal*. Although sharing strategic actions fields, each plan concerns a set of initiatives that originated from the local contexts. Therefore, each plan is different because it is flexible within local contexts.

## 4 CONCLUSIONS. TOWARDS NEW URBAN GOVERNANCE

Folke's theory of the Panarchy (2006) enables the Transition Towns movement as a practical example of the use of the resilience concept in a spatial dimension to be analyzed.

In particular, the concept of resilience in the Transition Towns movement emerges as a *new paradigm of urban growth and development* (Connors and McDonald, 2011) based on oil-free ideas, practices and policies for urban management.

In this movement, resilience is the capacity of urban systems to react to the external disturbance of peak oil. Regarding this disturbance, the transition initiatives propose new ways of using environmental resources that focus on energy conservation and closing energy cycles (eg. food supply based on local production).

However, peak oil is not the only external disturbance (Trapese, 2008). There are indeed several external disturbances that could spark off system shocks (eg. the current economic crisis). Consequently, resilience is not only the capacity of urban systems to react to peak oil disturbance but it is closely linked to the

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[15] Seyfang and Haxeltine (2009, p. 6) underline that «[...] *the vast majority (89.0%) are set up by individual citizens (76.7% are set up by several individuals coming together to instigate the group, and another 12.3% are set up by just one person at the outset). At the same time, 19.2% have one or more pre-existing groups involved in setting up the group. Only one of the respondent groups (1.4%) had a business involved in setting up the group, and none of them were started by local councils*».

[16] Data confirm that 55.2% of the respondents share this mission (Seyfang 2009).

[17] According to Seyfang and Haxeltine(2009), the 82,4% of the initiatives are linked to other initiatives promoted by pre-existing social organizations (in particular 86,5% are environmentalist ones).

adaptive and progressive capacity to react to all evolving external disturbances (Folke, 2006). It is a progressive, adaptive (also to context) and learning process, that could take a long time and may not involve all urban systems in the same way, at the same time. In this sense, the Transition Towns movement is only one model in terms of the use of the resilience concept in spatial planning.

As a first conclusion, we can affirm that resilience has a broad extent. It concerns the rethinking of the traditional idea of urban growth and development that outstrips the traditional paradigm of sustainability and concerns the use of resources in general (Latouche, 2005).

On the other hand, the concept of resilience in the Transition Town movement also emerges as *innate capacity of systems to propose bottom-up ideas, practices and policies for urban management*.

Extending our gaze to the nature of the phenomenon itself, the Transition Towns movement is a grassroot movement - like several others - that provides solutions in order to manage urban complex systems, especially on a local scale. As Jane Jacobs said (1961), the renewal of cities – as complex systems – is innate in the capacity and interest of citizens. The Transition Towns movement was indeed born in and spread through the urban context and it is a practical reaction promoted by the urban community. The movement never refuses the idea of the city. Bottom-up strategic actions aim at new common and shared solutions in terms of urban management.

In this sense, the concept of resilience underlines how some events could be chances to improve the current urban systems status, to trigger social mobilization, to recombine sources of experience and knowledge for learning, and to spark novelty and innovation. It may lead to new kinds of adaptability or possibly to transformational change (Folke*et al.,* 2010).

As a second conclusion, we can affirm that resilience is the innate adaptive capacity and creativity of urban systems to react to various external disturbances and propose new paradigms of growth and development. In other words, system reactions to external disturbances (not only peak oil) are not related to top-down solutions but to solutions innate in the systems, especially in their characteristics and memory.

According to both meanings of resilience in spatial planning – as a *new paradigm of urban growthand development* and *innate capacity of system to propose bottom-up ideas, practices and policies for urban management* – we can stress that it is an approach, a way of thinking, able to propose a *new urban governance perspective* (Folke*et al.,* 2010). This new urban governance, based on the concept of resilience, concerns urban systems management relating to bottom-up learning capacity and adaptive ability to propose new paradigms and practices. In other words, it means rethinking urban governance through a new rules framework that concerns the three features of *stakeholders*, their *roles* and consequent *tools*, as follows:

– *Stakeholders*. Community-led movements – and those of transition towns – could be stakeholders able to propose new paradigms of urban development and planning practices (Friedmann, 2011).
– *Roles*. Citizens may have a more central role in public choice and, on the other hand, the public sector could innovate itself, learning from bottom-up experiences. In other words, the new urban governance perspective concerns restoring the balance of the stakeholders' role. It means understanding the relevance of inclusive decision-making and (horizontal) subsidiarity (Hirst, 1994; Hirst and Bader, 2001; Brunetta and Moroni, 2012).
– *Tools*. Finally, both features – regarding all stakeholders and their new balanced roles - may have repercussions on urban governance tools (policies and practices). In particular, it means promoting more inclusive policies and practices, which also learn from bottom-up experiences (e.g. EDAP).

To sum up, the concept of resilience and its use in the Transition Towns movement suggests a new urban governance perspective that takes into account evolving social, economic and territorial organization and consequent systems complexity. It may be based on a new balance between institutional and social stakeholders in both decision-making (policies) and subsidiarity (tools achievement).

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## IMAGES AND TABLE SOURCES

Cover Image: http://commons.wikimedia.org/wiki/File:Toronto_Downtown_Core_at_Night.jpg; Tab. 1 and Tab. 2: Bayley et al., 2010.

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# TeMA

Journal of
Land Use, Mobility and Environment

TeMA 2 (2013) 265-287
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1625




# REVIEWS PAGES

## RESEARCHES, PROJECTS AND GOOD PRACTICES FOR BUILDINGS IN THE SMART CITIES

The Reviews Pages keeps the readers up-to-date on developments in five reports: web, books, urban practices, law, news and events. Each report deals with the specific subject proposed in the TeMA issue. These reviews are specialist in nature but contain enough introductory material to make the main points intelligible to a non-specialist. The reader will not only be able to distinguish important developments and trends but will also find a sufficient number of references to the original literature, web and other resources.

**01_WEB RESOURCES**

The web report offers the readers web pages which are directly connected with the issue theme.


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**02_BOOKS**

The books review suggests brand new publications related with the theme of the journal number.


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**03_LAWS**

The Law section proposes a critical synthesis of the normative aspect of the issue theme.


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**04_URBAN PRACTICES**

Urban practices describes the most innovative application in practice of the journal theme.


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**05_NEWS AND EVENTS**

News and events section keeps the readers up-to-date on congresses, events and exhibition related to the journal theme.


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# 01

SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR BUILDINGS

# REVIEW PAGES: WEB RESOURCES

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In this issue

## SMART CITY AT BUILDING SCALE

It is estimated that, at present, the building sector is responsible for 30% of total global greenhouse gas emissions and consumes up to 40% of all energy (Buildings and climate change. United Nations Environment Programme). Because of the progressive growth of construction industry in developing countries and the massive energy waste related to existing buildings, if nothing is done, building-related GHG emissions would grow at alarming rates over the next two decades. Therefore, it is essential to take action to reduce significantly carbon emissions from buildings, helping the dissemination of the most efficient models and strategies to progress towards a low carbon future.

In this context, the European Commission plays a key role, in fact, many of its initiatives support cities and regions in taking ambitious and pioneering measures to progress by 2020 towards a 40% reduction of greenhouse gas emissions; these measures include the promotion of new buildings with net zero energy requirements and net zero carbon emissions (*Net Zero* building).

Today that it's all about the smart city experience, it is necessary to broaden the idea of *Net Zero* buildings and start thinking to *Smart* buildings. While *Net Zero* buildings are constructed using the most advanced technological solutions, *Smart* buildings are designed to run more efficiently and, more important, to communicate with and about their various sensors/systems. Smarter buildings emerge from a holistic point of view that involves collaboration between facilities and IT organizations at new levels (IBM, Smarter buildings). Various components, together, make up what we call a *Smart* Building: heat generation with heat pump, temperature control with blinds, communication with smart grid, energy generation and storage, interpretation of monitored data and forecast for consumption, generation and storage, etc.

*Smart* buildings represent one of the critical success factors of a smart city because they contribute to optimize energy consumption, integrate renewable energy, reduce costs and CO2, generate and store CO2, support E-mobility charging and more.

In this number, three websites are presented; they are related to the promotion of sustainable building in Europe and U.S.. The first website analyzed is the European web portal for energy efficiency in buildings: Build Up. It is a platform that promotes the exchange of information between all stakeholders involved in the construction industry. The second website here proposed is that of Solar Decathlon Europe: an international competition among universities, which promotes research in the development of efficient houses. In the end, the third and last website indicated is that of the Better Buildings Neighborhood Program, which is a program within the U.S. Department of Energy helping over 40 competitively selected state and local governments develop sustainable programs to upgrade the energy efficiency of more than 100.000 buildings.

## BUILD UP – ENERGY SOLUTIONS FOR BETTER BUILDINGS

www.buildup.eu

The goal of Build Up, the European web portal for energy efficiency in buildings, is to provide a platform to exchange knowledge between the different stakeholders involved in the building sector, aiming to reduce the energy consumption of buildings in Europe. Politicians, building professionals and occupants can share information on energy saving for buildings as well as be updated about EU energy policy in the field. The website meets the needs of three different user profiles: building professional, public authority and building owner or tenant, each of which can explore a specific, dedicated, part of the website.

All the information offered by the portal is grouping into eight different sections: *News, Events, Publications, Links, Cases, Tools, Blogs, Communities* and *Frequently Asked Questions.*

In the *News* section, the user can learn more about the latest European news regarding energy efficiency problems and laws, both nationally and internationally.

The *Events* section includes the schedule of the most relevant energy efficiency related events, divided into Top and Upcoming Events. Anyone registered to the site can submit an event to the portal and the list is often updated.

In the *Publications* section, there are reports, set of rules, informative papers, researches and training material related to the issue of reducing energy consumption in buildings. Users can easily submit a document and share their experience with the community.

More than one thousand of links are listed in the *Links* section of the portal; links refer to a wide variety of organizations, institutions and activities across Europe.

The *Cases* section represents an important source of good practices realized in Europe to save energy in buildings. Cases can be projects, energy efficiency campaigns, or reports that can address different topics, such as innovative technologies, legislation, energy performance certification, design for low-energy buildings, monitoring, controls systems and others. The database includes 433 cases.

In the *Tools* section, users can find and submit helpful tools for the improvement of energy efficiency in buildings. Tools can include software applications, excel lists or other programs, which contribute to energy saving; an example can be the *energy performance calculation procedures*.The Build Up *Blog* gives members of the portal the opportunity to post their opinions, papers, doubts and responses to others' questions; users can interact with each other expanding the debate related to the energy efficiency themes.

The *Communities* section includes over fifty communities, each of which brings together people with same interests and it promotes the exchange of knowledge and experience. Any registered user can start or join a community, but there are specific guidelines to be observed.The last section of the website is dedicated to the Frequently Asked Questions, ordered by theme and answered by Build Up experts. Each section of the portal is frequently updated and the website counts almost ten thousand of registered users, providing to be a point of reference for energy efficiency in Europe.

## SOLAR DECATHLON EUROPE

http://www.sdeurope.org

Solar Decathlon is an international competition born in 2002 in the U.S.; the challenge occurs every two years and the next one is scheduled this October, at Orange County Great Park.

Twenty collegiate teams, applying from all over the world, are call to design and build energy-efficient houses powered by the sun.

The name «decathlon» comes from the number of contests the teams have to overcome: 10 contests for a total of 1.000 points.

Each competition allows assessing a specific feature of the houses, such as affordability or livability; there are two different types of contest:

- *measured contests*, like task completion (cooking, cleaning, etc.) or monitored performance (maintaining certain standard of temperature and humidity, etc.);
- *juried contests*, base on jury evaluation.

The aim of the challenge is to encourage the use of renewable technologies in building industry, educating students about the convenience, both in economic and environmental terms, of building a sustainable home: it is possible to have an energy-efficient and solar-powered house which is comfortable, attractive, eco and affordable.

In 2007, with an agreement between the Spanish Ministry of Public Works and the U.S. Government, the Solar Decathlon Europe (SDE) was born.

The competition is held biennially, in alternate years respect the American one and while the first two editions took place in Spain, the 2014 edition will occur in Versailles, France.

The organization of the SDE challenge is the same as the American, based on 10 contests.

The last edition took place in Madrid in 2012 with eighteen teams representing thirteen countries.

It is very interesting to visit the SDE website because it includes the videos of the eighteen houses that participated in the challenge, allowing users to perceive the SDE's atmosphere.

An introductory video presents the competition, its organizers and managers, the jury and some team's members, showing an incredible enthusiasm and excitement.

Furthermore, other videos complete the virtual tour of the 2012 SDE edition: each of these videos explores one of the challenge house, giving a team's member the opportunity to explain the project, from concept to completion.

More other useful information can be found in the portal, for example, it is possible to learn about the rules and the way a team can apply for the next SDE, or read the profiles of the jurors.

After the incredible success of the European Solar Decathlon, Solar Decathlon China has been added to the international family of Solar Decathlon competitions, in 2011.

The first edition will take place in China, next August and it promises to be a triumph.

## BETTER BUILDINGS NEIGHBORHOOD PROGRAM

https://www.1.eere.energy.gov/buildings/betterbuildings/neighborhoods

The Better Buildings Neighborhood Program (BBNP) was born in 2010 within the U.S. Department of Energy to develop sustainable energy efficiency upgrade programs using federal funds.

The program aims to upgrade existent buildings, both residential and commercial, to reduce energy consumption and allow consumers to save on energy bills as well as produce environmental benefits across the United States.

The BBNP website consists of six parts: *About, BBP Partners, Innovations, Run a program, Tools & Resources* and *News.*

If you want to deepen your understanding of Better Buildings Neighborhood Program, you can find any answer in the *About* section, where an explanatory video shows the advantages produced by the program, communicating straightforward with users.

The *BBNP Partners* section includes more information about partner profiles, case studies and innovative approaches that have already been implemented in many of U.S. states and cities.

This section provides many good practices that can be considered as an example by anyone who visits the portal.

A list of the most successful innovations developed to improve energy efficiency in buildings is provided in the *Innovations* section, distinguishing between for types of innovations: *program design, driving demand, financing* and *workforce development.*

The *Run a program* section contains the guidelines for creating and developing a new program; the step-by-step guidance is based on the most positive experiences tested by Better Buildings communities and it can be personalized according to specific needs.

In the *Tools & Resources* section, there is a wide directory including *Documents and Reports*, and *Tools/Calculators* for homes and commercial buildings, downloadable on line to help build new programs.

The latest available program data, namely up to the end of December 2012, reveal that BBNP partners completed more than fifty thousand upgrades by the end of the year, reaching an amazing result and demonstrating the value of the project.

## IMAGE SOURCES

The images are from: https://www.asme.org/kb/news---articles/articles/energy/the-net-zero-water-dorm; http://www.alueurope.eu/energy-efficiency-and-build-up/; http://www.univ-angers.fr/en/index.html; http://energy.gov/better-buildings.

# 02

## SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR BUILDINGS

## REVIEW PAGES: BOOKS

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In this issue

### NEW AND EXISTING BUILDINGS: WHAT SHOULD WE DO?

The World Business Council for Sustainable Development identified buildings as one of the five main users of energy where megatrends are needed to transform energy efficiency. About 40% of EU final energy demand is due to buildings (it is a larger share than both the transport and the industry sector) and it is estimated that currently available energy-efficiency measures could cost-effectively save around 28% of this. Buildings are also one of the most significant sources of GHG emissions (36% within the EU); for these reasons EU policy has identified increased energy efficiency for buildings as a key objective of energy and climate policy (COM(2006)545). Refurbishing the existing building stock is one of the most attractive and low cost options to save energy and to reduce the emissions of $CO_2$ at the same time. Therefore, adopting energy efficiency measures in the built environment is important to reach successfully both energy security and ambitious carbon reduction targets. These few considerations allow to understand easy that buildings hold great potential for cost-effective energy savings; the International Energy Agency (IEA) estimates that current trends in energy demand for buildings will stimulate about half of energy supply investments to 2030 and that the energy savings potential in this sector in 2009 will be in the range of 20 EJ per year by 2030, which is the same as the current annual electricity consumption of the United States and Japan combined. Hence the energy optimization of urban structures needs to be part of the sustainability strategy of each European city. Sustainable policies in European cities have to contribute to the paradigm shift from traditional sector oriented approach to a more integrated approach which ensures the consistency between the district energy supply and urban development (BPIE). It should necessary to support and to encourage the construction of buildings with net-zero energy consumption and on the other side, to implement policies improving the energy efficiency of existing buildings. Nevertheless, the regulations regarding the existing real estate reveal little effective because of the complexity of energy problem. The effort that European cities need to take is enlarging the range action both of measures and regulations from the individual building to urban settlements. In these perspective three documents are proposed in order to share energy efficiency good experiences and policies: the holistic strategy for neighborhood energy efficiency of the project Urb.Energy, the steps for a successful implementation of net Zero Energy Building and the energy efficiency policy implementation in the IEA member states.

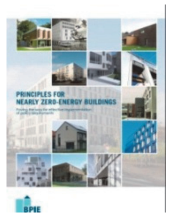
**Title: Holistic strategies for energy efficient refurbishment of the housing stock and renewal of the related energy supply system**
Author/editor: AA VV
Publisher: German Association for Housing, Urban and Spatial Development
Download: http://www.urbenergy.eu/241.0.html?&L=0%3E.%3F1%3D1
Publication year: 2011
ISBN code: n.d.

Urb.Energy project's main objective is the development and implementation of integrated concepts and strategies for the comprehensive energy efficient renewal of residential area in the Baltic Sea Region. The several partners of the project worked together in order to relate measures of energy efficiency refurbishment of the housing stock to overall development of residential neighborhoods and the renewal of energy supply infrastructure. Therefore the project aimed at including energy and climate issues within the urban development policies and instruments too. Since the project outcomes have showed that the different local urban and socioeconomic conditions have to be taken into account (i.e. age and status of buildings or energy supply structure), this guide presents an overview of various suitable and realistic approaches to implement energy and climate friendly measures to improve energy efficiency and the use of renewable energy sources in the housing sector, embedded in the framework of an integrated energy efficiency concept for residential urban areas. It provides lessons and recommendations aiming at giving advice to practitioners on local level to choose appropriate solutions in the development of energy efficiency concepts, measures and supporting structures. The integration of the energy efficient concept into the urban development process starts realizing small scale energy efficiency projects, related to single buildings or to a small area, to test and learn from experience and then developing the energy concept for the entire city. Solitary energy efficiency pilot projects, not considered into urban planning process, do not address energy and climate issues and have a weaker impact on climate adaptation and energy reduction or efficiency in the city. Five are the main components to build up a proper energy and climate concept:

- analyzing the energy supply and consumption of the city/neighbourhood and its $CO_2$ emissions;
- evaluating the potential to save energy, according to the results of energy balance;
- establishing energy and climate objectives;
- developing an action plan with priority, in order to reach the above mentioned objectives,
- developing a plan for managing and monitoring the implementation of measures to increase energy efficiency and climate protection.

In regard to energy requirement of neighborhood it is helpful using the plausibility check: it evaluates the influence of settlement structure type and size, building density and typology on the energy balance of a neighborhood. Another recommendation concern the cooperation and participation of stakeholders (apartment owner associations, residents) to recognize their interests and to create a climate of confidence and collaboration. Information campaigns and meetings should focus mainly on benefits and economically feasible energy efficiency measures and financing opportunities; in this way it is possible increasing awareness and motivating local stakeholders.

All the know-how described derives from the experience gained by the project partners: in the last chapter of the guide over twenty good practices are presented and they cover a wide range of energy concepts and measures for different urban areas, in order to demonstrate under which conditions energy efficiency measures can be realized successfully and how detected barriers can be overcome.



**Title: Principles For nearly Zero-Energy Buildings**
Author/ editor: AA VV
Publisher: Buildings Performance Institute Europe
Download: http://www.bpie.eu/nearly_zero.html
Publication year: 2011
ISBN code: 9789491143021

The Buildings Performance Institute Europe (BPIE) promotes policies and measures for increasing the energy performance buildings, and thereby reduction of $CO_2$ emission levels both at EU and Member State level, in order to make a significant contribution to the achievement of the 2020 EU targets. Nearly Zero-Energy Buildings (nZEB) will become mandatory for all new constructions from 2020 onwards. To facilitate this process, BPIE analyzed ten methodological challenges and their implications for setting a sustainable and practical nZEB definition, providing an outlook on necessary further steps towards a successful implementation of nZEB. A proper and feasible nZEB definition should be based on three basic principles related to the main aims of energy efficiency building sector: reducing energy demand, the use of renewable energy and reducing associated GHG emissions. These principles and the relative approaches for implementing them have been performed to verify and evaluate them; the main challenge of the simulation was to provide robust insights into the nZEB principles effect by applying them to a set of reference buildings, sufficiently representative of the wide variety of building-types, considering at the same time the influence of three different European climate zones. According to BPIE assessment of the European building stock, the most representative buildings are single-family houses and multi-storey non-residential building, and for both of them geometry, technical systems and usage patterns have been defined. Over these characteristics, the main European climate zones (Copenhagen, cold climate; Stuttgart (Germany), moderate climate; Madrid, warm climate) have been taken into account.

The simulations have shown that a new-built nZEB standard, based on the suggested principles and findings from this study, is achievable with existing technologies. Related to single family home outcomes show that it is possible to achieve a 90% share of renewables only by using a 100% heat supply from biomass fired systems (boiler, Cogeneration Heat Power), while for multi-storey office building only the biomass boiler and biomass fired micro-CHP variants exceed the 50% share of renewable and it should be helpful using 100% green electricity due to the higher relative share of electricity (lighting). For both types of buildings, using off-site green electricity significantly decreases $CO_2$ emissions. Possible barriers to the availability of systems and resources may be a market that is not able to satisfy the increasing demand for new technologies. Investments in general need to rise in the future to satisfy the additional demand created by new nZEBs. Therefore, the structure of legal requirements needs to be adapted or changed. This especially applies to the close linkage in the nZEB concept between requirements for the building envelope and renewable energy systems. It would be useful to merge regulations for renewables (as far as they already exist) with existing building regulations or to broaden the scope of regulations more towards renewable. The concept of nZEB also links to the EU job creation targets.

The EU strategy for creating growth and jobs in a sustainable manner, known as the Lisbon Strategy, promotes innovation within businesses and investment in people to create a knowledge-based society. Job effects of the energy-related costs can be calculated by multiplying these with the turnover per employee. According to that calculation, the implementation of nZEB as a mandatory requirement in the future would create about 345.000 additional jobs.


**Title: Progress Implementing the IEA 25 Energy Efficiency Policy Recommendations**
Author/editor: AA.VV.
Publisher: OECD, IEA
Download: http://www.iea.org/publications/insights/name,15211,en.html
Publication year: 2012
ISBN code: n.d.

The 2012 International Energy Agency report investigates progress with implementing energy efficiency policies in IEA member countries from March 2009 to April 2011. In order to help countries to improve their energy efficiency, the IEA has proposed 25 energy efficiency policy recommendations that cover 25 fields of action across seven priority areas: cross-sectoral activity, buildings, appliances, lighting, transport, industry and energy utilities. The IEA estimates that if implemented globally without delay, the proposed actions could save as much as 7,6 (Gt) $CO_2$/year by 2030, almost 1,5 times the current annual $CO_2$ emissions of the United States. The rigorous evaluation process is based on several information mainly related to IEA energy efficiency indicators, policies and measures database and to policy reports and questionnaire submitted by IEA member countries. The outcomes of this assessment show that there have been significant energy efficiency policy developments since the last evaluation conducted in 2009: IEA member countries have implemented many of the policies in the transport and lighting sectors that were only planned in 2009. The transport recommendations focus on road transport and include policies to promote ecodriving and to improve tyre energy efficiency and fuel economy standards for light and heavy-duty vehicles, due to heavy-duty vehicles are responsible for 30% of worldwide fuel use. In particular, Japan is the only country in the world to have fuel-efficiency standards in place for heavy-duty vehicles. Despite this, policies for heavy-duty vehicles lag behind light-duty vehicles. In regard to lighting sector the report revealed further efforts to improve lighting energy efficiency. For example, the Energy Performance of Buildings Directive (2010/31/EU) requires lighting to be considered within the overall building energy performance. Others energy efficiency policy developments are related to energy efficiency requirements for buildings that are a key feature of all IEA member country policies. Infact, most IEA member countries reported recent policies to improve energy efficiency in the buildings sector: Austria, Denmark, France, Germany and United Kingdom had planned policies to promote very-low or no-net energy consumption in buildings (passive-energy houses and zero-energy buildings-ZEB). Nevertheless, the biggest challenge facing most IEA member countries is to strengthen the energy performance of existing buildings. To do this, countries should improve minimum energy performance requirements for existing buildings and implement policies to increase the rate of energy performance renovations.

Most Italy energy efficiency policy implementation has been guided by EU directives and regulations, particularly in the transport, appliance, lighting, and buildings sectors. On the other side IEA states that Italy needs to enforce these policy measures and to maximize their effectiveness, implementing energy efficiency policies not covered by EU directives; for example, much is still to be achieved both in the industrial sector and high quality and comprehensive information for the entire building stock (i.e. information on use, building size, construction type and age) should systematically collected, in order to identify target and document barriers to increased energy efficiency in this sector. In summary, all IEA member countries still have significant unexploited energy savings opportunities that could be achieved with additional energy efficiency policy implementation, whose benefits extend beyond energy security and climate change mitigation to job creation and health improvements.

# 03

SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR BUILDINGS

## REVIEW PAGES: LAWS

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In this issue

## TOWARDS NEARLY ZERO-ENERGY BUILDINGS: THE FUTURE OF THE BUILDING SECTOR IN EUROPE

Since 2002, with the first Energy Performance of Buildings Directive (EPBD - 2002/91/EC), the European Union has set out a strong regulatory framework for achieving a substantial reduction of the energy consumption in buildings. On 8th July 2010, the European Parliament adopted the EPBD Recast (Directive 2010/31/UE) in order to strengthen the energy performance requirements and to clarify and streamline some of the provisions from the 2002 Directive it replaces.

The new version of the Directive tightens the implementation assignments for the Member States and sets the 9th of July 2012 as the implementations deadline. With the EPBD Recast the Member State has been severely tested since the Article 9 requires that "by 31 December 2020 all new buildings shall be nearly zero-energy consumption buildings (NZEB); and new buildings occupied and owned by public authorities shall comply with the same criteria by 31 December 2018". The EPBD doesn't set specific target for the renovation of existing building, but Member States shall follow the leading example of the public sector by developing policies and take measures such as the setting of targets in order to stimulate the transformation of buildings that are refurbished into nearly zero-energy buildings.

A definition of NZEB is given in Article 2 of the EPBD recast as "a building that has a very high energy performance" whereby "the nearly zero or very low amount of energy required should to a very significant level be covered by energy from renewable source, including renewable energy produced on-site or nearby". Member States shall furthermore "draw up national plans for increasing the number of nearly zero-energy buildings" by December 2014, which will have to include:

- the Member State's application in practice of the definition of nearly zero-energy buildings;
- the intermediate targets for improving the energy performance of new buildings by 2015;
- information on the policies and financial measures adopted to encourage improving the energy performance of buildings.

Each European country shall also draw up a list of the existing and potential instruments used to promote improvements in the energy performance of buildings that should be updated every three years.

# THE TRANSPOSITION OF DIRECTIVE 2010/31/EU IN THE MEMBER STATES

The European countries are at different stages in transposing and implementing the EPBD recast at national level. The Concerted Action EPBD (www.epbd-ca.org) and the European portal for energy efficiency in buildings, BUILD UP(www.buildup.eu), provide updated information on national implementation status.

A comparative analysis of EPBD progress towards implementation in EU 27 Member States has revealed significant diversity and that only some EU-27 Member States have managed to fully implement EPBD: some States have only adopted a national plan but have not transposed yet the directive into national law and *vice versa*.

In September 2012 the Commission started infringement procedures against 24 Member States that had not notified to the Commission the national measures transposing the directive into national law (the deadline for transposition in the Member States was 9$^{th}$ July 2012). In the meantime a number of Member States notified the Commission of their national transposition, although several did not, and reasoned opinions were therefore sent to Italy, Greece, Portugal, and Bulgaria in January 2013, to Spain and Slovenia in April 2013, to Belgium, Finland, France, Latvia, Germany, the Netherlands and Poland in June 2013.

Among them Italy (DL 63/2013) and Spain (Royal Decree 235/2013) have recently notified the Commission of their national transposition while Portugal did not and therefore the Commission has decided to refer Portugal to the European Court of Justice proposing a daily penalty of € 25 273.60 to be paid from the date of the judgment until the transposition is completed.

The Member States that have already drawn up national plans for increasing the number of nearly zero-energy buildings but that have not transposed the directive into national law are: Belgium, Cyprus, Finland, France, Germany, Hungary, Ireland, Lithuania, the Netherlands, Slovak Republic and Sweden.

To encourage the transition towards nearly zero energy building the European countries don't rely only on direct regulation but also on several economic instruments for energy efficiency in buildings, such as: economic incentives, duties, tax reduction and grants, taxes, charges, etc.

Austria, France and the Netherlands have established national grants for demonstration projects for nearly zero-energy buildings; Germany has allocated grants and reduced interest loans not only for demonstration projects but also for realization of passive houses (standard very close to nearly zero-energy buildings) and Belgium has established regional and local incentives for nearly zero-energy buildings, because the implementation of the Energy Performance of Buildings Directive is a regional responsibility.

In North Europe Denmark, Ireland and the United Kingdom have established national grants for demonstration projects. In particular, the Irish Department of the Environment, Heritage and Local Government has financed in 2009 ten nearly zero carbon social housing developments and the United Kingdom has introduced tax reliefs for "zero carbon homes". In East Europe, Latvia has set national grants for demonstration projects, and the Slovak Republic has foreseen easier administrative procedures for nearly zero-energy buildings at national level. Slovenia and Greece has established incentives for passive buildings and technologies related to nearly zero-energy concept (Annunziata *et al.* 2012).


# ITALY AND THE STEPS TOWARDS NEARLY ENERGY ZERO BUILDINGS

Italy transposes the EU Directive 2010/31 with the Decree Law n. 63 of 4 June 2013 governing "urgent provisions for the transposition of Directive 2010/31/EU on the energy performance of buildings for the definition of infringement proceedings by the European Commission as well as other provisions on social cohesion". The new Decree Law should be enacted into law within 60 days, a period during which the government will be willing to consider any comments made by the Regions.

The new provision amends and completes the Legislative Decree n.192/2005 and is intended to "promote the improvement of energy performance buildings, taking into account the climatic and local conditions, as well as the provisions relating to indoor climate".

The provision, entered into force on 6th June 2013, introduces the following innovation:

- the transition from "Energy Certificate" to "Energy Performance Certificate" (EPAs) to be drawn up by qualified professionals. The EPAS will be mandatory for all new buildings or for buildings undergoing relevant refurbishment, in case of sale or lease to a new tenant and for all properties occupied by public authorities. In case of new buildings the certificate is produced by the builder; in case of existing buildings, the certificate is produced by the property owner. In this regard, the Decree n.63/2013 establishes the penalties for violating the commitment to provide the Energy Performance Certificate for new buildings, for buildings in sale or subjected to a new lease and in case of violating the commitment to report energy parameters in the announcement of an offer for sale or lease. The certificate is valid for a maximum time of ten years since its release and is updated at each major restructuring that changes the building energy class;
- the implementation of a national calculation methodology for the definition of energy performance buildings, which will have to take into account the characteristics of the building envelope, the air conditioning systems and the production of domestic hot water;
- the development, by 31 December 2014, of the National Action Plan to increase the number of nearly zero energy buildings needed to clear the definition of NZEB, setting intermediate targets for improving the energy performance of new buildings within 2015, defining policies and financial measures for the transformation of the architectural heritage in NZEB;
- the determination of the date by which all public buildings will be transformed into NZEB; the Dl. 63/2013 fixed as the deadline December 31, 2018, by which all the buildings occupied or owned by public authorities, including schools, will have to be "nearly zero energy", extending this provision to all new buildings since 1st January 2021;
- the introduction of deductions of 65% for energy upgrading of buildings for expenses incurred from 1st July 2013 to 31th December 2013 and extending the deduction of 50% for renovations until 31th December 2013.


# SOLAR THERMAL ORDINANCES: MAKING A COMMITMENT TO LOCAL SUSTAINABLE ENERGY

Following the adoption of the Renewable Energy Sources (RES) Directive (2009/28/EC), the 27 EU Member States, "in their building regulations and codes or by other means with equivalent effect, shall require the use of minimum levels of energy from renewable sources in new buildings and in existing buildings that are subject to major renovation by 31 December 2014. Member States shall permit those minimum levels to be fulfilled, inter alia, through district heating and cooling produced using a significant proportion of renewable energy sources". In the framework of the RES and the EPBD it is therefore essential that not only the Member States should promote and encourage the use of energy in buildings, but above all the local authority. Local and regional authorities, in fact, play a vital role in setting-up and implementing renewable energy projects, energy efficiency measures and other energy-related activities. For this reason, at local level there have been developed some innovative planning tools, called "Solar Thermal Ordinances" (STOs), in order to encourage local production and use of renewable energy sources as well as enhance energy efficiency. Solar Thermal Ordinances (STOs) are legal provisions requiring owners of buildings to install a solar thermal system for new buildings or for buildings undergoing major renovation. They are in most cases part of national or regional energy laws and often implemented by means of the local building codes at municipal level. A growing number of municipalities, regions and countries (e.g. Spain, Portugal, Italy, the Baden Wuerttemberg region in Germany and some Austrian regions) are already making use of solar thermal obligations. The first European city to have a Solar Ordinance is Barcelona in August 2000 requiring residential and commercial buildings to generate 60% of hot water requirements from solar. This paved the way for the STO to be included in the national technical building code (CTE, Codigo Tecnico de la Edificacion), approved in 2006, which includes an obligation to meet some of the Domestic Hot Water (DHW) demand with solar thermal energy (whose contribution varies between 30 and 70%). A major benefit of solar thermal ordinances is their effectiveness combined with low costs and limited administrative overheads for public authorities. As part of the building permit process, the inspection with regard to the renewable energy requirement is simple and thus does not strain the public budget.

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**04**

SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR BUILDINGS

# REVIEW PAGES: URBAN PRACTICES

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In this issue

## INTELLIGENT UNIVERSITY CAMPUS: THREE CASE STUDIES

More efficient and cost-effective use of the built environment is increasingly being driven by economic and environmental pressures requiring reduction of the cost of ownership and operation of commercial and public buildings. The emerging solution to these pressures is the creation of innovative and ICT-based technologies that improve buildings' efficiency in a reliable, cost effective, and sustainable manner.

For this reason, despite the current economic crisis, the demand for smart building technologies is still growing. Indeed, the value proposition for smart technologies has been demonstrated and a growing number of building owners are starting to adopt them with positive results. From early applications to commercial and office buildings, smart buildings technologies are now applied to a wide range of building types such as residential and educational buildings. As the technology continues to evolve, improve, and decrease in cost, efficient and intelligent technologies will start to become an even more pervasive fixture in buildings worldwide.

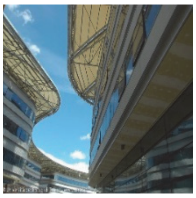
This paper focus on a particular type of educational building: the university campus. In particular, the paper describes and analyzes the use of smart technologies and innovative building solutions applied in three university's campus projects:

– Campus Luigi Einaudi of the University of Turin (Italy)
– King Abdullah University of Science and Technology's Campus (Saudi Arabia)
– Cloverdale Campus of the Kwantlen Polytechnic University (Canada)

The case studies aim to analyze the design solutions and technological opportunities offered by this new emerging approach to smart and sustainable buildings.

Although the three case studies are diverse in nature and combine different techniques, they share a set of characteristics that set them apart from "conventional" buildings. An intelligent site planning, low impact buildings material, bioclimatic strategies and solar design, the integration of building services and computer-based building management systems represent key features in the analysed projects.

Compared with "conventional" buildings, these buildings improves operational performance, increases occupant comfort and satisfaction and provides the owner with systems, technologies and tools to manage and minimize energy and water consumption.



# THE STUDY CASE OF CAMPUS LUIGI EINAUDI OF THE UNIVERSITY OF TURIN – ITALY

Opening with the academic year 2012-13, the new seat of the Faculty of Law and Political Sciences of Turin completes the campus that the University of Turin is building as part of a complex program of reorganization of its offices that, started in late nineties, included the moving of the faculties in new structures on abandoned Italgas areas along the river Dora.

With 45,000 square meters, 14,000 square meters of green, 70 classrooms for 80,000 students and the modern library pole, the campus is an integral part of a broader process of regeneration of the Northern Eastern part of the city, once headquarter of high environmental impact industries, a site in complete state of abandonment since the seventies. The new complex is designed with a great focus on the issues of environmental sustainability and energy conservation, using innovative low impact materials and an integrated and computerized management of the technological systems.

The new campus, designed by the British firm Foster & Partners, is composed by seven blocks (with parking and technical rooms in the basement) distributed around a circular plaza. A suspended roof, designed with the most innovative criteria of bioclimatic strategies and solar design, connects and shields the campus buildings. Its overhanging sides, devised and diversified according to solar gain, provide the right compromise between sunshine and shade on the walls. Hence, the high level of comfort inside the building and the significant reduction of air-conditioning costs in the summer. This strategy has permitted the use of large windows (ensuring the containment of heat) and the provision of work-study positions with a direct view, overlooking the surrounding landscape. Recourse was made to low-consumption and adjustable lighting (depending on the type of employment and use of the environments) and integrated lighting equipment. From the point of view of consumption containment, the integration between natural and artificial lighting ensures an energy saving of about 20%.

The walls, designed and built to acoustically insulate the building, provide noise abatement which reaches values exceeding 48 dB: even in the presence of high external noise (due to traffic for instance) the educational or consulting activities take place in a quiet and comfortable environment.

Particular attention has been taken in the use of building materials that minimized detrimental environmental effects while promoting, for example, wood products that meet rigorous FSC environmental standards. Over 7,200 square meters of outdoor photo catalytic flooring have been used that, thanks to the combined action of sunlight, neutralize the hydrocarbon molecules, or dust pollutants that settle on them.

A centralized, integrated and computerized management of the technological systems allows the regulation of consumption according to actual use of the building, while continuously monitoring and reporting indoor temperature and air quality condition.

The supply of heat and cold from the trigeneration plant of the complex allows approximately 15-20% savings compared to separate production with individual machines, better efficiency, reduced emissions and increased effectiveness of controls.

# THE STUDY CASE OF KING ABDULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY CAMPUS – SAUDI ARABIA

King Abdulla University of Science and Technology (KAUST) is a new graduate-level research university established in Saudi Arabia to drive innovation in science and technology, and to support research in areas such as energy and the environment. The University's focus on sustainable development is well reflected in the site planning and in the building design of the new KAUST's campus, located on the Red Sea at Thuwal and officially opened with the academic year 2009-10.

Designed and built in just 30 months, the campus integrates a series of innovative strategies to create a low-energy, highly sustainable project in the context of an extremely hot and humid climate, limited rainfall and potable water resources. With its 800 postgraduate students and 600,000 square meters of lot size, located on a flat desert coastal, the campus itself can be considered as a living laboratory where smart technologies are tested.

The campus, designed by the international architecture firm HOK, is composed by 27 buildings arranged in a semi-circle, which border a harbour on the Red Sea. These buildings are specifically located and grouped to maximize the benefits of the unique site microclimate and ecosystem. The strategic position of the buildings was designed to reduce outdoor walking distances and to mitigate the detriments of the sun's movement and the harsh Saudi Arabian climate by minimizing the amount of exterior envelope exposed to the sun. Light-colored paving materials were selected to reflect solar heat gain and decrease the overall temperature. A monumental roof connects and shields the campus buildings from the harsh climate. This roof has been designed to incorporate massive solar thermal arrays to provide domestic hot water to all campus buildings, and solar photovoltaic arrays to generate and distribute power to campus buildings based upon demand. While the roof protects the buildings from excessive solar gain, atria and courtyards have been integrated throughout campus buildings to infuse natural daylight and facilitate natural ventilation into a majority of the interior spaces.

Passive ventilation strategies of the traditional Arabic house also influenced the design of two iconic, solar-powered wind towers that harness energy from the sun and wind to passively create airflow in pedestrian walkways.

Recognising the value of the water in the region, numerous strategies to reduce the amount of non-potable water needed to irrigate the KAUST campus have been implemented. The comprehensive irrigation plan, for instance, allocates water reclamation loads from condensate, storm, gray and black water to satisfy a majority of the irrigation requirements.

Particular attention has been taken in the use of building materials selection: 38% of materials have being manufactured within 500 miles of the site, and 21% containing recycled content. 100% of the wood was FSC certified.

Highly interactive direct digital controls optimize system operation while continuously monitoring and reporting system performance, energy harvested, energy recovered and energy used to ensure long-term energy management.

The project delivers exceptional performance in the areas of water (100% wastewater reuse, 42% water reduction) and energy (27% annual energy cost savings, 7.8% percent on-site renewable energy). Furthermore, KUAST campus is Saudi Arabia's first LEED certified project and is the world's largest LEED Platinum campus.

# THE STUDY CASE OF CLOVERDALE CAMPUS OF THE KWANTLEN POLYTECHNIC UNIVERSITY – CANADA

Officially opened in 2007 as new home of Kwantlen's Faculty of Trades and Technology, the Cloverdale Campus is a successful example of integration between architecture, natural systems and smart technologies.

With its 17,000 square meter, 21 shops, a lab for a variety of trades and technologies and 27 classrooms that accommodate up to 900 full-time students, the campus was designed to minimize the environmental footprint through efficient use of energy and water resources, while providing improved indoor environments and healthier building sites.

Designed by the Canadian firm Bunting Coady Architects, the campus use approximately 50% less energy than other universities across North America. Indeed, The Cloverdale campus is the City of Surrey’s first certified LEED Gold building.

Particular attention has been taken in the site planning: building orientation and landscaping were developed to optimize energy performance of the building. The placement and positioning of the Centre allows more natural light and natural ventilation supplied by operable windows and the use of the skylight as a central air chimney.

A major characteristic of the building is the intensive use of renewable energy resources. The Institute’s greenhouses draw power from a geothermal energy system, while a bio digestion system uses methane recovered from green waste to power the greenhouses’ operations. . A large south-facing photovoltaic array generates 5 kilowatts of renewable energy.

Several water conservation strategies, such as the low-flow drains installed on the roof, allow a water use reduction of 45 % over “baseline” conditions.

Great attention has been taken in the use of locally produced materials and from non- or low-VOC (volatile organic compound) emitting products: at least 50% of building materials are manufactured locally while the wood for the roof and the interiors was sourced within a 500-mile radius of the campus.

The Building Automation System was embraced as a core area of focus to enhance facility improvements and achieve their environmental sustainability goals, which contributed significantly to achieving the LEED Gold Certification.

Some of the key technologies installed includes building controllers integrated with lighting occupancy sensors, isolation dampers for rooms with scheduled operating times, digital networked thermostats for precise control and feedback, occupancy sensors triggered by sound, in addition to movement, control of exhaust systems, and awareness and training programs.

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# 05

## SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR BUILDINGS

# REVIEW PAGES: NEWS AND EVENTS

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In this issue

## SMART BUILDING

The field of smart buildings is one of the most dynamic sectors of smart cities, affected by a major research activities, with many and important innovations in recent years. In the future it's expected greater progress to transform almost all the current concept of building. The goal is to include the development of buildings that turn in real intelligent entities, able to continually adapt to the different needs of different and multiple users. Of course, the road is still very long, but all over the world there are a lot of experimental projects implemented successfully and that promise to build new buildings and renovate existing buildings in smart buildings. In this context of particular importance for the various operators, investors and industry researchers to organize events that allow to show the benefits of new solutions developed, ready to be applied and the possible developments planned for the future. These events are also an opportunity to promote and initiate an exchange of ideas between the various stakeholders, in fact in almost all the exhibitions are planned sessions for discussion and debate. Most of these events take place in the countries in the developing world, that is in those countries currently interested by a strong economic and social development. In which the greater dynamism and the availability of capital to invest in this sector means that in these countries are numerous initiatives and opportunities to enable the realization projects dedicated to the realization of smart buildings.

Among the many events organized at European and international level expected in the coming months, there is the Green Building Brazil 2013, that is an international conference focused on the theme of sustainable buildings that will take place at the end of august in the Brazilian city of Sao Paulo.

This year is now in its fourth edition, which now can be considered the leading industry conference of fields for the whole of Latin America. The Green Building Brazil is organized by the Green Building Council of Brazil, which also seeks with this event to allow for a constructive dialogue on these issues among managers, entrepreneurs and professionals interested in the development of sustainable buildings. In particular, there are many Brazilians and international experts who take turns during the various sessions of the conference to discuss and present new solutions and experiences that have been or are being developed in this area. There are numerous companies that during this conference have the opportunity to show a wide and qualified audience their products and services. Each year the conference is also an opportunity to take stock of the state of implementation of LEED (Leadership in Energy and Environmental Design) in general in Brazil and in Latin America. And in particular, one of the main topics discussed with is the one on the application of LEED to the next big sporting events that will take place in Brazil in the coming years from the World Cup in 2014 and then finished with the Olympics in Rio in 2016. The goal of the organizers of the World Cup is to organize the first Green World Cup history, then to plan the same objective was also moved by the organizing committee of the Olympic Games in Rio.

From the European point of view one of the main events that will take place in the old continent in the coming months and that will also address the issue related to the development of smart buildings is the Sustainable Conference 2013. This conference will take place in the first half of September in the city of Graz in Austria, and is organized by Graz University of Technology and the Institute for Sustainable Technologies. This conference is one of a series of major international conferences that address the issues of sustainable buildings and that are promoted by the International Council for Research and Innovation in Building and Construction. The program of this conference has a duration of three years. During the first year they prepare regional conference, the second year is devoted to the performance of these, and finally in the third year there is the World Conference, which will take place in Barcelona in 2014. On the website ww.sbconference.org, you can find the list of all the regional conferences that are not carried out and that will take place during 2013, prior to the World Conference. The importance of the organization of these regional conferences borns from the desire to consider all aspects of technical, economic, social and environmental issues related to sustainable building and how these are addressed in the various regions of the world. In order to create a common knowledge in relation to these issues, as well as to promote also the start of fruitful international cooperation. The importance of the creation of such a network of exchange of information arises from the fact that the construction industry is one of those areas that has more room for innovation and has a great impact on the environment.

Another event of particular interest organized in Europe is the Green Building 2013, which is the most important exhibition in the field of sustainable and energy efficient buildings in Denmark and is organized every year in the first part of October in the city of Copenhagen. In the years, this conference with the large participation has become an important point of reference for all the countries of the Baltic region. In this conference there is the participation as exhibitor many Danish companies that have developed practical and effective solutions that generate real benefits for the environment. For them, this conference is an excellent opportunity to show off a national and international level, given the large participation of visitors on the way of politics, the constructions and design. This conference is of even greater prestige as anticipated by a few days one of the most important global conferences related to issues of environmental sustainability and that is the Global Green Growth to be held at Copenhagen October 21 to 22. In Denmark many initiatives undertaken in agreement between the public authorities and the private investors to ensure greater sustainability of buildings, with the intention to arrive in the near future the construction of buildings can reduce energy use and produce more than what they consume. Looking at the success and great participation in these events it can be stated that the achievement of this goal isn't far away.

Another of the countries interested in recent years by a strong development in which cities are expanding is India. In this country there is a big interest on the part of public authorities and private investors in creating new buildings that provide a minimal use of new natural resources and that they are able during their exercise to limit the energy consumption for their operation. This search for new smart solutions is dictated by the absence of new resources and the need to reduce the maintenance costs of the buildings. To respond to these needs of the various stakeholders is organized Indian Smart Building Summit 2013, which will turn in 3 to 4 October in the city of Mumbai. The topics, during the two days of events, will be numerous and affect all life stages of the building and the various types of use of buildings and also analyzing the way in which the individual buildings interact with each other. So the vision that is provided to participants during the various sessions in which the conference is divided, it is very broad and comprehensive as to highlight the benefits and opportunities deriving from the use of smart solutions related to both the creation from scratch and the renovation of existing buildings.

Another event organized is the Shanghai Intelligent Building Technology now in its 7th edition will take place in 25 to 27 September at the new exhibition center in Shanghai, where will be set up over 10,000 square meters of exhibition space. This event aims to become the reference point for the growing field of smart solutions, which is developing rapidly in China. In fact, with the rapid economic growth of the country and the ambitious goals of urbanization, is growing the demand for new technologies and solutions that deliver increased comfort, convenience, energy efficiency and security of the buildings.

The growing demand for new smart solutions is also due to the strategic choice of the Chinese government to focus concretely to the development of smart cities in China, so this has become one of the main priorities that the Chinese government is working. This choice has led many state and private companies that are investing in these initiatives. For example, the China Development Bank, is committed to pay USD 12.9 billion of euro for various projects on smart cities between 2013 and 2015. This year's edition will focus in particular on three central themes of Building Energy Efficiency, smart cities and smart homes. In addition to the large exhibition areas, with many exhibitors of major global companies are provided a series of forums and seminars as well as to enrich the event for both visitors and for exhibitors.

The planned sessions include discussions and presentations on the following main topics:

- Shanghai International Intelligent Building Development Symposium.
- Building Automation and Energy Management Systems Technical Seminar.
- China Smart Home Industry Alliance Forum.
- Intelligent Building and Wiring Systems Forum.
- Solutions for the city safe and Smart Building: Russian and international experience.
- KNX Technical Seminar.
- Shanghai Intelligent Building Technology - Building Standard forum.

GREENBULDING BRASIL
Where: Sao Paulo – Brazil
When: 27 - 29 August 2013

SUSTAINABLE BULDING CONFERENCE
Where: Graz - Austria
When: 25 -28 September 2013

INTELLIGENT BUILDING TECHNOLOGY
Where: Shangai - China
WHEN: 25 - 27 September 2013

SMART BUILDINGS INDIA SUMMIT
Where: Mumbai - India
When: 3 – 4 October 2013

BUILDING GREEN
Where: Copenaghen - Denmark
When: 9 – 10 October 2013

**WEB SITES**

http://www.buildinggreen.eu

http://www.expogbcbrasil.org.br/en/

http://www.messefrankfurt.com.hk/fair_homepage.aspx?fair_id=45&exhibition_id=46

http://www.nispana.com/smartbuildings/

http://www.sbconferences.org

http://www.sb13.org

Il Bahrain World Trade Center è un edificio costituito da due torri alte 240 metri, situato nella capitale del Bahrain Manama. La costruzione delle torri è stata ultimata nel 2008 ed è il primo grattacielo al mondo che integra delle turbine eoliche nella sua struttura (http://www.bahrainwtc.com/)

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Journal of
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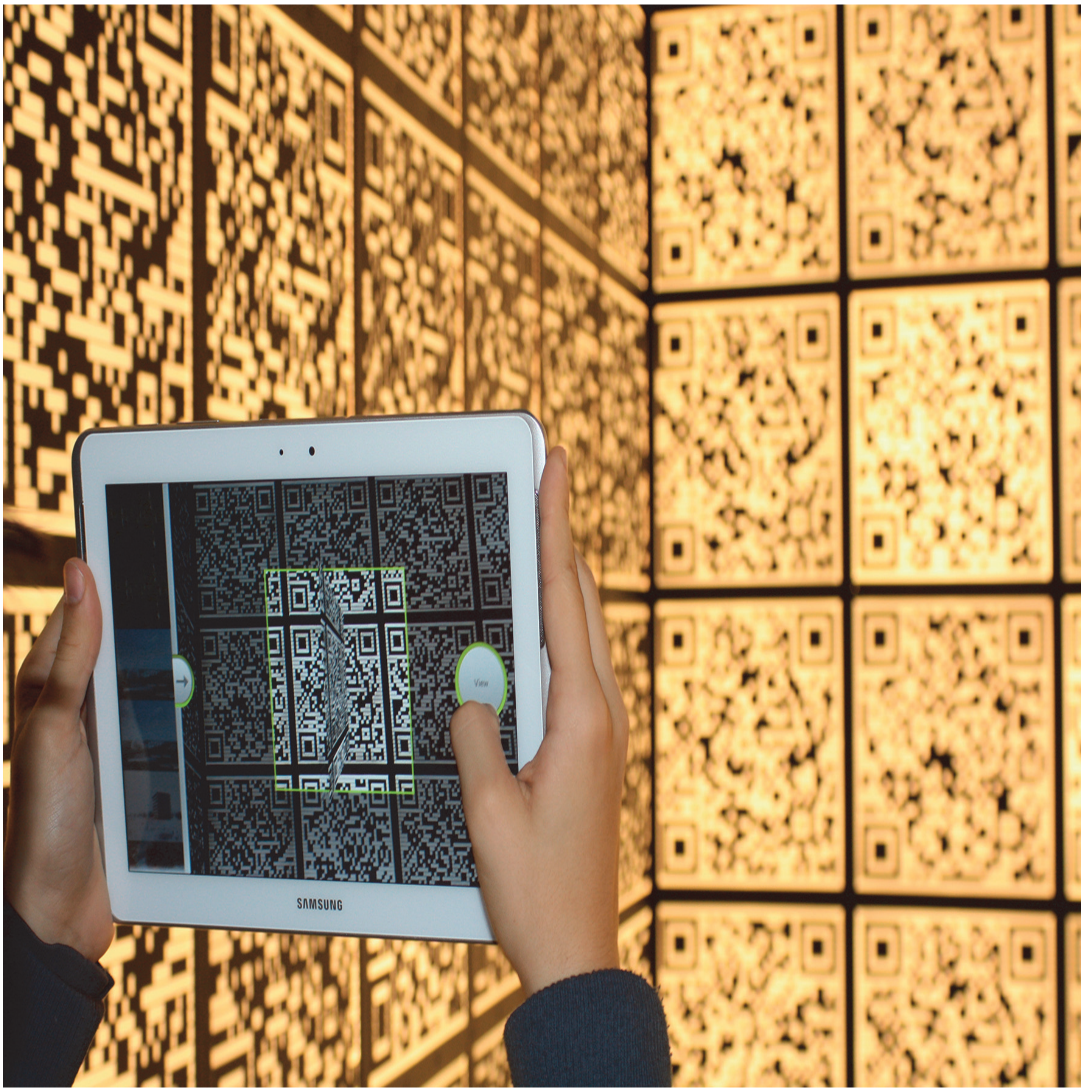
# SMART CITIES:

## RESEARCHES, PROJECTS AND GOOD PRACTICES FOR INFRASTRUCTURES

3 (2013)




Giusepe Mazzeo, Mediateca TeMA*Lab* 2012

TeMA

Journal of
Land Use, Mobility and Environment

TeMA 3 (2013) 291-292
print ISSN 1970-9889, e-ISSN 1970-9870
DOI: 10.6092/1970-9870/2189



# EDITORIAL PREFACE:

# SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR INFRASTRUCTURES

ROCCO PAPA
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The volume n.6 of TeMA Journal of Land Use, Mobility and Environment deals with the topic of Smart City and this third issue deals in particular with the theme of Smart Urban Infrastructural systems. The main subjects that this issue point out are innovation of networks and infrastructural systems for people and goods mobility; advanced technologies of communication; intelligent systems for energy production and distribution; innovation in the production and management of water systems and disposal; early warning systems; monitoring systems for provision of real time information on different aspects of urban life (mobility, climate conditions, safety and so on). In this broader context one of the key theme is the role of ICT in innovating government and the policy decision processes: by enhancing the linkages between various governmental and social organizations, ICT supported knowledge flows (Socio Technical System) is a mean for sustaining innovation in the public sector since they enables governments to better cope with the uncertainties of a complex environment.

The first article of this issue is named "Collecting distributed knowledge for community's smart changes" by Alessandro Sciullo and Sylvie Occelli. The article is an output of the MIDA project (Monitoring ICT Digital Divide in Asti) that has been carried out in Piedmont Region by the Asti Province government supported by the regional ICT observatory (PICTO). The project, taking inspiration from a crowdsourcing approach, involves citizens in the data collecting activity concerning broadband coverage, Internet access and usages. MIDA has been an opportunity to test the role of Internet as a dynamic collaborative environment in which diverse information, opinions, experiences collective benefits is likely to emerge from aggregated individual contributions, connecting statistically relevant data and interpreted information, thereby shaping a sort of collective learning process. The study suggests that local governments have a main role to play in prompting community transformation processes and to give local government information for policy interventions and to give citizens an opportunity to understand what the contents of the policy interventions are likely to be about, thus representing an effort to establish relationships between inside and outside government and make the linking between government and governance more effective.

The second article by Giuseppe Mazzeo titled "City and energy infrastructure: a between economic processes and urban planning" analyses the relationships between energy, economy and urban planning, assuming the city as an intelligent system constantly evolving and as a system where economic processes come out at their highest level affecting other aspects of social and urban structure. The article analyzes the meaning of the intelligent city as an entity that is constantly changing and continuously adapting; another aspect studied is the role of the energy systems in the evolution of the activities and of the city's image. Finally the paper investigates the role of the economic factors in the city evolution, pointing out that the way towards smart and green urban systems largely depend on their economic advantages.

The third article by Paola Pucci is titled "Mobile Phone Data and Mobility Policy" and it focuses on the potentialities offered by mobile phone data to provide useful knowledge of spatial practices and the use rhythms of the contemporary city, for more effective and equitable mobility policies. Starting from the results of a research carried out by the Politecnico di Milano, using mobile phone data provided by Telecom Italia and finalized to verify the meaning of mobile phone data in returning the density of land use and the origins and destinations of daily movements, the paper highlights how new maps, based on the processing of mobile phone data can exemplify spatialized urban activities and how they can give new insights for analyze space-time patterns of mobility practices.

The fourth article titled "Smart Mobility Opportunities and Conditions" by Luca Staricco, starts from the assumption that most of the opportunities of smart mobility are related to technological innovations for managing and organizing trips and traffic and for improving the environmental efficiency of vehicles; but the impacts of these innovations, in particular over the long term, depend on how they are embedded by the users in their daily activities and practices. These "boundary conditions" are often disregarded, just as they generally concern not a technological dimension, but the psychological-cognitive and socio-cultural domain. The article analyzes the boundary conditions and the opportunities they can support and which risks can emerge if they are not fulfilled.

In the last article, titled "EU Smart City Governance" the authors Carmela Gargiulo, Valentina Pinto and Floriana Zucano analyse three documents of the European Commission (Cohesion Policy 2014-2020 of European Community, Digital Agenda for Europe and European Urban Agenda) describing the general contents of these policy documents, illustrating the scenarios for the future of the European cities according to them and tracing the evolution of the Smart Cities theme developed by these three instruments.

Finally the Review Pages define the general framework of the theme of Smart Cities Infrastructures and Network with an updated focus of websites, publications, laws, urban practices and news and events on this subject.

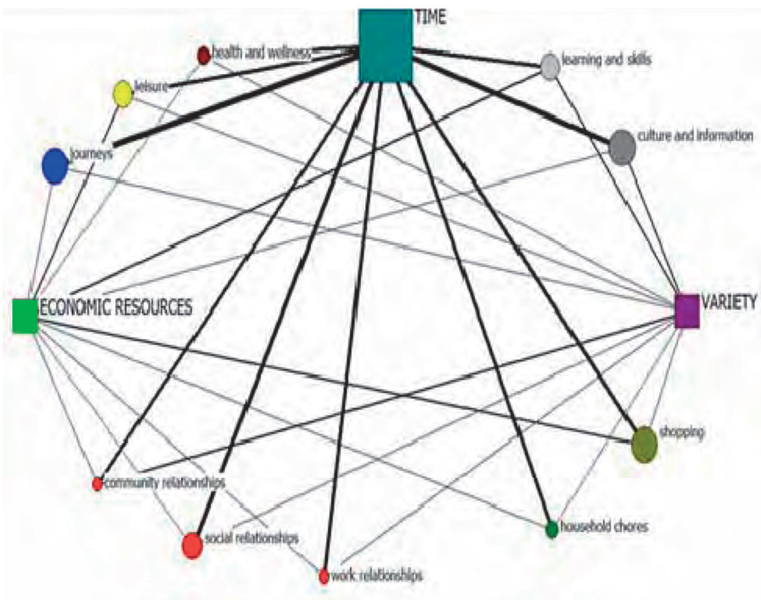
TeMA

Journal of
Land Use, Mobility and Environment

TeMA 3 (2013) 293-309
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1931

review paper received 29 September 2013, accepted 30 November 2013

www.tema.unina.it




# COLLECTING DISTRIBUTED KNOWLEDGE FOR COMMUNITY'S SMART CHANGES

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ABSTRACT

The paper deals with the role of ICT in innovating government's and the whole process of "policy production process".
By enhancing the connections between various governmental and social organizations, ICT supported knowledge flow s and the associated Socio Technical System may be a vehicle to support innovation in the public sector. In fact, they would enable governments to better cope with the uncertainties of a complex environment.
The MIDA Project carried out in the territory of Asti Province (Piedmont) can be considered as an attempt to engage in building such as a system.
The Project uses a crowd sourcing approach and it involves citizens in collecting data concerning broadband coverage, Internet access and usages.
From a research standpoint, MIDA represented an opportunity to test the role of Internet as a dynamic collaborative environment where statistically relevant data and interpreted information could be merged.
In terms of policy, the project stood as an opportunity for the local government to engage itself in a new policy approach to grasp people's needs and improve service delivery.

KEYWORDS:
policy innovation, socio technical system, crowd-sourcing, collective learning.

# 1 INTRODUCTION

## 1.1 BACKGROUND: PUBLIC SECTOR ON THE MOVE

This paper is concerned with ICT supported knowledge and its role to spur innovation in government and the whole policy production process. Lately a main shift has taken place in ICT government programs as these are evolving from being narrowly defined as a technology to enhance the efficiency of transactions through ICT applications, to a system approach facilitating the linkages between the various government departments and social organizations (Occelli, 2102a).

ICT supported knowledge flows accompanying and/or underlying these linkages (what in the literature has been popularized as Socio Technical Systems). Indeed, they have a foundational role in establishing (new) infrastructure for policy activity and service delivery. Moreover, they help achieving greater openness and transparency in the government transformations, while reinforcing resilience in the transformation processes (see Maier-Rabler and Huber, 2011, Davoudi, 2012). ICT supported knowledge flows (STS), in fact, are a main vehicle for empowering changes (sustaining innovation) in the public sector, while enabling government organizations to better cope with the uncertainties of a complex environment (see Nograsek, 2011, Witworth, 2009). Ultimately, they are a crucial determinant in establishing the smartness of today cities and local communities (IBM, 2013, Nim and Pardo, 2011).

## 1.2 THE STUDY CONTEXT AND MOTIVATIONS

The above arguments are also true for Piedmont, where since 2005 an observatory has been established, the Piedmont ICT Observatory (PICTO), with the aim to accompany and monitor the deployment of the 2005-2009 broadband programme in the region. As this came to a completion in 2010, a number of thorny questions became apparent, concerning the role of ICT in supporting the regional smart growth as required by the Europe 2020 strategy. Among them, how to properly leverage the cascade of changes produced by broadband/Internet and how to address the new types of digital divides likely to be caused by an increasing demand variety of higher performance broadband services.

It became apparent therefore that PICTO's earlier concern to provide a pertinent observation lens of ICT spreading in the region, needed to be extended to better account for the technology impacts as agents and organizations appropriate of ICT in social practices and transform their original functions.

In 2012, the collaboration with the Asti Province provided an opportunity to address some of these issues. Situated in the central hilly part of Piedmont, Asti is a relatively small area (220.000 inhabitants), mostly rural, where, in spite (or because) of forms of digital divides persisting, awareness over the potential of broadband has increased over time. To better target future ICT policy initiatives in the area, the local government decided to engage in what back then was unique experiment within the Italian context. With the scientific support of PICTO and the institutional endorsement of the R&D Department of the Piedmont Region, it launched a project (Monitoring Ict Digital Divide in Asti, the so called MIDA project) which directly involved citizens in the data collecting activity concerning broadband coverage, Internet access and usages.

Notwithstanding a shared interest by all supporters for testing in vivo an innovative approach, different objectives motivated the experiment:

a) an overarching policy goal to have more reliable (and geo-referenced) information about the quality of broadband services at municipal and sub-municipal level (as required by the European Digital Agenda);

b) a management purpose associated with the need to establish a platform for information exchange between citizens and governmental bodies allowing for quicker service delivery at sub-regional level (as hoped for by national e-government initiatives);

c) a research interest, stimulated mainly by the opportunity to explore a new type of approach for collecting information about ICT equipment and usage.

This paper gives an account of the main results of the MIDA project, focusing in particular on those more oriented at addressing some research issues which are also

- data vs. knowledge issue, that is the possibility to collect more relevant data, better understand the available ones, give meaning to them and use the more performing information for relevant action;
- involving recipients of a policy initiative at the early stage of a policy;
- investigating new kind of knowledge, and namely the possibility to connect quantitative and qualitative information.

To fulfil these purposes, the paper has been organised in four sections.

Section two gives an overview of the main challenges government organizations are confronted with for making their activities more open, efficient and effectives. In section three the context of the study is introduced and the Asti situation briefly outlined. Section four recalls the project design and discusses its main results. Finally, some general remarks and suggestions for future research are outlined in section five.

## 2 A CHANGING GOVERNMENT ENVIRONMENT

Notwithstanding considerable progress has been made over the last decade, the impact of ICT applications in policy practices has been limited or, at least, their results in terms of public service effectiveness and efficiency have not matched the expectations.

The reasons are manifold and can be attributed to various factors such as: i) the difficulties in keeping up with the rapid pace of technological improvements; ii) the lack of resources and competences to comply with ICT regulative frameworks; iii) the inertia in the overall government organization.

In Piedmont, some of these questions have been regularly investigated since 2005, when an observatory was established, the Piedmont ICT Observatory (PICTO), to accompany and monitor the deployment of the 2005-2009 broadband programme in the region.

When the programme came to a completion in 2010, a number of thorny questions arose.

First, as observed in other countries (see for example Centeno, van Revel and Burgleman, 2005, Navarra and Cornford, 2007) some shortcomings in the currently implemented approaches became apparent as most regional e-government programs turned out to be too narrowly conceived. Being mainly aimed at enhancing the efficiency of transactions through ICT applications, they paid little attention at the relational capability of ICT applications, i.e. how their usage could enhance the linking among the different government departments and between institutions and citizens. In addition, most of the programs proved unable to keep the pace with the technological advancement and exploit the potential of new applications, such as those based on web 2.0 and social networks.

Second, it was understood that fresh opportunities existed in the role ICT could play in supporting the regional/local growth paths as required by the Europe 2020 strategy, i.e. by properly leveraging the cascade of changes produced by broadband/Internet and addressing the new types of digital divides likely to be caused by an increasing demand of diverse and higher performance broadband services.

More generally, the questioning gives ground to the idea that in order to get full advantage of technology, government organizations have to re-mould themselves and namely to change their working while better adapting to the context (see Australian Government Department of Innovation, Industry, Science and Research, 2011, OASIS, 2011, Occelli, 2012a, Scholl, 2003, Swederberg and Douglas, 2003). That is it is becoming increasingly apparent that (also) government organizations have to engage in a co-evolving process of mutual adaptation (see for example Middleton-Kelly, 2011, Gill-Garcia, 2012), whereby reflection about it is itself part of the process (Occelli, 2006, 2008).

In Piedmont as well as in Italy, the issue has been generally overlooked as other questions related to the efficiency of public administration, the steady reduction in public funding and the viscosity of inter-institutional relationships were considered as more prominent.

Indeed, considering innovation as a way to empower changes has never been a main concern in the public sector (see NESTA, 2008), mainly because: a. the fact that in the public sector most transformations are imposed by legislation or political changes, b. the weakness of ecological forces of competition and the risky aversion attitude in the public sector and c. the difficulty to have clear indications of the benefits yielded by the outcomes of the programs, in term of public value.

The mandatory nature of many e-government initiatives, is also a major explanation for the ICT diffusion trend observed in the local authorities of Piedmont, where progress in the last decade has taken place with boots and straps according to legislation (see PICTO, 2012).

Recently, some weak signals revealed by PICTO findings suggest that new possibilities may exist. As the socio technical infrastructure implemented by the regional broadband program consolidates and more open and transparent government websites are created, new opportunities exist for (ICT based) information delivery and creation. Indeed, they can support more comprehensive, robust, and socially oriented e-government programs. Information about the whole as well as the different components of service production process turns out to be one of the main drives for innovative changes in government organizations to take place. It is an essential ingredient for achieving cost effectiveness, and, up to a certain point, to increase variety in the service bundles and their delivery alternatives.

As widely documented in the literature (see Berra, 2007, Castells, 2004, van Dijk and Winters-van Beek, 2009, Wellman, 2003, Whitworth, 2009) ICT networks are crucial enablers for these processes because: a) they facilitate the valuable connection between the internal and external observation lens of the different actors involved in government programs, b) they facilitate the inclusion of service users as a main information source in reference to the service performance and expectation and c) they make it possible to create (adapt) new so-called Socio Technical Systems, through which those programs are implemented in situated context.

## 3 THE PIEDMONT REGIONAL CONTEXT AND THE ASTI PROVINCE

### 3.1 ICT PENETRATION IN THE REGION

With the completion of the five-year regional broadband programme in 2010 the skeleton of a region wide socio technical infrastructure was established in Piedmont. Its impact on the penetration of the Internet and web related services has been noticeable, although the development of e-government services depended very much on the evolution of the national agenda and were led by the Italian public administration laws.

To date, almost all municipalities and government offices in the region are now equipped with the basic ICT infrastructures and services (broadband, certified e-mail, digital signature and institutional websites). The interactivity level of online services, however, is still low and limited to the provision of fill-in forms to prompt administrative procedures. The most widespread online service is population registry self-certification, followed by property tax payment, which is also the most widely available among the transactional services.

ICT presence is the highest in core administrative back office services, such as taxes, demographics and financial services. These services are often managed inside the administration (CRC-PICTO, 2012).

One municipality out of four perceives ICT equipment cost as the main barrier to ICT penetration in the organization, Fig.1.

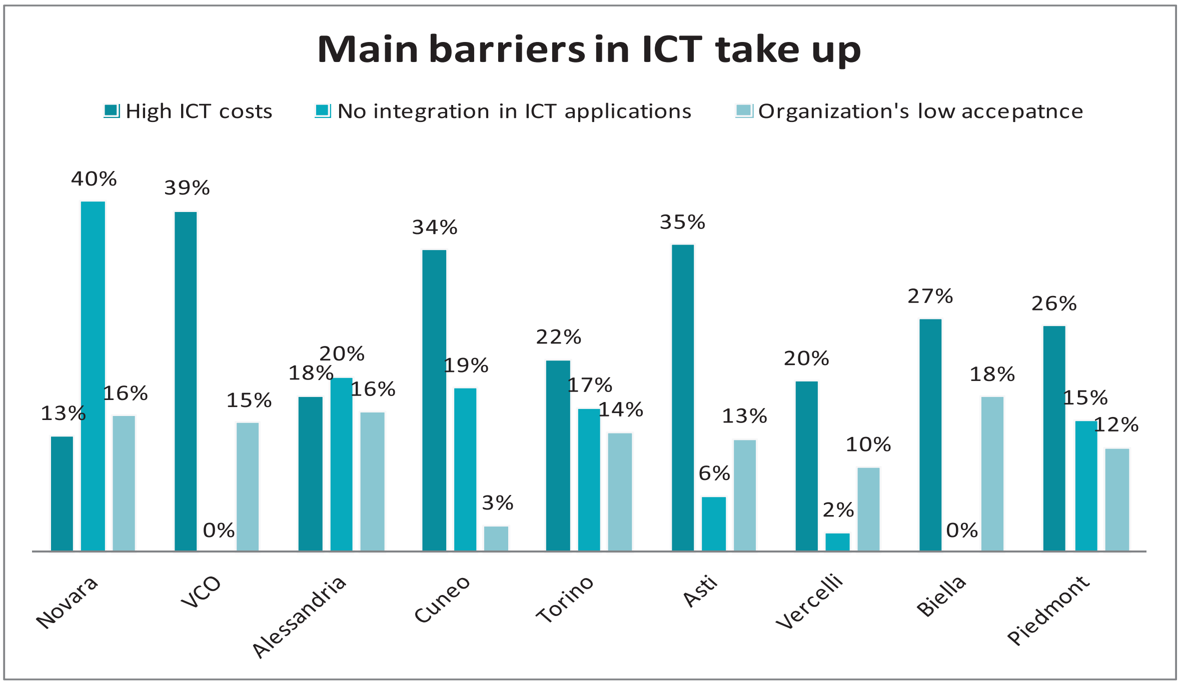



**Figure 1: Main barriers in ICT take up by municipalities in Piedmont province, 2011**

Additional difficulties emerge in the low capability to exploit, or at least to properly handle, the cascade of changes produced by the ICT usages.

In 2011, the PICTO survey on ICT diffusion among local authorities investigated some of these aspects[1] and reported on:

the front-office oriented action domains, such as better understanding the users' needs, improving the quality of service and promoting new functionalities in service delivery;

the back-office oriented changes, meant at improving service accessibility interoperability and personnel's ICT skills and competence, simplifying access procedures and norm revision.

Results show that, so far, awareness by local authorities on the possibilities offered by ICT to design service upgrading and/or upgrade existing functionalities is still low.

As for the action domains, only half of the municipalities considered the quality of service and users' needs as important (or the most important) domains for action, Fig.2. Compared with the regional profile, the Asti province showed a greater concern for having better insights into users' need.

Requirements for back-office changes were however more evident.

About half of the municipalities reported that the majority of the existing services needed to be improved, Fig.3.

1 A sample of 189 municipalities, out of 1206, were surveyed. The questionnaire investigated all the back office activities and for some of them assessed some main underlying dimensions, such as costs, skills of the employees, quality of services, functionality, etc.(see, PICTO-CRC, 2012).

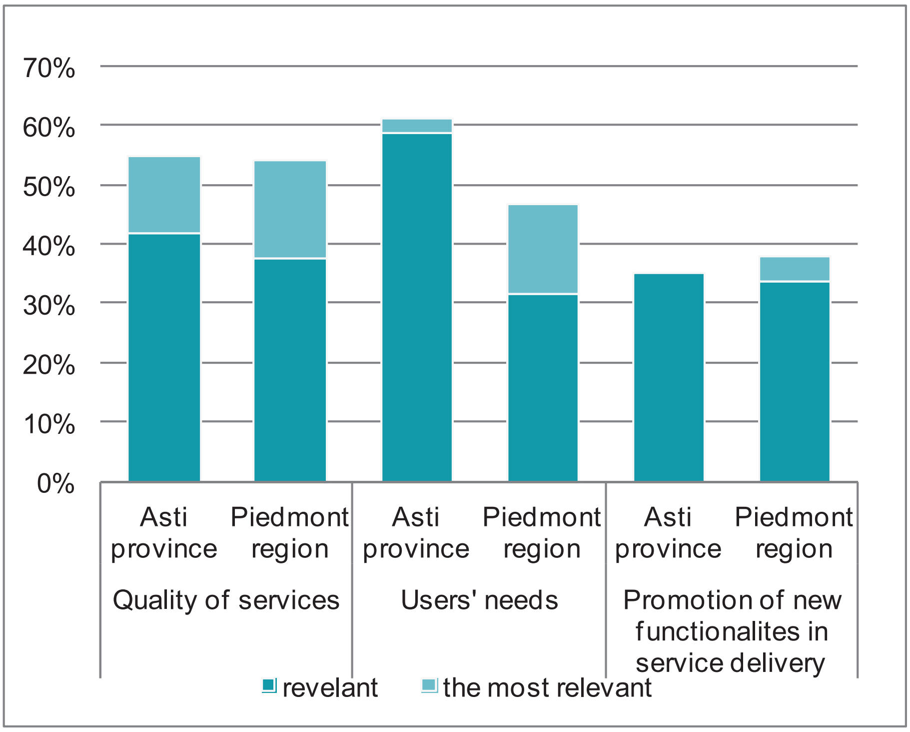



Figure 2: Main action domains for improving online service for citizens by municipalities in the Piedmont region and Asti province, 2011

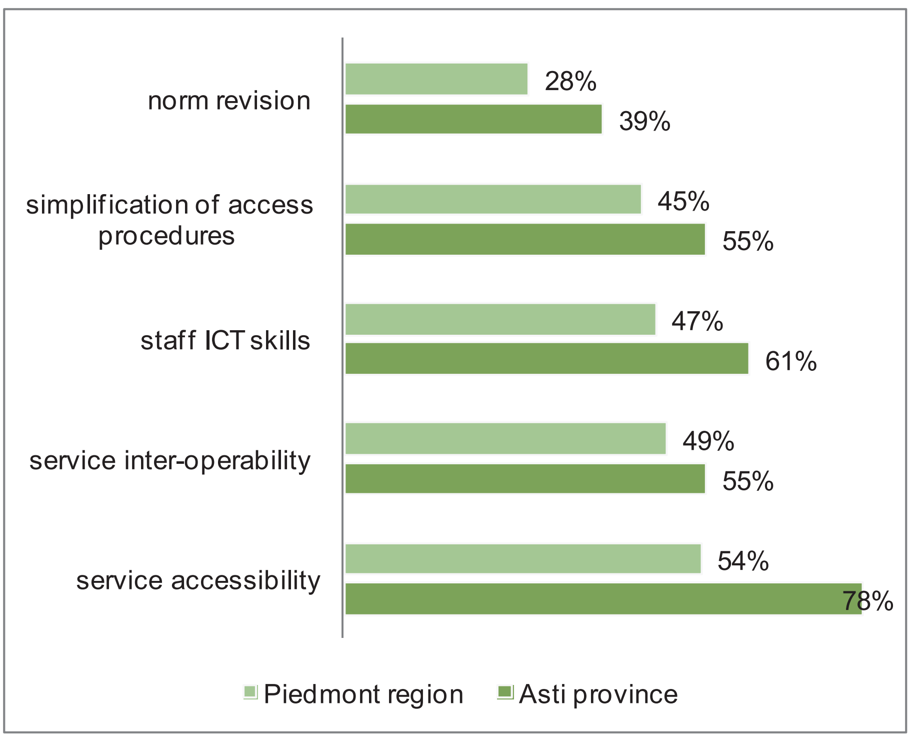



Figure 3: Main target areas for improving online service for citizens, by the Piedmont region and Asti province

In particular, service accessibility and inter-operability were identified as a main area of improvement, whereas revision of norms and regulation were regarded as the least important.

As shown in Fig. 3, with respect to these aspects, the Asti province showed a relatively higher sensitivity than the region as a whole.

# 4 ENGAGING CITIZENS IN KNOWLEDGE BUILDING IN THE ASTI PROVINCE

## 4.1 THE PROJECT DESIGN

It is against this background that, in order to better assess broadband needs in the area, the local government decided to launch the MIDA (Monitoring Ict Divide Asti) Project .

Taking inspiration from a crowdsourcing approach (see, Goodchild 2007), the population of Asti aged between 15 and 74 was invited to participate to a wide information gathering activity to assess the quality of their broadband connections and investigate their *daily practices* in ICT usages. People were asked:

to send via mobile phone SMS, geo-referenced information about the quality of home/places broadband access;

to answer a web questionnaire investigating the availability of broadband services and Internet utilizations. Designed according to the data collection protocol and used for implementing the EU Digital Agenda Indicators, the questionnaire also tries to elucidate the perceptions of the benefits obtained by individuals in using ~~the~~ Internet in their daily practices. As the nature of internet use has changed over time, the question wording was meant to reflect new behaviours;

to tell the story of what they consider as their most positive Internet experience.

Launched in mid September 2012, the data gathering campaign lasted about one month and a half and had ended by October. Real time information about the data gathering progress was provided by the Asti Province website, Fig.4.

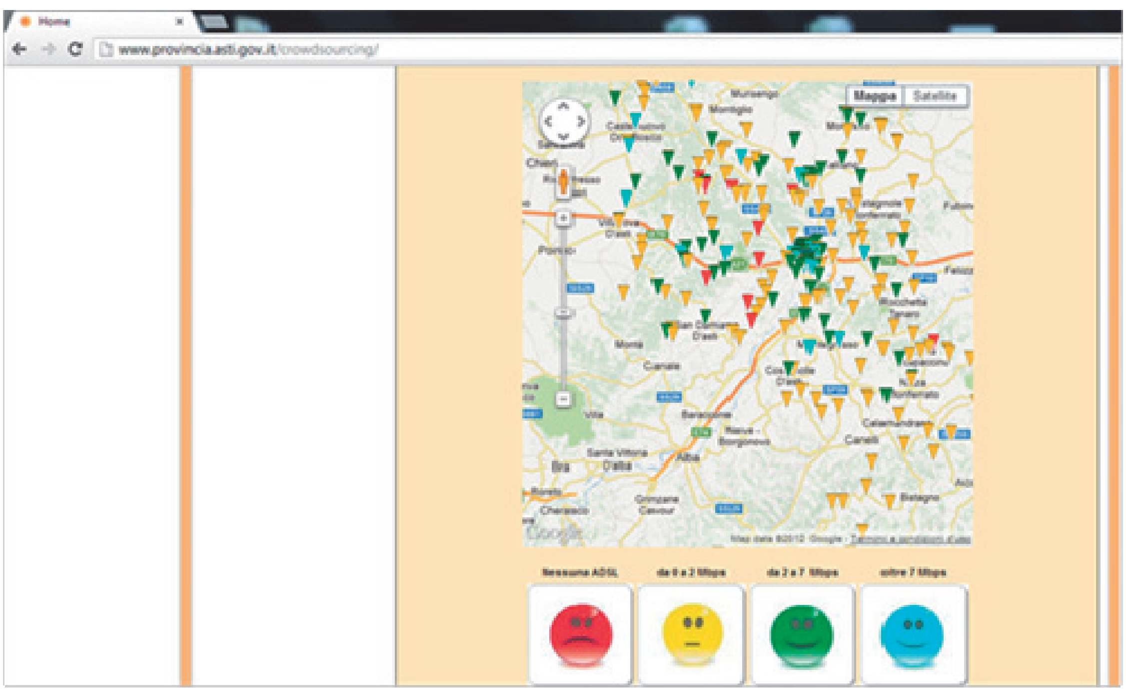



**Figure 4: The MIDA webpage with the results of the data gathering activity during the survey**

## 3.2 THE PROJECT RESULTS

Notwithstanding the efforts made by the Asti province to promote the initiative through the local media and schools, the participation to the project was below expectations. Only three hundred and a half people sent the information about the broadband access. Two out of three also answered to the online questionnaire. Very few offered their successful stories about using Internet.

The reasons of this low participation are manifold, but can be justified according to the following explanations.

The first has to do with the general climate of uncertainty, which because of the turmoil in the economy, in Piedmont as in rest of the country, is affecting most of the social practices. This situation did not allow for an innovative project such as MIDA to catalyse the citizens' interest. Indeed, as reliability in governmental action has been progressively declining over the last months, the project was unable to be regarded as attractive by citizens.

A second explanation has to do with the fact that the enthusiasm and expectations of the promoters for this kind of initiative were most likely too high compared with the real interests of people. To some extent, this also suggests that there is a sort of dis-alignment between how experts interpret e-government problems/solutions and how people perceive using e-government services.

Finally, the existence of inertia and/or socio-cultural barriers to change is an additional factor, which was probably underestimated, and might have prevented people' participation.

A partial support to this explanation is offered by the results of the ICT diffusion survey carried out by the Italian National Bureau of Statistics in 2011, Fig.5. This last shows that, compared with other Italian regions, Piedmont is not among those most advanced in using ICT for communication and e-government.

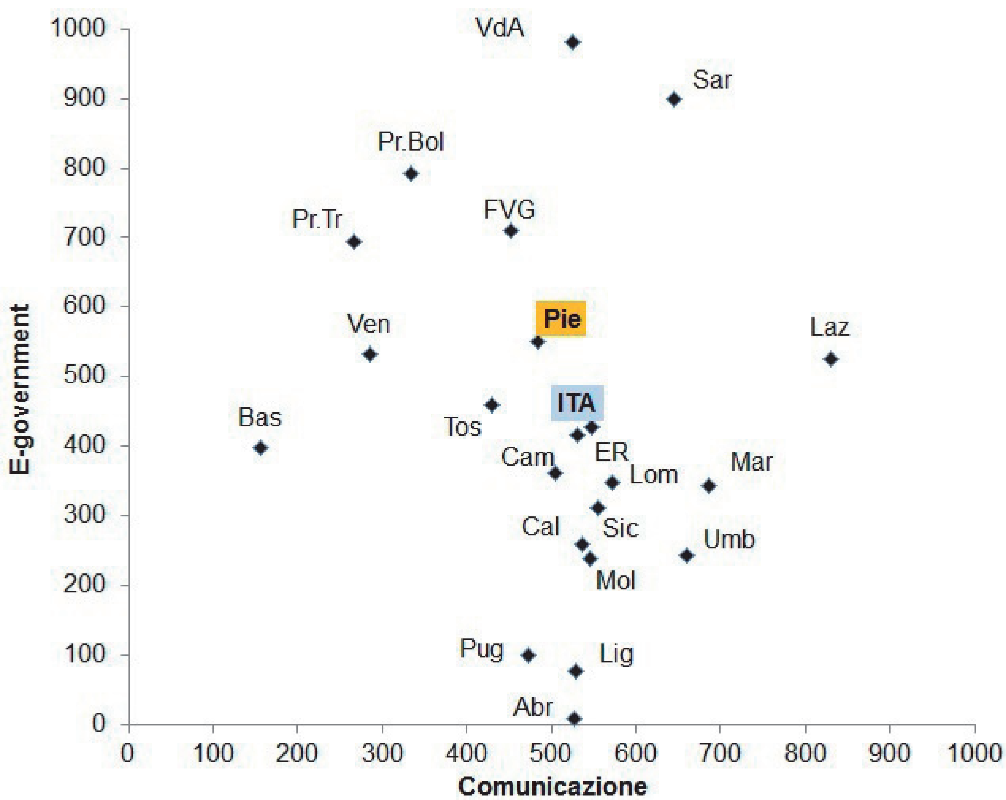



Figure 5: A joint analysis of ICT for communicating and using e-government services by citizens in Italian regions, 2011 (*)
(*) Averages values of normalised elementary indicators (see PICTO, 2013, chapter 4)

Not unexpectedly, the MIDA respondent profile is only partially representative of the resident population. A larger majority made of young (one out five was 20 year old) and adult population (about 30% was aged between 40-50). 80% of respondents belonged to households with a low or medium income; households with 3 or more components were over represented (80%). One respondent out of four had a high education level, and this proportion was significantly larger compared with the average in the area. Students accounted for 23% of the respondents, and 60% were employees mostly in clerical professions.

On the whole, the respondent profile reveals features generally associated with a certain propensity to adopt ICT and engage in their use. Actually, almost all the respondents to the MIDA questionnaire were Internet users.

In the following, attention is focused on the profile of Internet utilizations on the perception of the benefits accrued to individuals in using the web in their daily practices.

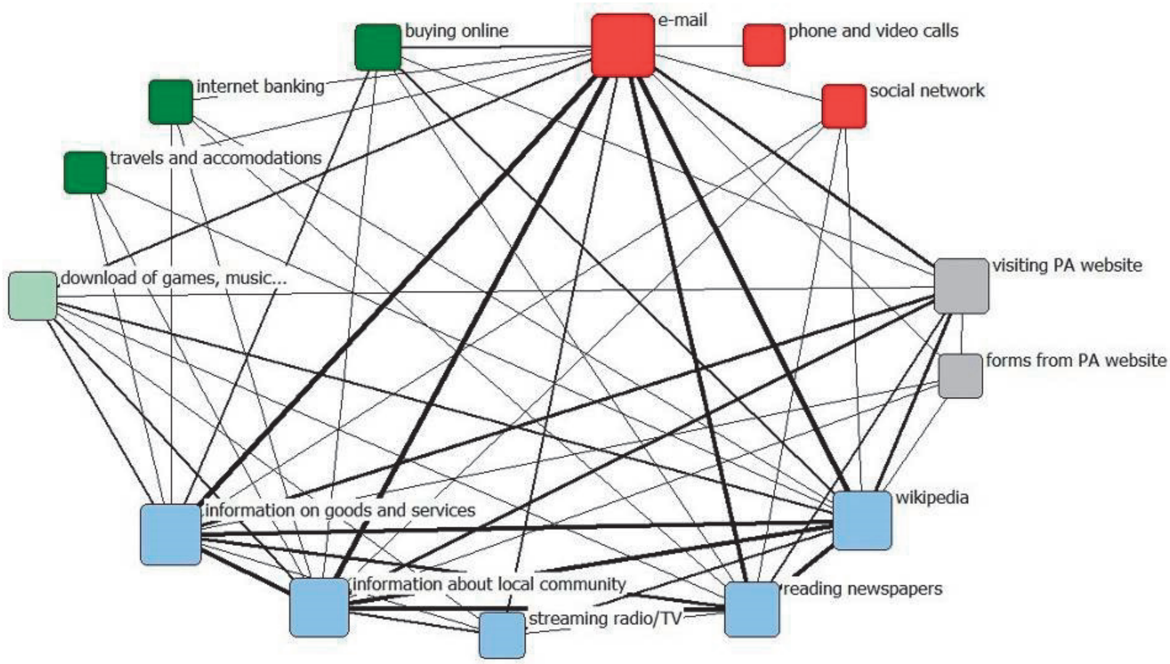
Table 1 shows the list of Internet uses, which have been investigated in the MIDA project. It also provides a measure of the relative importance of each usage (degree) which results from an application of a Social Network Analysis meant to analyse the connections among the different usages.

Fig.6 graphically shows the network of the overall connections. Not unexpectedly, e-mail and online payment to PA are the most and least popular utilization of the web, respectively. The former, in particular, is more strongly connected with the search of information (about goods, service and local community) the use of Wikipedia and the access to online newspaper.

A high connectivity is also exposed between visiting PA websites and using the web for information search.

| Rank | Internet usage | Degree | Rank | Use | Degree |
|---|---|---|---|---|---|
| 1 | e-mail | 59,5 | 13 | forms from PA site | 39,7 |
| 2 | Wikipedia | 58,0 | 14 | phone and video calls | 39,5 |
| 3 | information about local community | 57,3 | 15 | upload of texts, pictures | 39,1 |
| 4 | Information about goods and services | 57,2 | 16 | Forum | 34,7 |
| 5 | reading newspapers | 54,8 | 17 | selling online | 26,8 |
| 6 | visiting PA website | 50,6 | 18 | sending filled forms to PA site | 23,5 |
| 7 | download of games, music | 47,6 | 19 | gaming online | 23,3 |
| 8 | buying online | 46,8 | 20 | creation of websites and blog | 19,9 |
| 9 | streaming radio/TV | 45,6 | 21 | adding contents in wiki-like sites | 19,4 |
| 10 | social network | 43,5 | 22 | job searching | 15,9 |
| 11 | Internet banking | 43,3 | 23 | E-learning | 15,8 |
| 12 | travels and accommodations | 41,1 | 24 | payment online to PA | 13,3 |

**Table 1: List of Internet usages by relative importance within the network of Internet usages for the MIDA respondents (*)**
**(*) The degree value is normalised according to the tie maximum value**




Tie statistics: min 8; max 157; average (density) 59,9; standard deviation 35,2

**Figure 6: Network of Internet usages for the MIDA respondents (*)**
**(*) Only ties above the average plus ½ standard deviation are shown**

To investigate the benefits of using Internet, it was asked to citizens to choose whether in undertaking their social practices, the positive impact in using the web was a result of: a) relaxed time constraints (time saving), b) reduced costs of carrying out an activity (economic resources) or c) access to a wider range of alternatives in carrying out a certain activity (variety of alternatives).

For more than 60% of the respondents, the most significant impact was felt with regard to time savings, while the other two constraints accounted for about a similar share (20%). Overall, this impact was relatively more important for adults (between 50 and 60 years).

The graph of Fig.7 details the results by social practices. It shows that time savings (TIME) has had a positive impact above all on journeys and socio-cultural activities. Not unexpectedly, shopping and learning activities are relatively more sensitive to a greater availability of economic resources (ECONOMIC RESOURCES).

Having the opportunity to access a greater variety of alternatives (VARIETY) is perceived to have a relatively higher positive impact on the relationships with the local community.

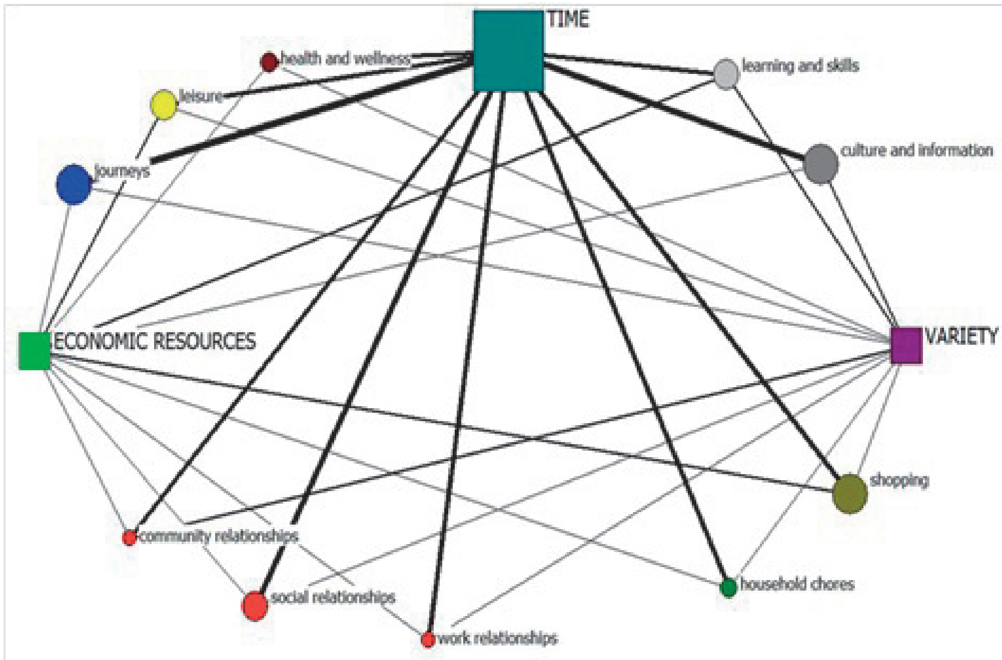



**Figure 7: Perceived benefits of Internet usages in relaxing time and cost constraints and in increasing alternative variety, in carrying out (a set of) social practices for the MIDA respondents**

The MIDA questionnaire gave also the possibility to probe into a domain never addressed in earlier PICTO surveys, concerning the relationships between patterns of Internet usages, such as those described in Fig. 6, and the perceived benefits of these usages, as revealed by Fig.7.

To address the issue, a cluster analysis was carried out considering the whole set of Internet usages (see Tab.1) which identified 4 groups of Internet users, whose profile is described in Tab.2 and Fig.8.

On the whole, the results give support to well known findings about the existence of positive relationships between certain socio-demographic features (such as high education level, younger age, and larger household size) and higher rates in the utilization of Internet services. This is clearly apparent in Cluster 1 and 2 which account for the respondent groups where Internet utilization is more widespread. The former consists of a relatively larger share of younger population.

The latter concentrates the larger majority of individuals who use e-government services.

The other groups concentrate on individuals who have a lower familiarity with the web. Interestingly in cluster 3 women and men are more equally distributed; the age profile is polarized towards the young and older age brackets. Cluster 4 has the lowest percentage of graduates and the highest share of retired people.

| | Gender | | Age groups | | | | | | Occupational Status | | | Large household | Graduate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | M | < 20 | 20-29 | 30-39 | 40-49 | 50-59 | >= 60 | employed | student | retired | | |
| Cl_1 | 10% | 90% | 13% | 43% | 33% | 10% | 0% | 0% | 57% | 37% | 0% | 53% | 40% |
| Cl_2 | 29% | 71% | 12% | 7% | 31% | 24% | 21% | 5% | 76% | 17% | 5% | 41% | 33% |
| Cl_3 | 50% | 50% | 24 | 6% | 16% | 29% | 16% | 8% | 53% | 24% | 6% | 39% | 22% |
| Cl_4 | 39% | 61% | 11% | 11% | 11% | 36% | 25% | 7% | 68% | 18% | 11% | 46% | 14% |
| Total | 34% | 66% | 16% | 15% | 23% | 25% | 16% | 5% | 63% | 23% | 5% | 44% | 28% |

**Table 2: Socio-demographic profile of MIDA respondent groups**

A comparison of the profile of Internet usages across the clusters, Fig. 8, suggests that MIDA respondents can be distinguished in two larger population groups accounting for a similar share of individuals: a group where the propensity to use the web for information and e-government is more widespread (Cluster 1 and 2) and a group where the appropriation of the Internet is relatively lower (Cluster 3 and 4).

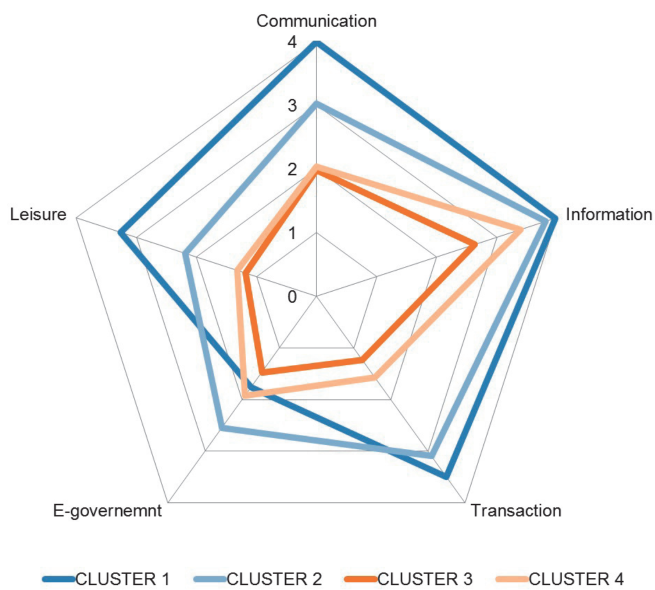



**Figure 8: Profiles of Internet usages in groups of MIDA respondents**

Note : Figure 8 presents average (range 0-4) of the following Internet usages:
COMMUNICATION: e-mail, phone and video calls, social network, forum.
INFORMATION: reading newspapers, search for information on goods and services, search for information about local community, streaming radio/TV.
TRANSACTION: buying online, reservation of travels and accommodations, selling online, Internet banking.
E-GOVERNMENT: visiting PA website, download of forms from PA website, sending filled forms to PA, payment online to PA.
LEISURE: download of games, images, music, movies, gaming online, upload of texts/ pictures/music/video, uploading contents into wiki-like websites

Not unexpectedly, the advantages resulting from Internet utilization are not uniform across the different population groups, Fig.9. Although the benefits of time savings are those most widely perceived in all groups, those depending on the possibility to access a wider set of alternatives are more apparent in Cluster 1, which concentrates individuals with a higher propensity to exploit the web.
Economic benefits are more appreciated by the individuals in Cluster 3.

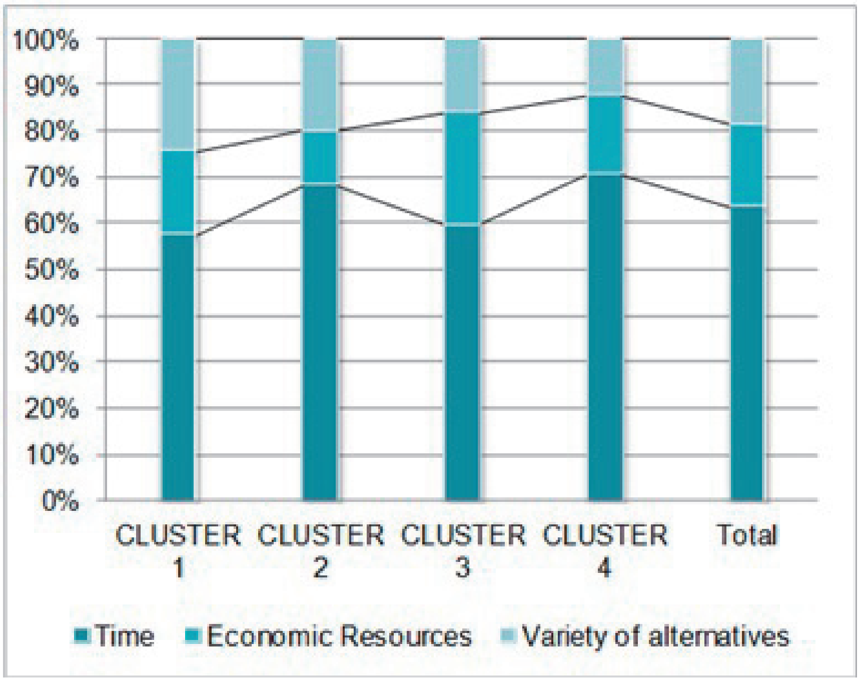



**Figure 9: Perceived benefits of Internet usages on relaxing time and cost constraints and on increasing alternative variety in the groups of MIDA respondents**

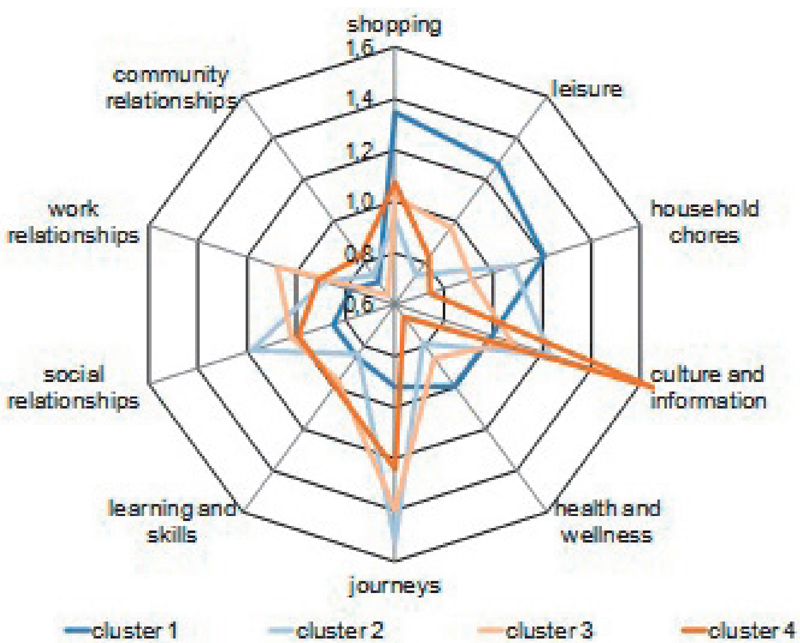



**Figure 10: Perceptions of time savings for the social practices, within the groups of MIDA respondents (*)**
**(*) Index values are computed as the ratio between the percentages of the answers "yes to time benefit" for each activity and the total share of these yes answers in each cluster**

When analyzing the time benefits accrued to the different social practices, some further differences can be detected across the groups, Fig. 10.

For respondents in Cluster 1, shopping, leisure and household chores are the social practices, which most take advantage from time savings. Reducing travel time in daily journeys is a benefit widely perceived by all the other clusters.

Time savings in accessing cultural activities and information is particularly appreciated by people in Cluster 4.

The results of this study support the claim that the more people use the Internet, the wider the benefits accrued to them in their social practices. Although this is not unexpected on a conceptual ground, the MIDA project gave the opportunity, at least for the Piedmont region, to support it on an empirical basis.

An additional aspect is gauged by the benefit profile observed in Cluster 1 (see Fig. 9), where Internet utilization is more widespread. As in the other clusters, it points out that by reducing economic costs and time constraints, Internet usages can help people to engage in their daily practices more efficiently and effectively.

Furthermore, it also suggests that by providing access to a wider range of alternatives, Internet usages are also a way for empowering individuals in their undertaking, i.e. helping them to establish new patterns of relationships (Quitney Anderson and Rainie, 2010) and new types of socio technical systems which on their turn make it possible to engage into social practices in novel ways (Whitworth and Witworth, 2010).

## 5. CONCLUDING REMARKS

This study gives evidence that a local government has a main role to play in prompting community transformation processes, and engage in smart community building (Nam and Pardo, 2012). Involving citizens in providing information/perceptions about their digital divides and Internet usages has a twofold advantage. It gives local government more detailed information in order to better and timely tailor policy interventions and it gives citizens an opportunity to understand what the contents of the policy interventions are likely to be about. Whenever the knowledge flows can be maintained and nurtured over time, a collective learning process may take place and help guiding the community's transformation processes.

The MIDA project carried out in Piedmont region has been an attempt to address the issue by directly involving citizens in gathering data and creating more significant information for steering e-government policy.

Although not wholly successful in terms of participation, the project had a number of positive outcomes.

First, it has been an opportunity to test the role of Internet as a dynamic collaborative environment in which diverse information, opinions, experiences, and skills can be grouped to provide substantial resources, in contrast to the currently used static information delivery platform Goodchild, 2007, Flanagin and Metzger, 2008). As widely emphasized in the new Socio Technical System literature, the essential premise is that given efficient means of information sharing and participation, collective benefits is likely to emerge from aggregated individual contributions (Berra, 2007, McIntyire, 2003, Wellman, Quan-Haase, Boase and Chen, 2003,Whitworth and Whitworh, 2010, Occelli, 2012b).

Second, by giving the possibility to connect statistically relevant data and interpreted information, the approach underlying MIDA project paves the ways to the production of enriched, and more *sensible* information. For PICTO, the project has been an opportunity for testing an information tool to implement such an approach. The web page created by the province administration to show in real time some results of the experience (see Fig.4) has been an effort in the direction: it shortened the *time to the public* (the final users) of the products of the data gathering process.

Finally, in terms of implications of the MIDA experience for policy innovation, two aspects can be mentioned which will deserve further attention in future research. The first one is that the involvement of citizens in providing information/perceptions about their (digital) needs gives local governments unprecedented possibilities to improve service delivery and tailor more timely policy interventions. This however requires to enhance the ability of government in managing information and communication, whereby both implies better technical competence and an increased attention at the quality of citizen-government relationships. For citizens, moreover, their direct involvement by government gives them an opportunity to grasp what the contents of the policy interventions are likely to be about. The positive outcome of the latter, however, crucially depends on the people's willingness to participate. With regard to this the MIDA project was not fully successful. The experience gained however suggests that deeper attention should be paid to how better align the understanding experts and decision-makers have about e-government problems/solutions and the views people build up from their perceptions about using e-government services. This calls for a more comprehensive approach to e-government processes, where the scientific, technological, institutional and social dimensions could be integrated (Gil-Garcia, 2012, Inguaggiato and Occelli, 2012, Rhodes, Murphy, Muir and Murray, 2011).

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## IMAGES SOURCES

Figg. 1,2,3: Piedmont ICT Observatory

Fig. 4 : MIDA Project website

Fig. 5: developed by PICTO on ISTAT data

Fig. 6,7,8,9,10 : results of MIDA project

## TABLE SOURCES

Table 1,2 : results of MIDA project

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Journal of
Land Use, Mobility and Environment

TeMA 3 (2013) 311-324
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1929

review paper received 21 September 2013, accepted 30 November 2013

www.tema.unina.it


# CITY AND ENERGY INFRASTRUCTURES BETWEEN ECONOMIC PROCESSES AND URBAN PLANNING

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ABSTRACT

The paper deals with the issues related to the relationship between city, energy, economic factors and city planning. These issues are analyzed from a theoretical point of view and are placed in a logical path based on three assumptions. The first considers the city as an intelligent system constantly evolving. The second considers the city as a system where economic processes come out at their highest level affecting other aspects of social and urban structure. The third considers the planning as the weak link in the process of urban development, one of the most exposed to economic and social pressures.

Energy production has experienced a great progress since steam and electricity were discovered. Each stage of this evolution has affected city and territory introducing significant physical signs, changing the ways of carrying out functions and creating new needs and new activities. The energy revolution, based on sustainable sources and on skillful management of the networks, will strongly affect the city and the way of organizing the activities, their location, dimension, and the shape of the spaces.

The paper explores some of the issues related to the relationship between urban system and energy.

The first section analyzes the meaning of the intelligent city as an entity that is constantly changing and constantly adapting. The second section analyzes the role of the energy systems in the evolution of the activities and of the city's image. The last section investigates the role of the economic factors in the evolution of the shape and meaning of city, pointing out that the way towards smart and green urban systems will largely depend on their economic advantage.

KEYWORDS:
City, Energy infrastructures, Economic factors, Urban planning

## 1 PAPER FRAMEWORK

The paper deals with the issues related to the relationship between city, energy, economic factors and city planning. These issues are analyzed from a theoretical point of view and are placed in a logical path based on three assumptions. The first considers the city as an intelligent system constantly evolving. The second considers the city as a system where economic processes come out at their highest level affecting other aspects of social and urban structure. The third considers the planning as the weak link in the process of urban development, one of the most exposed to economic and social pressures.

Energy, with its meanings and its implications, is used as the Ariadne's thread of the following analysis.

Energy production has experienced a great progress since steam and electricity were discovered. Each stage of this evolution has affected city and territory introducing significant physical signs, changing the ways of carrying out functions and creating new needs and new activities. From the night-light that has illuminated the cities to the factories that have blackened them, from the vehicles that have developed the communications to the traffic jams that have slowed down the cities, there are so many direct consequences related to the progress of the energy system.

The same energy revolution, based on sustainable sources and on skillful management of the networks, will strongly affect the city and the way of organizing the activities, their location, dimension, and the shape of the spaces.

This scenario is based on the observation of the city as intelligent system able to adapt to changes of all kinds, especially of economic and social nature. In this scenario the planning takes part only later, by regulating processes already under way.

The paper explores some of the issues related to the relationship between urban system and energy, focusing its attention on the city meant as intelligent system and on the energy meant as the engine of this system.

The first section analyzes the meaning of the intelligent city as an entity that is constantly changing and constantly adapting. The second section analyzes the role of the energy systems in the evolution of the activities and of the city's image. The last section investigates the role of the economic factors in the evolution of the shape and meaning of city, pointing out that the way towards smart and green urban systems will largely depend on their economic advantage.

## 2 THE CITY IS ALWAYS INTELLIGENT

A city is a physical, spatial structure. But its shape is not sufficient to describe the city, because it shows multidimensional characteristics, such as ecology, culture, technology, economy, society and other (Castells 1989, Hall 1998). The city as "system" was conceived more than 50 years ago: a group of elements that operate as a closer entity, on which planning exerts its command and control prompts (Berry 1964, Batty 2011). The city as complex system has been the next step, with the assumption that it does not automatically return to balance after a perturbation, like a simple system.

The transition from simple to complex system represents the passage from the city seen as machine towards to the city seen as an organism, with a biological transformation of the system based on a loop model instead of a linear model. The meaning is that the city does not work by means of input-output actions. The next step considers the city as «'complex adaptive systems' in which cities exhibit properties such as non-linear cause and effect relationships» (Eames, Dixon, May, Hunt 2013), with permeable boundaries allowing the passage of energy and of other vital elements (Rotmans 2006).

The above assumptions leads to suppose that the city is an intelligent structure (Lévy 1996), and that its intelligence should be assessed in an historical perspective and linked to the social, economic and political period under analysis.
The intelligence of the urban structures is a direct consequence of the city meant as holistic system (Cheli 2010). Generally speaking, the social systems are not the mere collection of individuals, but have holistic characters that make the molded organism more complex (Dubeski 2001). Applying the Durkheim's statement to the urban systems it is possible to state that the character called "intelligence" is one of the factors that goes over the simple sum of functions and activities contained in a city. The organizational level reached by the social capital, as defined by Putnam, adds to this system further weight and meanings (Trigilia 1999).
The urban systems, then, are more significant than the sum of their elements. The Roman city was intelligent for its historical moment, also because it was built by people endowed with great pragmatism and determination. The Italian Renaissance city was an example of great intelligence also because it was based on a strong concentration of wealth and on a steady cultural foundations. At the end of eighteenth century London and Paris were intelligent and changed the type on intelligence when, a few decades later, they were equipped with modern infrastructure such as aqueducts, sewers, subways. So they became worldwide economic and political capitols tanks to very determined and organized expansion's policies.

**Fig. 1: Interior of Cristal Palace, London, where in 1851 was held the Great Exibition**

It follows that every city is intelligent, or rather it is intelligent in a different manner, in relation to the historical period we analyze.
If we look at the different stages of a city's evolution without considering an historical perspective, all the cities of the past seem unintelligent. Actually this view is wrong and leads to the significant logical error to consider the urban evolution as a random aggregative process, and not as the result of economic, social,

political, and thinking forces which act regularly on it and create communities that represent the highest level of civilization in a particular period.

Moreover, the city shows its intelligence favoring or penalizing the specific actions that the urban subjects have started. Not all the possible actions are also practicable and not all the activities carried out are concluded because, at that time, they may be neither feasible nor are necessary.

Actions, finally, need to be contextualized. Even if they can be categorized and typed, the ways in which they are carried out and their results are not necessarily are the same in different places. For example, the "western route to the urban transformation" affects urban areas through actions targeted to balance the current malfunctions, directing the cities to sustainability tracks. In this perspective the consumption of new soil is seen as a negative factor, while to act on the built city is a method of action that, if made in the right way, increases the urban resilience (Moccia 2013), reducing its environmental loads.

In newly developing country the situation is completely different. In fact, while they set up expensive initiatives targeted to carry out showcase-projects on sustainable urban systems, the simple transformation of the existing city still goes on as well as its expansion in an uncontrolled way, with a scarce – or completely absent – attention to the sustainability.

## 3 A NEW KIND OF INTELLIGENCE

The need to build urban systems with high sustainability and increasing resilience has had as crucial after-effect the diffusion of a specific meaning of the idea of intelligence. This meaning adds to the intrinsic intelligence of the cities a more material connotation. A universe of sensors and machines able to manage and optimize all the activities carried out by human beings, but also able to allow a potentially total control on people and on their freedom of action (Longo 2013).

A critical dimension of the cities is the growing supply of services, based on advanced and smart technologies meant «to integrate smartness in the infrastructure of the city so as to extend the effectiveness of the services at a lower cost» (Berthon, Guittat 2011).

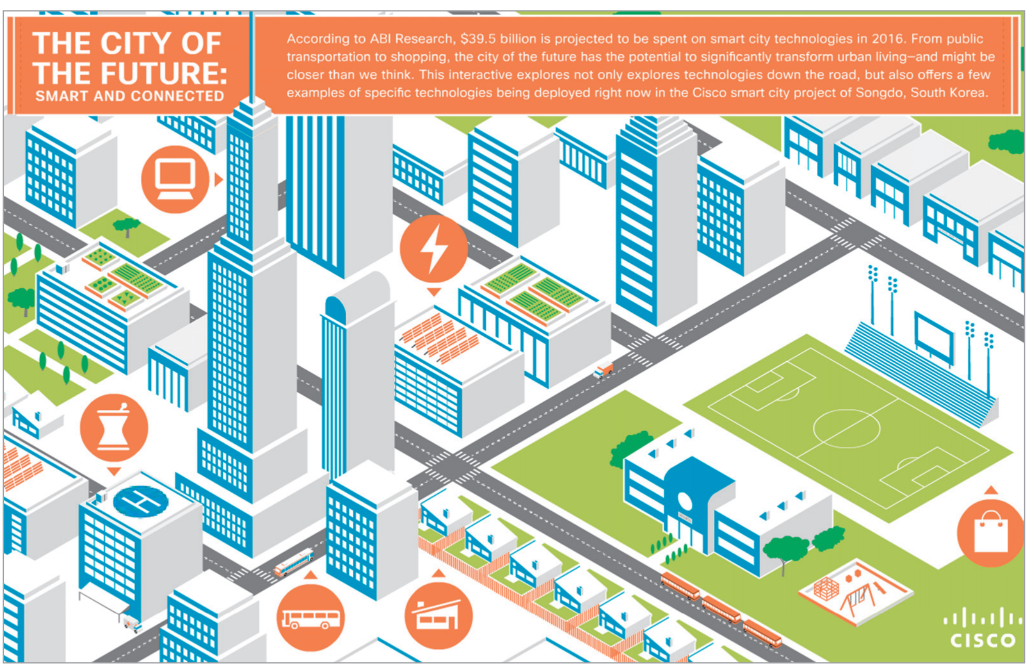


Fig. 2: Cisco smart city project of Songdo, South Corea

The integration of infrastructural systems leads to the creation of an "intelligent infrastructure", able to handle large amounts of data, analyzing the trends, and acting accordingly by changing the service delivery.
A further level of intelligence is the one that overcomes the autonomy of the single infrastructural system reaching the coordinated management of many systems (energy, water, data, phone, …) in an open, if possible, environment.
Starting from this meaning of "intelligence", being purely technical and perhaps even consumerist, the city becomes an object on which it is possible to apply economic models suitable to any commercial product. One of the most interesting model, applied to evaluate the evolution of the technology market, is the hype cycle model (Fenn, Raskino 2008). It hypothesizes that the emergence of any new product follows recurrent phases. The first phase creates strong expectations; the second is a phase of disenchantment, and only later there is the "enlightenment", phase in which that technology shows its effective potential.
This trend can be applied in the case of "high intelligence" urban systems, normally defined in the literature as "smart city" (Papa, Gargiulo, Galderisi 2013; Fistola 2013).
At first, the neologism "smart city" was used to label ambitious plans for fully sustainable and computerized new towns, projects with a so high costs to curb the achievement. The disillusionment towards these adventures has prepared the ground to the third phase of the smart cities. It is based on an approach according which the cities develop sectorial projects creating a different way to access the services, which are addressed to an overall sustainability of the urban system and show a strong synergy among different subjects.

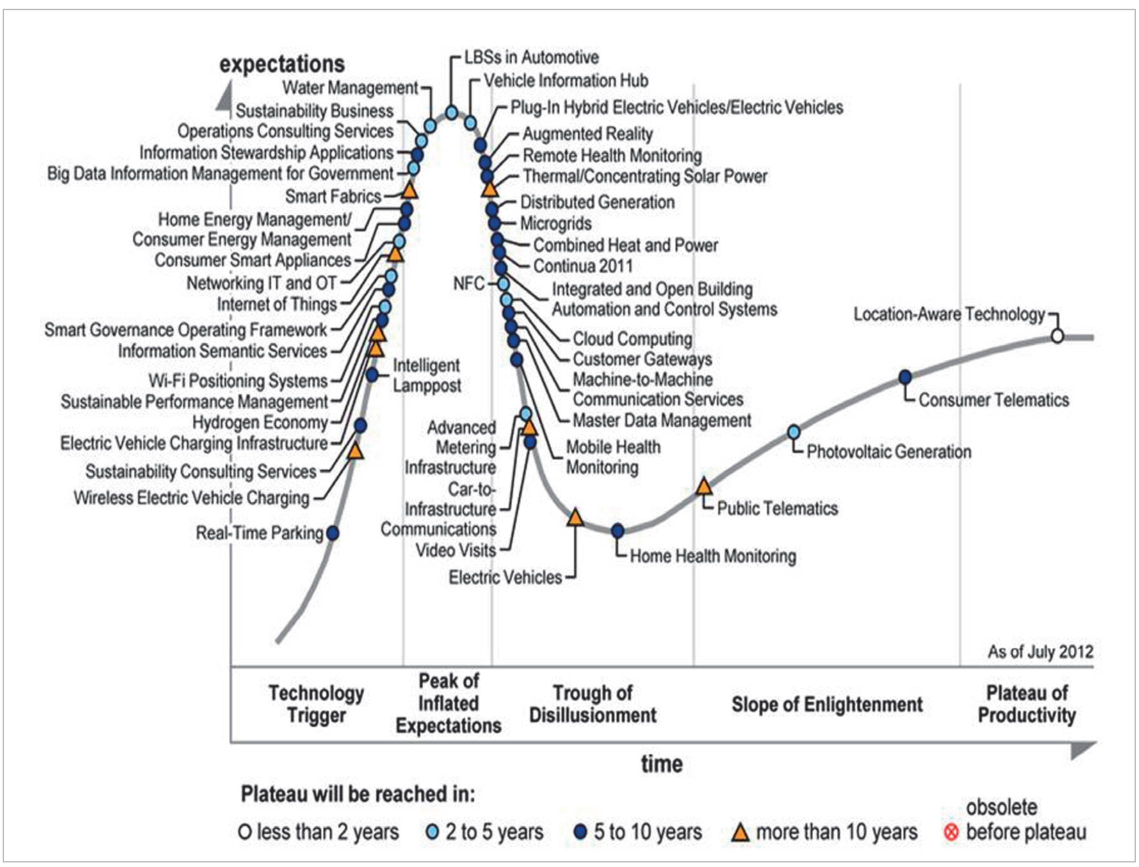


**Fig. 3: Hype cycle model**

Therefore the cities are to revise their action, as, indeed, they have always done in the past. «All this suggests that the smart cities of the future will not be those created from the top down, but those that have grown organically more intelligent. Cities will not look very different from how they do today, but they will operate more efficiently thanks to the "data exhaust" they generate» (Siegele 2012).
From this assertion results the following consequence: as in the past, also in the future every city will evolve with its own characteristics, keeping and reproducing its specificities: in fact «every place is different. Every city, town or busy street is different from every other; often in many, important and significant ways. You can't just cut successful design or policy solutions from one place, paste them to another, and simply expect them to work like a dream. So you shouldn't. What you should do, instead, is to examine the conditions that made for success in the one place and try to work out if and how they can be replicated in your place» (Dales 2013).
Such considerations can be applied also, and above all, to the evolution of the energy systems that innervate the cities.

## 4 ENERGY DEMAND AND SUPPLY

Networks and infrastructure nodes represent the vital elements for the urban and territorial structures, because they make it possible to deliver the "oxygen" needed by the city, made up of energy, goods, and information. But also goods and information cannot circulate without energy.
For a long time the organization of the energy distribution has been essentially based on the purchase, on the international market, of the raw materials needed to meet domestic consumption, organizing consequently its production and distribution. In this phase «no one has ever asked if citizens did a reasonable and efficient use of energy, or not. It was made a 'supply programming policy', as called by technicians, without caring about teaching the consumers how to use only as much energy as it really needed» (Silvestrini 1980, 11).
Also thanks to this irresponsibility, energy consumptions have increased with remarkable rate over the years, with a growth that seemed unstoppable for a long time, up to the moment where the increase in the energy costs has become unsustainable.
From an economic point of view, the energy costs have a visible component – that is the cost of production, distribution and taxation – and an unseen component that strongly influences the first.
The visible costs of energy have grown significantly in the last thirty years. On January 1, 1980 a liter of diesel fuel was purchased at 0.12 Euros (250 Italian Liras), in the summer of 2013 the same liter of diesel costs 1.75 Euros. By comparison, a liter of bottled mineral water in 1980 was paid 0.20 Euros (more than diesel fuel), now 0.50 (one third of diesel fuel).
The strong increase in the price of oil has been the most significant factor relating to the increase in the price of fuel. The price of oil is a paradigmatic case of supply and demand. The supply has not increased in proportion to the growth in demand, driven worldwide because countries like China and India, as well as other developing countries, are strongly increasing their demand for petroleum.
This demand couples with the weakness of the dollar, which makes it worthwhile to invest (or to speculate) in commodities such as oil. These causes are pushing oil prices up.
Also the invisible component has affected this trend. This component is formed by at least three elements raining down on the final cost of energy products. The first is the critical condition of the environment in which we unload the wastes resulting from the combustion; the second is the undefined quantity of the row material reserves, in particular oil and coil (Maugeri 2013); the third is the geopolitical component, since the major energy reserves are often used as pressure instruments in the international policy.

The answer to this situation has been the variation of the national energy policies. This change of route has added to the supplies actions other actions concerning the demand, pointing out the negative consequences of an indiscriminate use of energy and the potentialities related to the processes of production and consumption from sustainable sources.

It is necessary, however, to act in this direction in a more effective way. If the progresses in the field of the sustainable and zero consumption building are evident, for example, the progresses in the field of the planning of urban areas and of mobility networks are less evident. As regards that, it could be useful to introduce specific evaluation systems for urban areas, targeted to achieve their sustainability certification, in the same way as for the buildings (Mazzeo 2013).

The need to work on this topic comes from the observation that, even in the most advanced cases of attention to urban sustainability, the action is still sectorial. If we analyze the case of Amsterdam, we can observe that the city is engaged in a set of sector programs characterized by high sustainability with the aim of reducing its environmental impact by increasing, at the same time, its national and international attractiveness (Berthon, Guittat 2011).

The overall programme has three primary objectives in the environmental field, as stated by the European Community regulations (EU 2007): reducing $CO_2$ emissions by 40% by 2025 compared to 1990; deriving 20% of the used energy from renewable sources by 2025; and achieving neutrality in terms of $CO_2$ emissions by 2015.

The achievement of these goals requires the interaction of different types of technologies and design methodologies (smart meters, electric vehicles, smart building design, …) that can promote energy efficiency in different sectors. A special attention has been given to the electrical distribution, with a control center that manages the entire power grid, using information and communication technologies, and that provides more reliable, safe and economic electricity, with a smaller amount of emissions of carbon dioxide.

Nevertheless, even in the case of Amsterdam, the action towards a smarter city is carried out by sectorial technological projects and still does not develop actions in order to achieve a coordinate management of the activities, characteristic of the strategic and urban planning.

## 5 ENERGY AND INFRASTRUCTURES: A SCENERY FOR THE CITY OF TOMORROW

In September 2013 at the MAXXI of Rome the exhibition "Energy – Oil and post-oil architecture and grids" ended.

The exhibition was centered on the development of the Italian energy system after the World War II and its fundamental role in the industrial development. Through a photographic journey, it also analyzed the current landscape of the energy infrastructures in Italy. To complete the exhibition there were several suggestions and views for the near future city and territory, based on the passage from the oil to other, more sustainable, energy types and on their subsequent impact.

The examples that witnessed the history of the energy in Italy showed their ability to influence the urban landscape and the Italian landscape (Ciorra 2013): as striking example there were the highways and the support infrastructures as the "Autogrill".

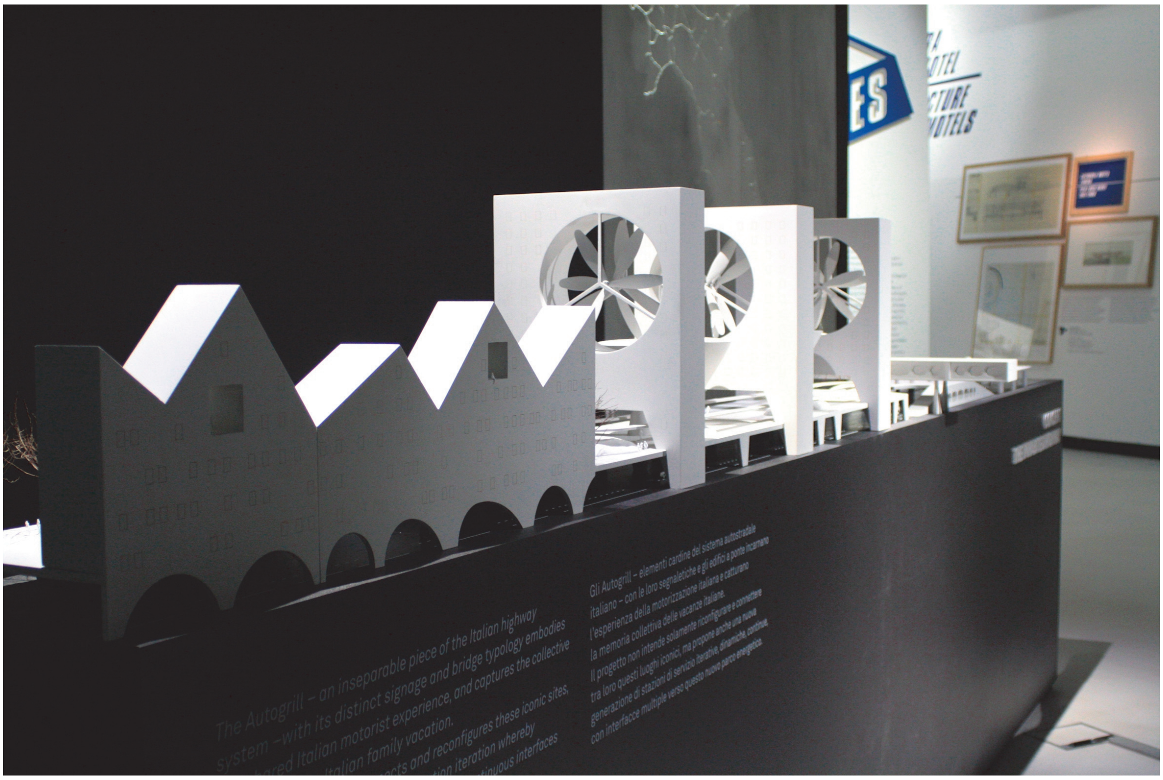

**Fig. 4: Oil and post-oil architecture and grids, MAXXI, Rome, March 22nd, September 29th Visions Section**

What happened in the recent past allows us to assume that also the transition to other types of energy could have the same huge impact and promote the same alteration of image and meaning.

The question is not of minor importance: if we state that the energies of the future will be sustainable, it can easily supposed that the production modes and the distribution networks will have to change radically.

This line of thinking can be true both for the nodes of production and for the modes of supply of the energy needed for the urban functions and for the personal and collective vehicular travels.

The production of refined fuels is possible only in specialized factories, the refineries, large plants located in areas that can be easily reached from the oil fields. The distribution of refined products departs from these factories. This means that there are few areas where large plants with a continuous loop are gathered, from which the product is carried to smaller and diffused distribution nodes until reaching the final user.

The same occurs for the production of electric energy: a limited number of plants in which the productive cycle takes place, which from oil, natural gas, coal, water, or other source leads to the production of electrical energy, and from which the distribution grid that reaches home, factories, and offices starts.

The situation changes radically if we consider the energy produced by sun or by wind. Each point of a territory becomes a side suitable for production, distribution and consumption of energy. This does not affect the importance of the grids, especially in order to convey energy to the sites with high demand and to pass data and information (smart grid), but they will be accompanied by an increasingly high percentage of locally product energies ("zero distance" energy).

The above-said assumptions points out the need for optimizing the use of energy at all scales, from the building to the city. The production from renewable sources allows to reason not only in terms of "network", but also in terms of "island". This concept can be applied to the case of distributed and widespread production over an area. «Consumptions as much as possible on local level, storage capacity, energy islands that intersect with those nearby creating smart areas on regional level» (Cianciullo 2013).

Fig. 5: Trento, Albere neighborhood. Project by Renzo Piano

In this perspective any road, building, neighborhood, public property become a potential location for the energy production, and the visible elements of these production's processes (wind turbines, solar panels, …) will became integral elements of the urban and territorial landscape. In other words «the increasing use of new technologies in all the fields of collective life changes the behaviors, the social relationships and, then, the organizational forms of life. The change of the relationships among the social subjects tend to evolve into more and more complex forms that necessarily require a formal, functional and semantic re-design of the anthropic space at different scales, from the urban scale to the building/architectural scale» (Papa 1993).

If one of the challenges of the near future will be the management of an energy system characterized by a strong territorial continuity, both in production and in distribution, two are the lines of this management process. The first is the control of the introduction of new energy production systems in a largely man-made territory, where evident marks of stratified architectural presences are contained. The second, related to the previous one, is the regulation of the use of technologies for the production and the distribution.

The main feature of the regulations will be the flexibility. It is necessary because technologies change fast, sometimes faster than the context they operate in, so it will be necessary to avoid laws and regulations that can limit the realization of the projects, reducing the possibilities of development and their potential positive impacts.

## 6 ECONOMIC FACTORS AND URBAN EVOLUTION

The implementation of the above-shown scenario can greatly affect the image and the working of the city as it is today, and in the same way as any other economic and energetic revolution has done previously.

From the description of the scenario an important statement derives, namely that the true engine that causes the changes in the city is the pursuit of the utility in economic terms.

Many examples seem to go in the direction of this statement.

At the end of seventies London was a city affected by a heavy crisis (Thornley 1992). The inversion and the rebirth of the city occurred when the way of considering the role of the State changed, namely at the time when the neoliberal policies imposed an overhaul of Great Britain on basis far from those of the Labour welfare. Just these policies have created the conditions for the rebirth of the city by encouraging the transfer of massive capital funds towards the city, which turned into investments, in creation of jobs and in redevelopment of whole urban sectors. The same strenght of the London Stock Exchange has encouraged the city giving it the role of primary node of the international financial exchanges.

Obviously, these processes have emphasized the income differences among social groups and the strengthening of the richer urban users, but this does not affect the leading role re-conquered by the city on global level.

Like other Chinese cities of the Eastern coast, in recent years Shanghai has been transformed in one of the driving areas of the China's economic development. This development, based on a pressing liberalization and on a stiff political control, had a significant impact on the form and on the metropolitan dimension of the city. It is in the Chinese cities – until the eighties made asleep by the ideological action of the Communist Party – that the same power has laid the basis for the radical economic change that has affected the country.

Also in this case there are negative implications. Among the others, the accelerated urbanization process that is blowing out all the Chinese megacities, and the high level of pollution in the urban areas (Mazzeo 2010).

From these examples it comes out that the assessment of the urban transformations are forced to deal with the economic factors that make them achievable.

The action of economic activities has been considered from Von Thünen onwards as the primary factor for the localization and development of urban centres (Grotewold 1959). Extending the reasoning it can be argued that the economic factors are the main cause of the urban phenomenon evolution, and their strength is so great that it prevails over most of the measures designed to regulate, including those implemented by planning.

Modern cities are shaped by economic factors that transform them, often to the point of distorting their structure and their shape. Structure and shape have remained unchanged only where the economic forces had been weak; and often these cities are dead cities or destined to this end.

In this context, the most recent scenarios consider the green economy and the smart economy as rapidly developing sectors (UNEP 2011; EEA 2013), for which it is conceivable that in the future these sectors could play an increasingly important role among the whole economic factors, becoming the driving forces able to shape and adapt the form and functions of the city.

As mentioned, these considerations overshadow the role of planning and require a review of its aims and its instruments.

Planning has often considered its work as predominant, and sometimes also in competition with the wealth-producer processes. Many planning theorists have thought the matter as an autonomous activity capable of creating an 'orderly and happy' urban structure.

The utopians such as Owen tried to draw urban structures in which production, dwelling, and services were present at the same time. Given the scarce results obtained and the condition of the cities after the industrial revolution, utopians have been replaced, on the one hand, by the planners associated with the established power, on the other hand, by the "militant" planners, who considered planning as one of the many variations of the political activity.

The current situation is clearly defined in the analyses of some sociologists. In the book *The Postmodern Condition* (1979), Jean-François Lyotard has analyzed the issue related to myths. Lyotard thought that the revolution of the eighteenth century have caused a complete dislocation of the mythical values, on which the existence of the society had been based up to that moment. «The modernity of the eighteenth century has

got rid of the myths of the origins (…) and has replaced them with the myths of the future (…), universalistic myths, which evoke the future of the humanity beings» (Augé 2005). Planning was an integral part of disciplines permeated with the myth of a better future also for the cities.
The transition from the modern to post-modern age is the time when these universalistic myths are thrown into crisis, causing the bitter fall of the illusions founded on the progress of humankind. And now that utopia has fallen, planning is naked in front of a reality most affected by economic factors.
To the emptiness left by the myth of the egalitarian society it has been tried to answer in different ways. Sustainability, participation, technological innovation, urban regeneration, … are all strands where planning has tried to develop its action in absence of a recognized and original line of thinking.
To quote Baumann (2013), it is as if planning had entered in a fluid period of interregnum, in which the old rules (of any kind) don't work anymore and in which the new rules have not been invented yet, because there are ongoing changes without no reference points. This is equivalent to a state of crisis that «consists in the fact that the old dies and the new cannot be born», as Gramsci wrote (1975, Q. 3, § 34). Moreover, «in this interregnum most various pathological phenomena occur»: a state of crisis full of dangers but also full of new challenges for the city, for its managers and for its planners.

## 7 ELEMENTS FOR DISCUSSION

The need to reconsider the ways to produce and consume energy in the cities represents a challenge to the management of the urban systems.
Cities should aim at overturn their attitude to the energy problem: from simple consumer of resources and energy, they should become producer and consumer at the same time, finding internal production factors that would affect environment in lower percentage.
Here we want to sum up some discussion points contained in the paper, delving into the relationship between cities and energy infrastructures.
The starting point is the city meant as intelligent system. We have tried to show that, starting from the contributions coming from different research areas, there is a convergence of analysis that identifies an organizational intelligence in the urban structure. This intelligence adapts the urban evolution to the external environment, giving the city its own intrinsic degree of resilience.
This characteristic enables the city to adapt also to changes forced by critical processes of environmental involution, as long as all its components (physical, functional and anthropic components) are able to react in an effective and coordinated way.
In the last years the association of the word "smart" to the term "city" has extended. This association is a purely utilitarian expedient: smart city is not a more intelligent city, but a city more equipped with instruments intended to drive, or to address, specific moments of the daily life of citizens. It can be said that a smart city is a city where people have the possibility of being more stupid, since they have given part of their intelligence to external control and management systems.
In this context, the energy problem clearly shows the difference of approach between intelligent city and smart city. An intelligent city is a city that learns to produce and to consume on the basis of its needs, and that from this learning ability draws new elements for further reducing its waste of global resources. A merely "smart" city, indeed, is a city that adopt forefront technological tools allowing them to control the behaviors without learning from this process and improving its critical ability.
The present organization of the society plays an important role, in which economical and productive processes – targeted only to reach efficiency and profit – are fundamental. In this context, the green economy does not seem to be different from the previous economies.

Energy infrastructure, nodes and grids will become increasingly smart. We have replaced the incandescent lamps with low consumption and long life lamps, and then we have used the LED lamps and so on. We will replace the internal combustion engine car with an electrical car. paper will be replaced by files.

We will tend to consume less energy per unit of performed work. We will always be more "sustainable", but not because we are aware that it is necessary to be sustainable. On the contrary, we will do so only because research and industry will launch new products and applications able to perform higher efficient works, making the user believe that, even if the consumption level increases, the waste of the already scarce resources at his disposal decreases and, therefore, he is relieved of his responsibilities.

As Orazio wrote Orazio «Prudens futuri temporis exitum / Caliginosa nocte premit Deus» (Ode 3, 29). If "a prudent god hides the events of the future in a dark night", we cannot neglect the inscrutable that always exists when we reason about future scenarios, however satisfied with the progress done and however confident in the future.

Therefore we affirm that the city of the future will be as intelligent, sustainable and democratic as the present one and may be more than this, and the access to the energy will be one of the litmus tests of these evolutionary characters. On condition that you remember that the city, like society, is also deeply unfair. It is the place where the extremes co-exist, and these extremes, most likely, will tend to increase the distance between them in the future.

Machines and applications that run on more and more powerful networks will make this city over-connected and over-controlled. Poles, panels and green architectures will make it different from today. But, like today, it will be a place where the incongruous and the unpredictable will work alongside the rational and the planned, showing that the city is intelligent, then manageable but not so much.

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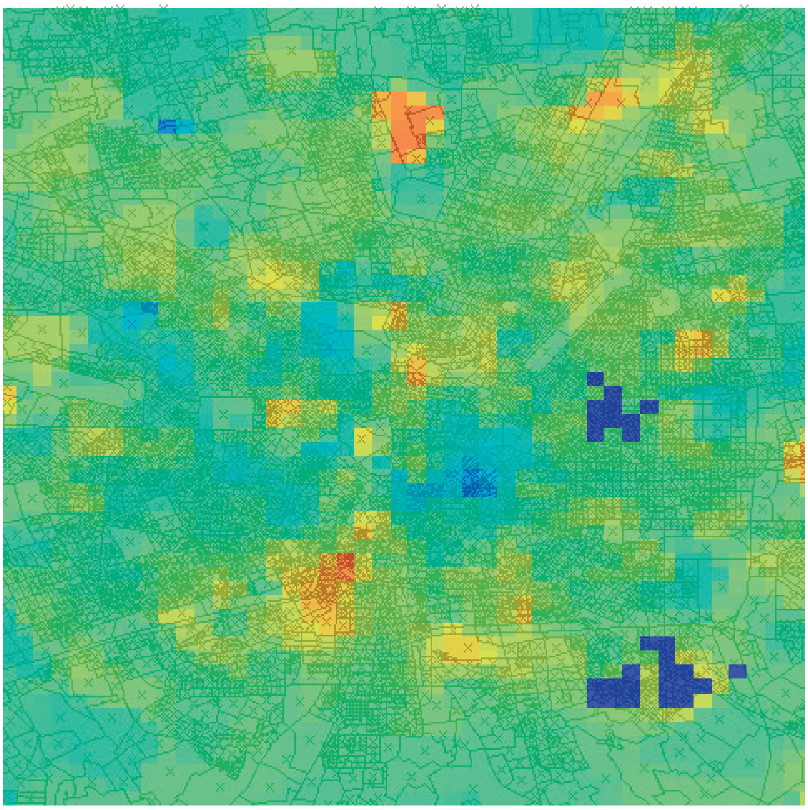
# TeMA
Journal of
Land Use, Mobility and Environment

TeMA 3 (2013) 325-340
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1935

review paper received 23 September 2013, accepted 30 November 2013

www.tema.unina.it



# DATI DI TRAFFICO TELEFONICO E POLITICHE PER LA MOBILITÀ

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ABSTRACT

The paper focusses on the potentialities offered by mobile phone data to provide useful knowledge of site practices and rhythms of usage of contemporary city, for more effective and equitable mobility policies.
Starting from the results of a research carried out at the Politecnico di Milano, using mobile phone data provided by Telecom Italia and finalized to verify the meaning of mobile phone data in returning the density of land use (Manfredini, Pucci & Tagliolato, 2012 and 2013) and the origins and destinations of daily movements (Tagliolato, Manfredini & Pucci, 2013), we will highlight how new maps, based on the processing of mobile phone data can represent spatialized urban practices and how they can give new insights for analyze space-time patterns of mobility practices.
In our research, mobile phone data, returning new maps of site practices in Lombardy Region with information on temporary populations and city usages patterns (daily/nightly practices, non-systematic mobility), allowed to trace "fuzzy boundaries" as perimeters of practices, proposed like a tool for supporting and increasing the efficiency of urban policies and mobility services.
In the paper, the identification of temporary urban populations through two types of mobile phone data (density of the calls and origin - destination traces of the calls) has not only a knowing purpose, but it is the condition for recognize new claims referred to "communities of practice", by which to build mobility policies incisive, also because not generalist.

KEYWORDS:
Telephone traffic data, mobility, mobile communities

## 1 SE LE FONTI SONO OPACHE RISPETTO A NUOVE FORME DI MOBILITÀ

Le analisi delle pratiche di mobilità si misurano da tempo con i limiti delle fonti disponibili che restituiscono perlopiù spostamenti in forma aggregata e in termini di flussi, non iscritti in uno spazio topologico, indifferenti quindi alle caratteristiche dei luoghi e alle modalità con cui le persone, con diverse finalità, utilizzano gli spazi urbani e le infrastrutture.

Le fonti disponibili, spesso non aggiornate, se non datate, offrono rappresentazioni sfuocate, incapaci cioè di restituire i ritmi[1] d'uso del territorio, legati alle modificazioni dell'organizzazione del lavoro e delle norme sociali[2].

Trasformazioni nelle dinamiche di mobilità spaziale emergevano già nel decennio scorso, analizzando i dati statistici "tradizionali" come gli spostamenti pendolari per motivi di lavoro e di studio (censimento Istat 2001) e le indagini sulla mobilità non sistematica disponibili per alcuni ambiti territoriali o in riferimento ad alcuni specifici temi (*survey* e indagini O/D).

Così, ad esempio, in Lombardia, i dati disponibili restituivano un uso articolato e complesso del territorio, esito di una trasformazione nella natura stessa degli spostamenti: i movimenti obbligati, per motivi di lavoro e di studio, caratterizzati da orari fissi e tragitti altrettanto definiti tra una origine (abitazione) e una destinazione (posto di lavoro/scuola), si ritagliavano un peso sempre meno significativo, a fronte dell'affermarsi di spostamenti per motivi personali, legati allo svago, agli acquisti, molto più articolati nel tempo e nello spazio.

Queste forme di mobilità multidirezionali che definivano cioé relazioni meno gerarchizzate e più articolate, soprattutto nei territori più dinamici della regione lombarda (Pucci, 2006; Pucci, 2007), spesso non trovavano nelle reti della mobilità e del trasporto pubblico una adeguata risposta in termini di offerta di collegamenti e di servizi, ancora prevalentemente radiocentrici e convergenti sui principali centri urbani.

Anche dalle poche fonti sulla mobilità non sistematica disponibili (O/D Regione Lombardia, 2002), si poteva leggere una complessificazione della catena di spostamenti giornalieri che concorreva a dilatare le fasce di punta giornaliere e che si accompagnava a un incremento dei tempi medi di spostamento, in parte anche dovuto a fenomeni di congestione crescente da traffico veicolare.

La mobilità quotidiana, descritta dalle fonti ufficiali, si caratterizzava per spostamenti ricorsivi e multidirezionali che restituivano un uso allargato e denso dei territori e non solo nella regione urbana milanese, risultato delle trasformazioni intervenute nei tempi, nei luoghi e nei modi della vita sociale e dei programmi di attività che concorrono a strutturare il territorio.

Quanto e come queste dinamiche si siano intensificate nel decennio intercensuario, ci informano le esperienze quotidiane e le poche indagini mirate condotte dopo il 2001, poiché non sono disponibili dati aggiornati sulla mobilità comunale e i pur utili dati del censimento Istat 2011 (ancora non pubblicati), per le modalità stesse con cui sono stati raccolti[3], saranno in ogni caso "opachi" rispetto a nuove forme di mobilità quotidiana che si sono affermate nell'ultimo decennio.

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1 Con riferimento ai lavori di Lefebvre, Amin and Thrift definiscono i ritmi urbani come "the coordinates through which inhabitants and visitors frame and order the urban experience" (Amin, Thrift, 2002, p. 17).

2 Sul piano individuale si è assistito a una razionalizzazione del tempo disponibile: lo si economizza per ridistribuirlo secondo una propria scala di valori nel corso della giornata, della settimana o dell'anno; il tempo diventa così più denso e, al contempo, "esploso", poiché differenziato. Sul piano relazionale, attraverso un regime di disponibilità permanente che tende a cancellare le frontiere tra privato e pubblico, si è assistito, per un numero crescente di figure professionali, a un indebolimento delle frontiere spaziali e temporali tra lavoro e vita privata, in relazione a un doppio processo che attiene da un lato a una "densificazione del lavoro", del suo contenuto, divenuto sempre più immateriale, dall'altro lato a una diversificazione dei tempi di lavoro e alla nascita di nuove tipologie di lavoratori (Godard,1997).

3 Il censimento Istat 2011 ha previsto un rilievo solo della mobilità giornaliera per motivi di lavoro e di studio, con informazioni unicamente sul mezzo impiegato e sui tempi medi di spostamento che, peraltro, non contemplano la possibilità di riconoscere spostamenti superiori a 90 min .

Se infatti nelle aree metropolitane si relativizza l'importanza dei movimenti pendolari nelle pratiche giornaliere di mobilità, accanto alla mobilità pendolare e alla mobilità "a sistematica" (legata cioè a motivi di svago e al tempo libero, al fare acquisto, al visitare amici ...), emergono nuove forme di mobilità che alcuni autori (Vincent Geslin, Kaufmann, 2011) hanno definito "reversibile", poiché relativa a "pratiche di spostamento che restituiscono un uso reversibile dei territori e delle reti" (Vincent Geslin, Kaufmann, 2011, p. 40). Si tratta cioè sempre di spostamenti legati al lavoro che assumono forme e temporalità più articolate rispetto agli spostamenti pendolari del secolo scorso[4].

Lo sviluppo crescente di forme di mobilità reversibile si spiega infatti perlopiù con le nuove possibilità offerte dalle reti di trasporto e comunicazione (mobilità come scelta), ma allo stesso tempo restituisce anche il compromesso tra l'attaccamento al luogo di vita[5] e la necessità di confrontarsi con un mercato del lavoro sempre più flessibile e aleatorio che obbliga, per avere un lavoro, a spostamenti giornalieri più lunghi (mobilità subita).

Se quindi in molti casi la mobilità reversibile costituisce una alternativa alla rilocalizzazione residenziale, in altrettanti casi la stessa è determinata da vincoli perlopiù dettati dal mercato del lavoro: la necessità, ad esempio, di spostarsi sempre più lontano per raggiungere giornalmente il luogo di lavoro, in assenza della possibilità di un trasferimento di domicilio che vincoli familiari o economici impediscono.

Queste forme di mobilità ibrida rappresentano una realtà importante, come emerge da alcune ricerche condotte, tra cui UE JobMob (Job mobilities and Family Lives in Europe http://www.jobmob-and-famlives.eu/) che individua tra le forme di mobilità quotidiana obbligata a cui prestare attenzione nelle politiche urbane europee: i pendolari di lunga distanza che destinano più di due ore del loro tempo al viaggio verso il luogo di lavoro; gli *overnighters* cioè persone che passano più di 60 notti/anno fuori dal loro domicilio abituale per motivi di lavoro, i "trasferiti recentemente", coloro che hanno effettuato una migrazione residenziale di più di 50 km per motivi professionali, le "relazioni di coppia a lunga distanza" tra coppie stabili che vivono in abitazioni diverse lontane più di un'ora di tragitto per motivi professionali e, infine, i *multimobiles*[6].

La complessità delle forme che assume la mobilità quotidiana era peraltro già in fieri in alcune ricerche degli anni'90 che articolavano le forme degli spostamenti legati al lavoro in modo più complesso rispetto a quanto restituito dai dati del pendolarismo casa-lavoro. Bericat (1994) distingueva tra *mobility to work* (i tragitti casa-lavoro), *mobility in/at work* (gli spostamenti svolti durante l'orario di lavoro, ad esempio per una riunione) e *mobility because of work* che traduce fenomeni di bi-residenzialità.

A una mobilità quotidiana che restituisce spostamenti ricorsivi secondo ritmi giornalieri variabili, non più riconducibili ai tradizionali orari del lavoro dipendente, si affiancano anche forme di mobilità periodica, occasionale e/o non ricorsiva, legate a fenomeni quali la multiresidenzialità, ma anche una mobilità pendolare periodica (1/2 giorni a settimana) di lunga distanza, associata al lavoro a domicilio che concorrono a intensificare la densità e il numero degli spostamenti quotidiani.

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[4] La mobilità reversibile è l'esito dell'effetto congiunto di due processi:
L'evoluzione del mercato del lavoro che impone una sempre maggiore flessibilità ed è soggetto a una maggiore imprevedibilità;
Le proprietà del territorio e delle reti di trasporto e di comunicazione che consentono di annullare le distanze fisiche, reinventandole.

[5] Per Vincent Geslin e Ortar (2012) è legato a tre condizioni: caratteristiche materiali e sensibili del luogo di vita; caratteristiche sociali (reti di relazioni) e caratteristiche culturali.

[6] Questa categoria, introdotta da Montulet et al. (2008), restituisce la "multi-appartenenza" a diverse comunità mobili, poiché la categoria dei "*multimobiles*", è composta da persone che appartengono simultaneamente a diverse "categorie mobili".

Queste nuove forme di mobilità, sia quotidiana che periodica, giocano sulla combinazione tra velocità offerta dalle reti per la mobilità e dai sistemi di comunicazione e capacità degli attori di appropriarsi dei sistemi tecnici.
Le conseguenze di queste pratiche di mobilità, espressione di popolazioni diverse che usano i mezzi e le risorse disponibili per lo spostamento in relazione non solo alla loro disponibilità effettiva, ma anche ai propri progetti personali, alle proprie preferenze e alle proprie capacità (competenze, accesso ai diversi mezzi, disponibilità finanziarie….), si leggono nel territorio che assume la forma di "un arcipelago" di luoghi e di legami che rivelano più una volontà di radicamento che di nomadismo. Il radicamento al luogo di residenza prevale e diventa la chiave per interpretare anche le mobilità reversibili.
In queste nuove pratiche di mobilità è il tempo e non la distanza a giocare un ruolo significativo: il tempo per gli spostamenti obbligati (lavoro, scuola), attorno a cui si organizza e da cui dipende il tempo personale, si fa più frammentario e con esso la variabilità spazio-temporale delle pratiche d'uso della città contemporanea.
Queste trasformazioni nelle pratiche di mobilità interrogano le fonti disponibili ed aprono a sfide operative che si misurano sulla capacità di integrare fonti esistenti - con cui si studiano gli spostamenti in modo aggregato (flussi O/D) riconoscendo una proporzionalità diretta tra utilità e costo / tempo dello spostamento - con approcci perlopiù interdisciplinari che interpretano la mobilità come forma spazializzata di interazione sociale[7], sperimentando anche nuove fonti.
In questa prospettiva, un interessante contributo viene dalle fonti digitali e, più in particolare, dalla telefonia mobile quale strumento per un monitoraggio in tempo reale delle dinamiche urbane e delle pratiche di mobilità.

## 2 NUOVE POSSIBILITÀ OFFERTE DAI DATI DI TRAFFICO TELEFONICO

Negli ultimi anni, numerosi progetti di ricerca hanno indagato se e come i dati di traffico telefonico possano essere utilizzati come strumenti di analisi e di rappresentazione delle dinamiche urbane e degli spostamenti individuali (Ahas, Mark, 2005; Ratti, Pulselli, Williams, Frenchman, 2006; Kwan, Dijst, Schwanen, 2007; Reades, Calabrese, Sevtsuk, Ratti, 2007).
In questi studi – incentrati sull'analisi, visualizzazione e interpretazione dei dati di traffico telefonico per restituire la densità d'uso e gli spostamenti delle persone, soprattutto in ambito urbano - gli utenti che generano traffico telefonico possono essere considerati come una rete di "sensori", distribuiti nel territorio e in grado di fornire informazioni sulle forme e sui modi d'uso dello spazio urbano, difficilmente ottenibili da altre fonti di dati, tradizionalmente utilizzate negli studi urbani.
In effetti, i dati di traffico telefonico offrono informazioni aggregate, omogenee nel tempo e nello spazio, sulla intensità del traffico rilevato dalle antenne del network, distribuite nel territorio, a costi e con tempi di trattamento dei dati inferiori a qualsiasi fonte tradizionale.
Le sperimentazioni avviate in letteratura[8] sui dati di traffico telefonico hanno lavorato principalmente su due diverse tipologie di dati: le densità di chiamate espresse in Erlang e i flussi rilevabili a partire da tracce localizzate e anonime di utenti di telefoni cellulari.
Si tratta di informazioni che non possono avere il dettaglio ottenibile con l'impiego di *Tracking technologies*, basate principalmente *sull'active mobile positioning* (*tracing*) che avviene mediante una specifica richiesta di

[7] Si tratta di approcci che considerano cioè la mobilità come capitale sociale e il territorio come spazio delle interazioni sociali, favoriti dalla mobilità.
[8] Per una sintetica ricostruzione si veda Pucci, Manfredini, Tagliolato (2013) in http://www.dastu.polimi.it/uploads/media/003-2013_DASTUwp_PucciManfrediniTagliolato.pdf

localizzazione di tracce di spostamenti individuali di un campione di persone scelto a priori, di cui si può avere anche il profilo socio-professionale[9].

Nonostante si tratti di dati anonimi e aggregati, i dati di traffico telefonico offrono in ogni caso opportunità significative sia in termini di disponibilità del dato, sia in termini di risoluzione spaziale e temporale dello stesso, consentendo cioè di indagare dinamiche territoriali senza ricorrere alla selezione "a priori" di un campione di individui da monitorare, come nel caso delle *Tracking technologies*, che necessariamente condiziona e orienta gli esiti delle indagini, oltre a essere quantitativamente più circoscritto.

Questo è il motivo per cui molti autori (Ahas, Mark, 2005; Reades et al. 2007; Ratti et al. 2006) indicano il monitoraggio anonimo e passivo del traffico telefonico come un valido complemento ai metodi tradizionali impiegati nell'analisi delle dinamiche urbane, in quanto può risolvere i limiti legati ai tempi di rilevamento tradizionali (è possibile derivare facilmente informazioni in tempo reale sullo stato della rete telefonica) e, al contempo, offre una alta pervasività di rilevamento nel territorio, dovuta all'enorme diffusione dei telefoni cellulari.

Le ricerche condotte hanno sperimentato la validità dei dati di telefonia mobile nel restituire le densità d'uso del territorio e la mobilità, secondo tre diversi approcci: studiando le relazioni tra coordinate spaziali del traffico cellulare e profilo socio-professionale delle persone che generano il traffico stesso (*Social Positioning Method* proposto da Rein Ahas and Ülar Mark, 2005); ricercando una correlazione tra intensità di attività telefonica, restituita per celle e distribuzione della popolazione nelle città (Sevtsuk, Ratti, 2010); utilizzando i dati di traffico dei telefoni cellulari come strumento-sonda per il monitoraggio del traffico (Caceres et al. 2008; Qiu et al. 2007; Fontaine, Smith 2005).

In tali approcci i dati aggregati di traffico telefonico sono trattati come il risultato di comportamenti e abitudini individuali, capaci quindi di restituire le tracce di popolazioni temporanee. In quest'ottica, gli stessi dati diventano una fonte utile nel restituire la variabilità delle densità d'uso della città che le fonti tradizionali difficilmente riescono a intercettare con una risoluzione spazio-temporale paragonabile.

Sulla utilità dei dati di telefonia mobile per le indagini urbane e sulla mobilità sono state avviate diverse sperimentazioni (Ahas, Mark, 2005; Ahas, Aasa, Silm, Tiru, 2009; Becker et al. 2011), anche in riferimento alla possibilità di classificazione funzionale del territorio, derivante da trattamento dei dati di telefonia mobile (Reades et al. 2007, Soto et al. 2011).

Questo aspetto riveste una particolare importanza per le politiche urbane perché consente di leggere la variabilità nei modi e nei tempi d'uso della città e, al contempo, di identificare diverse popolazioni temporanee che generano domande diversificate e che definiscono, attraverso le loro pratiche, geografie spazio-temporali d'uso del territorio che interferiscono necessariamente con i perimetri delle politiche istituzionali.

## 3 DATI DI TRAFFICO TELEFONICO PER LEGGERE LE DINAMICHE URBANE: UNA SPERIMENTAZIONE EMPIRICA

Da alcuni anni presso il Dastu Politecnico di Milano e in collaborazione con Telecom Italia, si è avviata una esperienza di ricerca[10] sulla significatività dei dati di traffico telefonico nel restituire le densità d'uso del

[9] Le metodologie di raccolta dei dati da telefonia mobile sono riconducibili a due principali tipologie: il posizionamento attraverso l'utilizzo di dati di telefonia mobile di un campionamento di tracce individuali *(tracking tecnologies)*; l'utilizzo di dati aggregati rilevati da antenne (principalmente *cell towers*) che restituiscono la densità di chiamate telefoniche.

[10] "Utilizzazione di dati di traffico telefonico nell'ambito di applicazioni urbanistiche e territoriali", convenzione di ricerca tra Dastu, Politecnico di Milano e Telecom Italia (2010 e 2011), coordinamento Fabio Manfredini e Paola Pucci, con Paolo Tagliolato e con Paolo Dilda e Carmelo Di Rosa.

territorio (Manfredini, Pucci, Tagliolato, 2012 e 2013) e le origini e destinazioni dei movimenti giornalieri di mobilità (Tagliolato et al., 2013).

La ricerca, condotta sulla Regione Lombardia utilizzando dati di traffico telefonico forniti da Telecom Italia, ha dapprima indagato la significatività e utilità dei nuovi dati per gli studi urbani (Manfredini, Pucci, Tagliolato, 2012) e per la mobilità (Tagliolato, Manfredini, Pucci, 2013), quindi ha sperimentato come e se le rappresentazioni delle dinamiche dei dati di traffico telefonico possano restituire la geografia spazio-temporale delle pratiche urbane e dare indicazioni utili a comprendere i modi d'uso e gli stili di vita delle popolazioni (Pucci, 2013).

La ricerca ha potuto elaborare sperimentazioni su due diverse tipologie di dati di traffico telefonico che restituiscono informazioni differentemente utili per il riconoscimento di dinamiche d'uso del territorio.

La prima tipologia di dati concerne la densità di chiamate telefoniche (Erlang), rilevate dalle antenne della rete radiomobile di Telecom Italia, relativa al territorio della Regione Lombardia e disponibile dal mese di gennaio 2009. L'Erlang descrive la densità del traffico telefonico ogni 15 minuti per aree di dimensioni pari a 250 m x 250 m. Il dato è stato dapprima trattato statisticamente per essere confrontato con variabili ricavabili da fonti di dati consolidate al fine di valutare le possibili ed eventuali correlazioni tra variabilità nell'intensità delle chiamate da rete cellulare e condizioni urbanistico-insediative (Manfredini, Pucci, Tagliolato, 2012).

Questa preliminare valutazione sui dati di densità di chiamate (Erlang) ha messo in evidenza alcuni limiti evidenti[11], ma anche potenzialità rilevanti per gli studi urbani, poiché il trattamento di questi dati permette di costruire alcune elaborazioni di grande interesse sulla intensità e variabilità spazio-temporale delle pratiche d'uso della città, anche connesse alla organizzazione di grandi eventi temporanei (come il Salone internazionale del Mobile) che attraggono, in periodi temporalmente circoscritti, grandi quantità di turisti, di *city users*, di popolazioni temporanee che si distribuiscono nella città, secondo ritmi diversificati, utilizzando intensamente alcuni servizi urbani (fig. 1).

Tali dinamiche, difficilmente cogliibili dalle fonti tradizionali soprattutto se l'evento non è concentrato in un unico luogo (come appunto il Salone del Mobile che con "il fuori salone" organizza eventi in diversi punti della città di Milano), rappresentano una informazione utile sia per la gestione dell'evento, sia per valutare i suoi impatti sul sistema territoriale (mobilità, congestione) ed economico (indotto, turismo) e per orientare alcune scelte in tema di offerta di servizi dedicati (Manfredini, Pucci, Tagliolato, 2010).

L'interesse e la significatività del dato sono stati confermati anche da elaborazioni che, attraverso un trattamento statistico (*spatial clustering*), finalizzato a estrapolare unicamente i trends costanti e ricorsivi dei dati in Erlang nell'arco del periodo considerato (Manfredini et al., 2012), hanno reso possibile restituire l'intensità e la variabilità del traffico telefonico georeferenziato.

La distribuzione spaziale dell'intensità del traffico telefonico durante il giorno e le dotazioni del territorio - cioè la presenza di infrastrutture, servizi e attività di diversa natura - ci hanno permesso di individuare diverse popolazioni temporanee, caratterizzate da pratiche d'uso diversificate nel tempo e nello spazio, all'interno della Regione urbana milanese.

Attraverso il trattamento dei dati di densità di traffico telefonico è stato dunque possibile ottenere nuove mappe della Regione urbana milanese, capaci di restituire densità di chiamate variabili nel tempo.

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[11] Il dato non consente di stabilire una correlazione "diretta" tra densità di chiamate (Erlang dati) e il numero di persone presenti in una cella, anche perché, come è noto, l'uso del telefono cellulare è condizionato dal profilo socio-professionale degli utenti (età, sesso, professione). Per questo lo stesso valore di Erlang registrato in una cella in 15 minuti di attività telefonica, può essere prodotto da 3 persone che parlano ciascuna per 5 minuti, ovvero da una sola persona che usa il telefono per 15 minuti.

Allo stesso tempo, le mappe prodotte consentono di collocare nello spazio "comunità di pratiche" (Wenger, 1998) che usano il territorio secondo temporalità e finalità diverse.

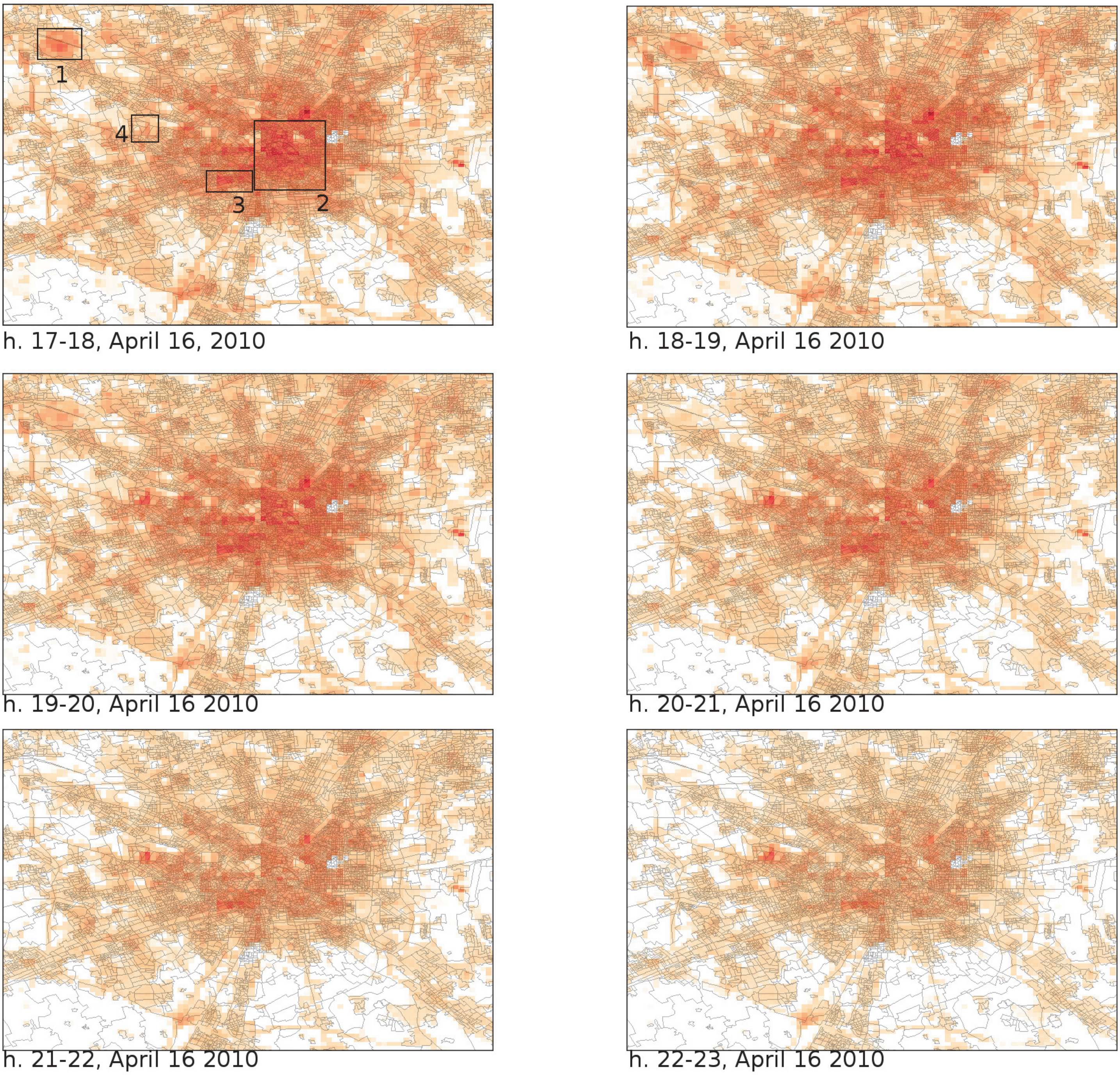


**Fig. 1: Densità di traffico telefonico durante il "Salone Internazionale del mobile" e le attività del "Fuori salone" (16 Aprile 2010 dalle 17h alle 23 h). In evidenza gli ambiti urbani interessati dalle attività espositive (1) e del "Fuori salone" (2 e 3)**

I risultati ottenuti presentano un certo interesse per le politiche di mobilità.
Le elaborazioni prodotte permettono, ad esempio, di osservare l'assenza di coincidenza tra i luoghi della mobilità pendolare del mattino e quelli del tardo pomeriggio (fig. 2). La carta dei territori della mobilità del tardo pomeriggio restituisce un arcipelago di luoghi densamente frequentati e legati allo shopping, alla cura della persona, ad attività personali che complessificano gli spostamenti serali, con conseguenze sulla rete infrastrutturale e dei trasporti pubblici.

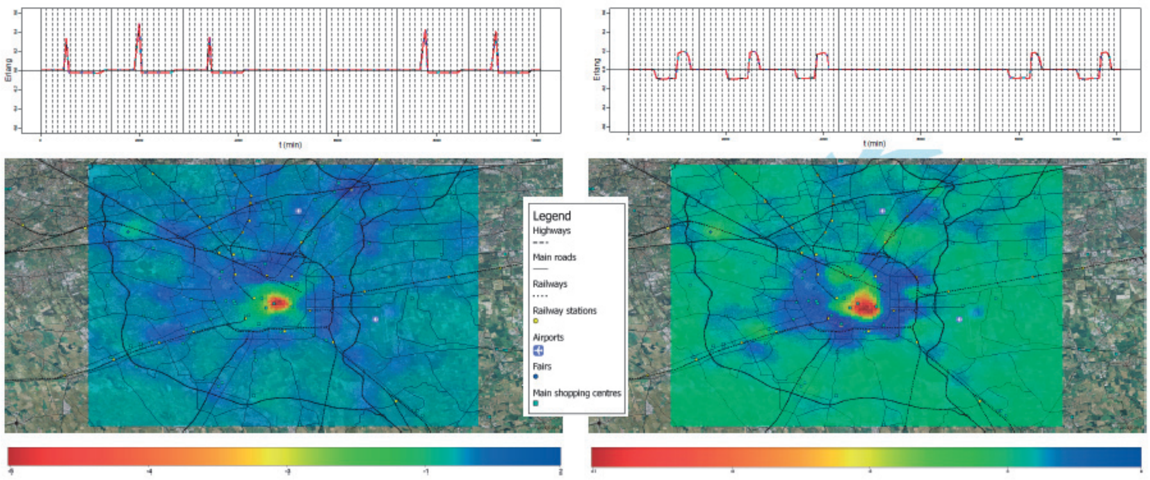


**Fig. 2: I territori della mobilità quotidiana: il mattino (a sinistra) e la sera (a destra)**

La catena di spostamenti dopo le 17.00 diventa dunque più articolata e complessa, poiché riferibile non solo e non tanto agli spostamenti legati al ritorno a casa dopo una giornata di lavoro, ma piuttosto alla frequentazione di luoghi diversi, da mettere in relazione ad attività personali.
In questo modo, coloro che sono pendolari tra le 8 h et 9 h del mattino si trasformano in *city users* tra le 17h e le 19h.
Le mappe rappresentano in modo efficace un modello di mobilità giornaliera tipico delle aree metropolitane, ma anche i luoghi in cui queste pratiche "hanno luogo" in modo ricorsivo. Ed è proprio questa caratteristica (la ricorsività) che ci permette di parlare di "comunità di pratica" o di "comunità mobili"[12]. Queste differenti popolazioni mobili generano dei perimetri contingenti, a partire dalle loro pratiche.
In questo caso, l'aggettivo contingente si riferisce alla capacità di trattenere, nella definizione di spazialità, la variabilità temporale connessa alle pratiche. Il riferimento a comunità mobili in quanto "comunità di pratiche" (Wenger, 1998), piuttosto che a "popolazioni metropolitane" (Martinotti, 1993), deriva dalla capacità della nozione proposta da Wenger di riconoscere la variabilità temporale e spaziale dei ruoli di ogni individuo, che può appartenere cioè a diverse comunità di pratiche nell'arco della giornata[13].
L'individuazione di queste comunità di pratiche attraverso la lente della mobilità non ha unicamente una finalità euristica, ma rappresenta la condizione attraverso cui riconoscere le nuove domande disaggregate per comunità di pratiche, su cui costruire politiche di offerta più efficaci e meno onerose finanziariamente, poiché non generaliste. Infatti l'uso del territorio che discende dal trattamento dei dati di traffico telefonico mette in discussione le politiche di offerta del trasporto pubblico, nonché la variabilità spazio-temporale di

[12] "Groupes sociaux définis à partir de leurs inscriptions territoriales, de leurs pratiques de mobilité, des dispositifs techniques qu'ils mettent en œuvre" (Le Breton, 2006, p. 26).
[13] Si veda anche Pasqui (2008) e, in particolare, la definizione di popolazioni urbane che l'autore propone a p. 148.

utilizzo degli spazi urbani, non necessariamente riconducibile alle funzioni offerte e ai loro tempi di attività, ma piuttosto ai modi con cui le persone frequentano alcuni di questi spazi. In questo modo, è possibile restituire i "ritmi urbani" generati dalle pratiche, piuttosto che determinati in base a orari di apertura/chiusura delle attività.

Le elaborazioni effettuate consentono così di mappare i territori degli acquisti, del tempo libero e dello svago (tra le 10 h e le 20 h) (fig. 3) che fanno emergere l'importanza, per queste attività, non solo del centro di Milano, ma anche del settore occidentale della città consolidata, piuttosto che dei grandi centri commerciali lungo l'anello delle tangenziali che sembrerebbero avere un peso molto meno rilevante nelle pratiche di acquisto del sabato.

Anche la geografia dei luoghi frequentati durante la notte restituisce mappe diverse nelle giornate di sabato sera rispetto alle sere feriali, così da consentire di mappare i territori del divertimento notturno che definiscono una geografia di luoghi densamente frequentati il sabato sera, del tutto differente da quella dei territori del lavoro notturno, cioè di quei luoghi frequentati dal lunedì al venerdì notte, per i quali va garantita un'offerta di trasporto pubblico anche di tipo non convenzionale (fig. 3).

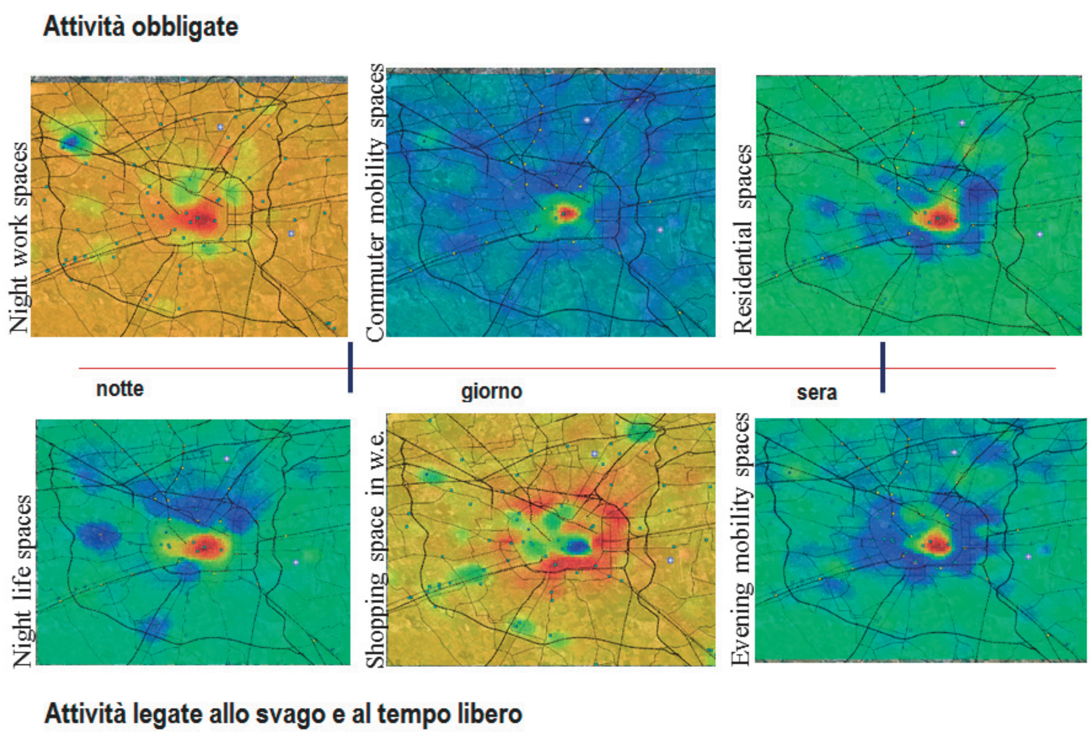


**Fig. 3: I territori delle pratiche**

Gli stessi dati contribuiscono a mettere in discussione alcune interpretazioni presenti in letteratura sui comportamenti erratici delle popolazioni metropolitane e sul nomadismo che caratterizzerebbe l'uso del territorio, come peraltro già alcuni studi condotti hanno evidenziato (Song et al., 2010).

Se infatti i dati confermano la importante densità di spostamenti giornalieri, gli stessi dati mostrano anche una forte ricorsività dei percorsi: ci spostiamo molto durante la giornata, ma seguendo percorsi conosciuti e

abituali. Questa osservazione rafforza il valore euristico dei territori contingenti, costruiti a partire dalle analisi della ricorsività delle pratiche di mobilità.
La seconda tipologia di dati su cui abbiamo lavorato consente di elaborare matrici origine-destinazione di flussi desunti dalle tracce localizzate e anonime degli utenti di telefoni cellulari della rete radiomobile Telecom. I dati sono stati raccolti in giorni feriali tra luglio e novembre 2012. In questo caso, le informazioni disponibili sono ricavate dalla geolocalizzazione di attività telefoniche di cellulari di utenti[14] e sono disponibile a livello di antenna che ha gestito l'attività. Per questo, presentano una grande capillarità spaziale e consentono di avere un dato ogni ora del giorno da una origine a una destinazione[15].
Le zone di origine e destinazione sono il risultato di tre diverse tassellazioni del territorio, sperimentate per arrivare a definire quella che meglio restituisse i flussi di spostamento[16]. Per questo studio, la tassellazione scelta è quella legata alla densità di antenne[17] che ha individuato in Lombardia 526 zone di origine e destinazione (Tagliolato, Manfredini, Pucci 2013).
I dati di origine-destinazione delle tracce di utenti di telefono cellulare hanno offerto la possibilità di mappare[18] la distribuzione degli spostamenti effettuati per motivi sia di lavoro sia personali, tra origini e destinazioni e per diverse fasce orarie giornaliere, di un campione realmente significativo di persone (più di un milione ogni giorno) (Tagliolato, Manfredini, Pucci, 2013).
Le elaborazioni prodotte hanno restituito, a grana fine e per ogni ora del giorno, i flussi prevalenti, confermando alcune dinamiche note, tra cui la polarizzazione degli spostamenti del mattino sui principali centri urbani e i poli di attività della regione, ma al contempo hanno permesso di far emergere anche la polverizzazione delle destinazioni degli spostamenti pomeridiani, in cui è rilevabile una articolazione più complessa della catena di spostamenti.
Si tratta di spostamenti spesso riconducibili a forme di mobilità non sistematica, in molti casi legata a spostamenti per motivi personali che vengono condotti dopo l'orario di lavoro.
La risoluzione temporale e spaziale dei dati consente infatti di far emergere quelle forme di mobilità che le fonti tradizionali non riescono a descrivere, così da restituire "the spatial and experiential dimensions of commuting rhythms, arguing that commuting can be alternatively conceived as a mobile practice" (Edensor, 2012, p. 189) che offre una ricca varietà di luoghi frequentati in base all'organizzazione oraria della giornata, legata non solo a eventi e attività obbligate (lavoro), ma anche ad attività personali (tempo libero, shopping, sport…).
Le elaborazioni prodotte portano infatti a ritenere che i dati disponibili costituiscano una fonte di rilevante importanza per leggere le dinamiche spaziali di mobilità giornaliera e il loro impatto sul territorio e sulle reti

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14 Con attività telefonica – via cellulare - intendiamo ogni interazione del dispositivo con la rete di telefonia mobile (ad esempio le chiamate ricevute o effettuate, gli SMS inviati o ricevuti, ecc.).

15 Con la finalità iniziale di "validare" questa nuova fonte di dati, le prime elaborazioni hanno portato dapprima a ricavare la somma vettoriale dei flussi che si spostano da ogni zona in ogni ora disponibile del giorno di rilievo. Il vettore finale considerato nella matrice o/d e ricavato dalla somma di tutte le singole connessioni tra ciascuna zona origine e le altre destinazioni, è caratterizzato da due dimensioni: l'entità, che è funzione delle grandezze dei vettori d'origine e l'angolo che esprime la direzione del flusso. Per restituire una rappresentazione grafica, i vettori somma sono stati, infine, applicati a ogni zona della tassellazione del territorio regionale (Tagliolato et al., 2013).

16 Le tre tassellazioni sono state eseguite in base ai seguenti criteri: aggregazione automatica dei comuni con almeno 13 antenne per zona (313 zone); aggregazione manuale in base agli "ambienti insediativi" della ricerca Itaten, tenendo quindi conto delle caratteristiche insediative (202 zone); clustering delle antenne (526 zone). Ogni zona è un'aggregazione di tasselli di Voronoi ottenuti a partire dai punti di localizzazione delle antenne. I raggruppamenti dei tasselli corrispondono al raggruppamento delle coordinate delle antenne ottenuto tramite clustering gerarchico. La zonizzazione finale è stata ottenuta calibrando l'algoritmo in modo da ottenere dei cluster sufficientemente equilibrati.

17 La distribuzione spaziale delle antenne dipende dalla quantità di traffico telefonico che deve essere gestito; pertanto la densità è moto alta nelle aree urbane e negli ambiti altamente urbanizzati, diversamente dalle zone agricole e scarsamente abitate.

18 Le mappe interattive sono consultabili in www.ladec.polimi.it/maps/od/fluxes.html

di mobilità, concorrendo a costruire conoscenza utile anche per gestire in modo più efficace ed equo l'offerta di servizi urbani e di trasporto.

In questa prospettiva, un esempio sull'utilità di una mappatura in tempo reale della geografia dei flussi e della loro variabilità, offerta dalla nuova fonte, riguarda la possibilità di riconoscere il modificarsi, nelle diverse ore del giorno, dei confini di attrattività dei principali centri urbani, come anche di individuare poli di attrattività che variano nell'arco della giornata.

Si tratta di informazioni utili per la gestione dell'offerta di servizi per la mobilità, ma anche per determinare i perimetri d'azione di alcune politiche urbane, tra cui le politiche tariffarie.

Infatti se si sovrappone il perimetro della gestione istituzionale del trasporto pubblico locale in Milano alle aree di influenza del capoluogo, definite in base ai flussi di traffico dei telefoni cellulari con destinazione Milano (fig. 4), possiamo constatare una discrepanza evidente tra ambiti di gestione del trasporto pubblico (Milano e i comuni di prima cintura) e l'ambito di attrattività del capoluogo.

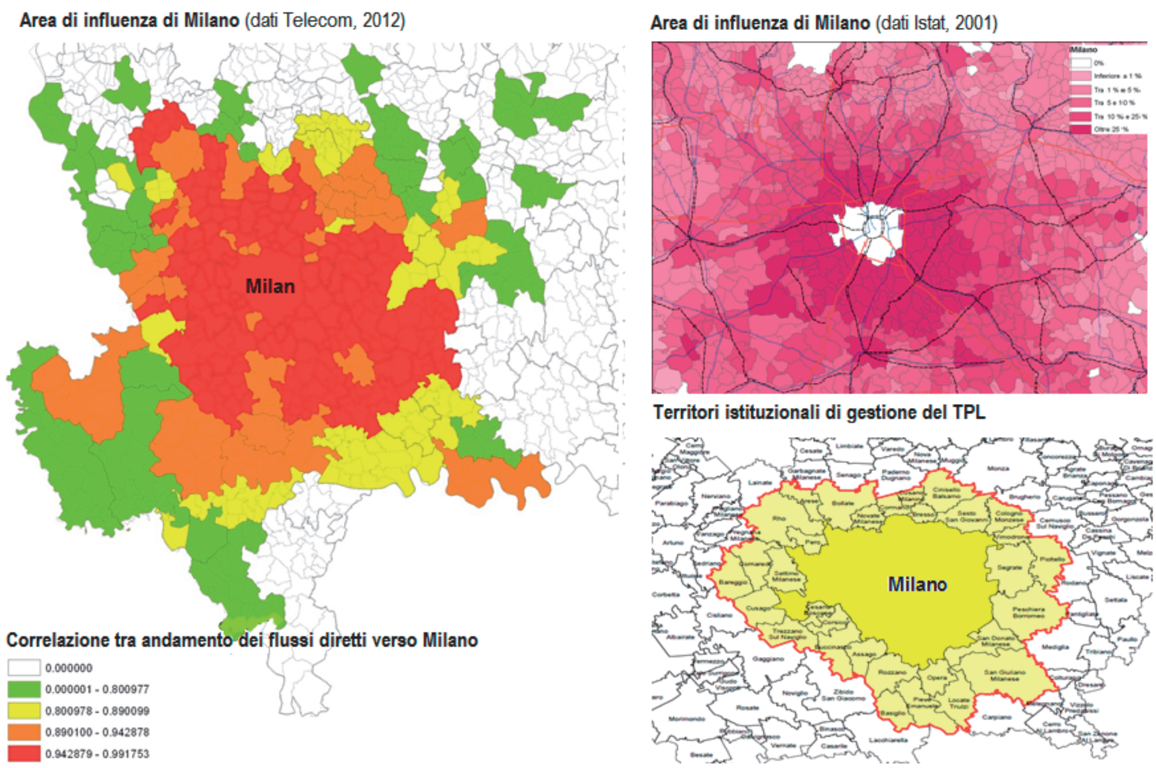


Fig. 4: Area di influenza di Milano con dati Telecom (sx) e dati Istat (dx) e il perimetro di gestione istituzionale del trasporto pubblico locale

Se tale fenomeno è da tempo noto anche in ragione degli "effets profondément structurants (ou déstructurants) de la mobilité des personnes sur les territoires politiques " (Estèbe, 2008, p. 6), meno scontata è la capacità di definire perimetri pertinenti per cogliere pratiche giornaliere di mobilità non solo pendolare, ma anche di *city users* (quindi più variabili nell'arco della giornata) che usano intensamente le reti della mobilità urbana e su questi ridefinire, con migliore efficacia, le politiche di tariffazione dei servizi di trasporto pubblico urbano. Possibilità che i dati di traffico telefonico consentono di garantire.

Va infatti ricordato che nella città di Milano – secondo una ricerca condotta da Pola e Ferri (2012) - 8,5% del budget comunale è destinato a coprire i costi dell'offerta di servizi urbani, tra cui un peso rilevante si ritaglia il trasporto pubblico. Del prezzo "politico" del biglietto di trasporto (1,5 euro a biglietto urbano) beneficiano non solo i residenti, ma anche i *city users*, i pendolari, le popolazioni temporanee che usano intensamente la rete del trasporto pubblico milanese. Questi ultimi non concorrono a coprirne i costi, poiché non sono interessati dalla tassazione locale, non risiedendo a Milano.

Reciprocamente, le popolazioni temporanee usano i servizi urbani, governati da una amministrazione locale di una città in cui non vivono e non votano; condizione che Martinotti ha efficacemente sintetizzato con riferimento al "paradosso del voto" (Martinotti, 1993, p. 163).

Se cioè i confini amministrativi rimangono i prerequisiti per l'allocazione delle risorse e degli interventi, in alcune condizioni, come quella evocata prima e in un regime di finanziamenti pubblici sempre più scarsi e di razionalizzazione dei servizi, la nuova configurazione di ambiti di fiscalità locale, definiti sulla base di confini variabili, costruiti sulle pratiche mutevoli che i dati di telefonia mobile possono restituire, diventa una misura non derogabile, oltre che capace di ripartire più equamente i costi di un servizio pubblico essenziale.

## 4 PROSPETTIVE E LIMITI DEI DATI DI TRAFFICO TELEFONICO PER LE POLITICHE URBANE

Lontani dal ricercare un determinismo analitico che consenta di fotografare la realtà delle pratiche d'uso dello spazio, utilizzando fonti quali la telefonia mobile, le elaborazioni prodotte hanno inteso valutare le potenzialità di una nuova fonte dati nel restituire la dimensione spaziale di pratiche d'uso, variabili nell'arco della giornata, che grande impatto hanno sulle densità d'uso della città e dei suoi servizi.

Se "certe tracce possiedono un valore individualizzante (…) ossia segnalano la presenza di una persona che ne è all'origine e che vi è implicata" (Ferraris, 2009, p. 336), nella nostra ricerca queste "tracce idioma", desunte dalle attività telefoniche, non collegano a un individuo, ma a "comunità di pratiche" proprio per la natura dei dati utilizzati che offrono cioè comportamenti aggregati legati alla intensità d'uso del telefono.

Questo implica considerare i dati di traffico telefonico come l'effetto di comportamenti e abitudini individuali che diventano, aggregati, un'informazione sulle caratteristiche del territorio, in qualche modo, una sua intrinseca proprietà, che varia nel tempo.

In questa prospettiva, le mappe prodotte a partire dai dati di telefonia mobile rappresentano i territori delle comunità di pratiche che generano dei perimetri contingenti, dei confini cioè che esprimono un valore relazionale, che sono variabili nel tempo in ragione delle dinamiche che si intendono cogliere e regolare.

Definire perimetri d'azione pertinenti per trattare la variabilità e l'interconnettività delle relazioni, la multiscalarità delle pratiche spazializzate che le categorie amministrative e le divisioni istituzionali dello spazio non riescono a trattare, è un tema da tempo al centro delle riflessioni nell'ambito dello *Spatial Planning*.

Se vi è consenso sulla necessità di costruire perimetri d'azione pertinenti sulla base dei quali proporre una diversa articolazione delle competenze e delle risorse che favoriscano una regolazione delle pratiche e la generazione di nuovi *frames*, necessari alla innovazione dei processi di governo (Healey, 2006, p. 1531), la sfida si pone in termini di strumenti interpretativi per riconoscerli.

I contenuti e le dimensioni principali di nozioni come *Soft spaces* (come spazi trasversali) e *Fuzzy boundaries*[19] (come perimetrazioni fluide) raccolgono infatti consenso, anche in ragione delle loro caratteristiche fondanti[20], capaci di declinare "the new post-devolution spaces of planning" (Haughton et al., 2010).

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[19] Fuzzy boundaries "are used to define functional regions which do not conform to known political or administrative units" (Heley, 2012, p. 6).

[20] I *Soft spaces* hanno quattro caratteristiche principali (Haughton and Allmendinger 2008) :
- " They are representative of a deliberate attempt to generate new thinking and insert new models of public engagement (…);

Meno scontate sono le modalità con cui definire perimetrazioni fluide e le ricadute operative in termini di rapporti con perimetri istituzionali che orientano e governano il comportamento spaziale individuale e collettivo e a cui corrispondono poteri e competenze consolidati.
Le considerazioni proposte a partire dal trattamento dei dati di traffico telefonico e in riferimento alle politiche per la mobilità, hanno dunque la finalità di suggerire un processo induttivo per mappare territori contingenti, utili per individuare misure tese a migliorare l'efficacia dei servizi e a rispondere a domande emergenti.
Avviare un processo induttivo rappresenta la condizione necessaria non solo per riconoscere e per nominare i territori delle pratiche, ma anche per operare un "re-scale" nelle gerarchie di intervento, quindi per governare processi dinamici, pur non rinunciando a un confronto con confini amministrativi istituzionali dati.
Infatti le politiche costruite sui territori contingenti sono "irriducibili a ogni formalizzazione tradizionale e, in definitiva, mettono in discussione la stessa modalità ordinaria di definizione e di trattamento delle politiche pubbliche" (Pasqui, 2008, p. 149).
Nel rapporto tra territori contingenti e territori istituzionali, i problemi legati alla variabilità temporale delle pratiche all'origine dei perimetri osservati, come quelli dei meccanismi di rappresentanza politica delle comunità di pratiche restano ancora irrisolti.
Tuttavia il riconoscere territori contingenti come espressione di pratiche d'uso del territorio, dei suoi servizi e delle sue infrastrutture che i dati di traffico telefonico consentono, rappresenta una condizione necessaria per le politiche urbane se si intende "prender atto che oggi una governabilità urbana che voglia essere efficace deve essere limitata, intrinseca ai processi e quindi capace di cogliere e valorizzare le sinergie tra interventi settoriali e le potenzialità offerte dal mutare delle situazioni catalizzatrici dei diversi interessi in gioco. Ciò che non significa affatto rinunciare a governare e quindi a ricomporre la città" (Dematteis, 2012).
Nel caso specifico, le caratteristiche dei dati di traffico telefonico, poiché consentono di restituire la variabilità delle pratiche d'uso del territorio, rendono i dati stessi una fonte promettente per contribuire a individuare quelle che Dematteis chiama "situazioni catalizzatrici dei diversi interessi in gioco". E, d'altronde, l'esempio riferito all'area di attrattività di Milano, generata a partire dal trattamento dei dati di traffico telefonico (fig. 4), restituisce le potenzialità di questa fonte nell'offrire conoscenze utili anche per migliorare l'efficacia, la qualità e l'equità delle politiche per la mobilità.
Se si condivide la condizione che "tous les gouvernements territoriaux vivent sous un régime permanent de dissociation entre les citoyens, les habitants et les usagers de la ville" (Estèbe, 2008, p. 17), la possibilità di riconoscere le diverse popolazioni urbane e i territori delle loro pratiche, attraverso il trattamento dei dati di traffico telefonico, può rappresentare una condizione utile per avviare processi di "re-scale" e di costruzione di nuove geografie di *partnerships* tra i differenti soggetti coinvolti nella costruzione di politiche urbane.

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- They are not antithetical to hard spaces, but are intended to work alongside, augment and where more expeditious challenge existing institutional frameworks and practices ;
- They are becoming more important and more numerous as part of the changing institutional landscape of spatial planning ;
- They are predominately defined (or not) in a fluid fashion, and with reference to fuzziness, in order that they are more amenable to shifting range of issues and actors, involved in spatial planning projects .

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## IMAGES SOURCES

Fig. 1: elaborazioni DAStU, Politecnico di Milano di dati Telecom Italia

Figg. 2, 3: elaborazioni MOX/DAStU Politecnico di Milano  di dati Telecom Italia

Fig. 4: elaborazioni DAStU, Politecnico di Milano di dati Telecom Italia (2012) e Istat (2001)

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TeMA

Journal of
Land Use, Mobility and Environment

TeMA 3 (2013) 341-354
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1933

review paper received 10 September 2013, accepted 30 November 2013

www.tema.unina.it


# SMART MOBILITY

## OPPORTUNITÀ E CONDIZIONI

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ABSTRACT

Smart mobility is often presented, in the strategies for smart cities that public institutions and private big players are promoting, as one of the main options, if not "the option", to pursue more sustainable transport systems.
Most of the opportunities of smart mobility are related to technological innovations for managing and organizing trips and traffic and for improving the environmental efficiency of vehicles; but the impacts of these innovations, in particular over the long term, depend on how they are embedded by the users in their daily activities and practices.
These "boundary conditions" are often disregarded, just as they generally concern not a technological dimension, but the psychological-cognitive and socio-cultural domain. The paper tries to analyze these boundary conditions, which opportunities they can support and which risks can emerge if they are not fulfilled.
It also tries to argue, by some experiences from the case of Turin (an Italian city that is considered at the cutting edge of smart mobility), why at the heart of smart mobility policies there should be citizens instead of technologies, and why these policies should be supported and integrated by other measures and policies (for transports, urban planning, education and so on) in order to influence the behavior and the choices of these citizens.

KEYWORDS:
Smart mobility; smart city; intelligent transportation systems; Torino

## 1 *SMARTNESS* E SOSTENIBILITÀ

La *smart mobility* costituisce una componente ricorrente nei discorsi sulla *smart city*. Rappresenta uno dei sei assi su cui è strutturato il concetto di *smart city* nella fondativa ricerca condotta dalle università di Vienna, Delft e Lubiana (Giffinger *et al.* 2007). Rientra tra gli ambiti principali dell'iniziativa "Smart cities and communities" lanciata dall'Unione europea nel 2011, ed è uno dei settori finanziati nei bandi connessi. Tra le sedici aree tematiche del programma "Smart cities and communities and social innovation", promosso dal MIUR nel 2012, due sono rappresentate da "Smart mobility" e "Last mile logistic". Nelle strategie sulla *smart city* promosse da *big player* privati come ABB, Cisco, Finmeccanica, IBM, Siemens, la *smart mobility* costituisce sempre un tema portante.

Alla base di questa centralità vi sono almeno due fattori. In primo luogo, la mobilità gioca un ruolo molto significativo nei consumi energetici, che costituiscono la dimensione ambientale principale, se non in alcuni casi quasi esclusiva, presa in considerazione nei discorsi sulla *smart city* (Toldo 2013). Limitandosi all'area dell'Unione europea a 27, nel 2010 il settore dei trasporti ha contribuito per oltre il 30% ai consumi energetici totali (di tale quota, oltre il 90% deriva da fonti non rinnovabili) e per il 25% alle emissioni di gas ad effetto serra (European Commission 2012); a sua volta, la mobilità specificamente urbana incide per il 40% sulle emissioni di $CO_2$ dei trasporti (Commissione europea 2007).

In secondo luogo, da ormai trent'anni il settore dei trasporti è già ambito privilegiato di applicazione di innovazioni legate alle ICT, volte a sviluppare i cosiddetti *Intelligent Transportation Systems* (ITS), e dunque la ricerca di una maggiore *smartness* nella mobilità è tutto meno che una novità (Ambrosino, Boero, Nelson, Romanazzo 2010); i risultati finora raggiunti dagli ITS restano però in gran parte frammentari, eterogenei e poco interoperabili, al punto che la Commissione europea ha adottato nel 2008 un Piano d'azione e nel 2010 una Direttiva con l'obiettivo principale di armonizzare, su standard comuni, gli ITS operanti in tutto il territorio dell'Unione. E proprio perché poco "maturo", il mercato di questi sistemi è estremamente interessante per le grandi compagnie delle ICT: secondo stime recenti (Markets, Markets 2012), a livello globale potrebbe crescere tra il 2012 ed il 2017 ad un tasso annuo del 12%, fino a sfiorare i 25 miliardi di dollari.

Benché dunque non costituisca una novità, il concetto di *smartness* applicato alla mobilità riflette quella vaghezza che si ritrova nella stessa definizione di *smart city* e che è già stata evidenziata in molti studi (si vedano, ad esempio, Caragliu, Del Bo, Nijkamp 2009; Papa, Gargiulo, Galderisi 2013). Due sono le principali accezioni che si trovano riferite all'espressione *smart mobility*:

- un sistema di mobilità efficace ed efficiente;
- un sistema di mobilità caratterizzato da un consistente e sistematico utilizzo di innovazioni tecnologiche, sia in termini di ICT (impiegate per fornire informazioni a chi si sposta, per fluidificare il traffico, per gestire le flotte del trasporto pubblico, per migliorare la logistica del trasporto merci ecc.), sia in termini di mezzi di spostamento (auto elettriche, *bus on demand*, *bike* e *car sharing* ecc.).

La prima definizione è indipendente dal ruolo giocato dall'innovazione tecnologica nel perseguire l'efficacia e l'efficienza del sistema di mobilità; o, meglio, fa riferimento all'uso di tecnologie "appropriate", più che necessariamente "di punta". Ad esempio, nei cataloghi di casi di eccellenza di *smart cities* (si veda, ad esempio, Cittalia 2012) è molto spesso inclusa Curitiba, città brasiliana la cui *smartness* viene attribuita soprattutto all'ottimo sistema di trasporto pubblico, basato su una rete di corridoi riservati agli autobus che possono viaggiare con alte frequenze e velocità commerciali: una soluzione molto efficace ed efficiente, ma del tutto *low tech* (e scelta proprio perché richiedeva investimenti limitati, non avendo la città le risorse finanziarie necessarie per realizzare un sistema di metropolitana).

La seconda definizione, viceversa, assegna un ruolo centrale alle tecnologie "di punta", più innovative (e in particolare alle ICT), a volte anche a prescindere da un'effettiva valutazione del rapporto costo/benefici del loro utilizzo (soprattutto in termini comparativi rispetto a soluzioni più tradizionali), trascurando il fatto che, come già è stato evidenziato per la *smart city* in generale (Morelli *et al.* 2013), non necessariamente *smartness* è sinonimo di sostenibilità. È però questa l'accezione oggi dominante nei discorsi e nelle strategie sulla *smart mobility*, e non solo dei *big player*[1]: anche i finanziamenti dell'Unione europea e del MIUR sono prevalentemente orientati a promuovere soluzioni ai problemi della mobilità in termini di innovazioni tecnologiche, se non altro per le ricadute economiche che esse possono generare[2]. Questa enfasi generalizzata su una *smart mobility* così intesa rischia di determinare l'appiattimento su un'unica visione tecno-centrica della città, in cui il ricorso alle tecnologie più innovative nel settore dei trasporti può apparire come quello che, nella *actor-network theory*, viene definito un "punto di passaggio obbligato" (Callon 1986) verso una mobilità più sostenibile.

Se diffusa è l'esaltazione delle opportunità offerte dalla *smart mobility*, sono invece spesso trascurate le "condizioni al contorno" perché esse si realizzino, anche perché tali condizioni sono per lo più esterne alla dimensione prettamente tecnologica, e connesse invece ad aspetti inerenti la sfera psicologico-cognitiva, quella socio-culturale, quella delle politiche settoriali e intersettoriali. Anche in questo caso, si riflette un nodo problematico già evidenziato più in generale per la *smart city*: una città non può essere considerata *smart* solo perché consuma meno energia o è costruita con materiali riciclabili, senza considerare il ruolo che vi giocano i processi di partecipazione, di costruzione del capitale umano, di formazione, di apprendimento sociale (Papa 2013).

Nelle pagine che seguono si proverà allora a mettere in evidenza quali sono le condizioni per una mobilità davvero *smart*, quali le opportunità che esse possono favorire e quali invece i rischi che possono presentarsi nel caso esse non si verifichino, in relazione alle pratiche individuali (par. 2), agli aspetti sociali (par. 3) e alle politiche settoriali e territoriali promosse dalle amministrazioni pubbliche (par. 4).

In quest'analisi, si farà più volte riferimento al caso di Torino, che è particolarmente interessante dal punto di vista della *smart mobility* (Staricco 2012). Da un lato, infatti, può vantare un'esperienza quasi trentennale nell'ambito dei sistemi ITS[3], è all'avanguardia a livello italiano nel *bike* e *car sharing*, partecipa a due dei progetti sulla *smart mobility* finanziati dal MIUR nel recente bando del 2012, ha una forte specializzazione produttiva nel settore dei mezzi di trasporto ed è sede di un distretto tecnologico ICT. Dall'altro lato, la città si trova ad affrontare criticità ambientali particolarmente accentuate, in buona misura legate proprio alla mobilità: secondo il database *Airbase* dell'Agenzia europea dell'ambiente, nel periodo 2004-08 Torino risulta la penultima tra le 221 città europee censite per qualità dell'aria, dopo la bulgara Plovdiv, e nel caso delle micropolveri e degli ossidi di azoto il traffico stradale sarebbe il primo responsabile; secondo stime dell'Arpa

1 Si possono riscontrare di frequente, nei siti e negli studi promossi da queste aziende, affermazioni che pongono l'innovazione *smart* come l'unica via per migliorare i sistemi di mobilità, come la seguente (contenuta nel rapporto *Smart mobility. Muoversi meglio per vivere meglio*, promosso da Finmeccanica): l'evoluzione verso la *smart mobility* "non è un passaggio teorico o una scelta opzionale; è un processo inevitabile e urgente" (The European House – Ambrosetti 2012, p. 35).

2 La Commissione europea indica esplicitamente, tra le motivazioni alla base del suo Piano d'azione per gli ITS, quella di "potenziare il ruolo guida dell'industria europea degli ITS sui mercati mondiali, promuovendo l'offerta di prodotti e servizi innovativi ai costruttori di veicoli, agli operatori del trasporto, alle imprese di logistica e agli utenti" (European Commission 2008, p. 13).

3 A partire dal 1984 Torino sperimenta il primo sistema in Italia di monitoraggio e controllo del trasporto pubblico; nel 1985 con il "Progetto Torino" sviluppa il primo sistema pilota di controllo semaforico intelligente. Questi primi progetti evolvono e confluiscono nel 1992 nel progetto 5T - *Tecnologie Telematiche Trasporti Traffico Torino*, consorzio pubblico/privato sviluppato nell'ambito del programma europeo Quartet (cui Torino partecipa con Birmingham, Atene e Stoccarda); dal 2008 diventa un Srl, con l'uscita dei soci privati e l'ingresso, accanto a GTT (che ne detiene il 35%), di Regione Piemonte (30%), Comune di Torino (30%) e Provincia di Torino (5%). Oggi 5T opera in due principali ambiti d'azione, entrambi connessi all'applicazione di tecnologie ICT al settore della mobilità: da un lato la fluidificazione e regolamentazione del traffico, dall'altro le informazioni agli utenti.

Piemonte, il 45% della popolazione torinese di giorno e il 67% di notte sarebbe esposto a livelli di rumore superiori alle soglie di legge, nel 92,6% dei casi a causa del traffico stradale. In altre parole, Torino sembra costituire un caso interessante per capire se una mobilità *smart* è anche, e in che misura, sostenibile.

## 2 *SMART MOBILITY* E PRATICHE INDIVIDUALI

L'impatto delle ICT sui trasporti è stato spesso sovrastimato in passato. Geels & Smit (2000) hanno passato in rassegna molti studi che hanno provato a valutare quali impatti avrebbe avuto sul traffico e sull'efficienza dei sistemi di trasporto l'introduzione di nuove forme di ICT, sia in termini diretti (ad esempio, i sistemi di navigazione satellitare e le informazioni sugli spostamenti) sia indirettamente (a seguito della diffusione del telelavoro, delle teleconferenze, del commercio elettronico ecc.): le stime analizzate sono risultate sistematicamente e significativamente superiori rispetto ai cambiamenti che si sono effettivamente realizzati. Gli autori individuano diverse motivazioni alla base di queste errate previsioni, in gran parte legate ad una mancata considerazione delle dinamiche e pratiche sociali attraverso cui le nuove tecnologie vengono adottate dagli utenti: ad esempio, si ipotizza che tali tecnologie siano usate in sostituzione delle precedenti (e non in complementarità con esse), si trascurano le nuove attività che possono emergere dalla loro diffusione, si tengono in conto solo gli aspetti funzionali (e non anche quelli psicologici e sociali) del loro utilizzo, si assume che il processo del loro *embedding* nella società non presenti problematicità.
Questi fattori non andrebbero trascurati nel valutare il potenziale futuro della *smart mobility*. Nel suo Libro bianco sui trasporti del 2001, la Commissione europea stimava che gli ITS avessero un potenziale di riduzione dei tempi di spostamento dell'ordine del 20% e di aumento della capacità della rete del 5-10%, alla luce dei risultati ottenuti in alcune sperimentazioni condotte nel decennio precedente in certe città. Nel più recente Libro bianco del 2011, così come nei già citati Piano d'azione per gli ITS del 2008 e Direttiva del 2010, la Commissione europea si è mostrata assai più prudente, evitando di esplicitare una valutazione degli effetti previsti dall'armonizzazione e diffusione dei vari sistemi ITS sui trasporti nel territorio dell'Unione.
In effetti, stimare tali effetti non è semplice almeno sul lungo periodo, proprio per gli aspetti psicologici-cognitivi e socio-culturali connessi all'utilizzo degli ITS. Si pensi ad una delle più esaltate potenzialità della *smart mobility*, quella connessa alle informazioni che possono essere fornite tramite le ICT agli individui sia prima sia durante lo spostamento, perché possano ottimizzarne l'organizzazione (nella scelta del mezzo, degli orari, dei percorsi): queste informazioni dovrebbero avere effetti importanti sulla congestione, perché permetterebbero agli automobilisti di scegliere volta per volta, in tempo reale, i percorsi meno trafficati. Si trascura però che questi effetti positivi si limitano in genere al breve termine, mentre possono annullarsi sul medio-lungo termine. È stato evidenziato (Adler 2001), ad esempio, come i navigatori satellitari, nel caso offrano indicazioni di percorso "off-line" senza considerare i livelli di traffico presenti sulla rete in tempo reale, comportino vantaggi per l'utente soprattutto in contesti in cui si trova a guidare per le prime volte; più migliora nel tempo la conoscenza del contesto, meno il guidatore tende a fare affidamento sul navigatore e più invece su riferimenti fisici e mnemonici come i *landmark*. Nel caso di navigatori che invece monitorano le condizioni di traffico in tempo reale, i vantaggi per l'utente possono mantenersi anche sul medio-lungo periodo, ma non è detto che questo sia vero a livello di domanda di trasporto complessiva. Come è emerso da più studi[4], nel corso della storia è rimasto pressoché immutato il tempo medio giornaliero dedicato dagli individui agli spostamenti: tra i 70 ed i 90 minuti, quasi si trattasse di un bisogno, quello di "muoversi", antropologicamente strutturale all'essere umano. È la cosiddetta "costante di Marchetti", dal nome dell'antropologo che per primo l'ha riscontrata: quando un progresso tecnologico aumenta la velocità media a cui è possibile muoversi, gli individui sfruttano generalmente il tempo risparmiato nei loro spostamenti non

[4] Si vedano, ad esempio, Marchetti (1994); Zahavi, Ryan (1980).

per svolgere altre attività, ma per compiere un numero maggiore di spostamenti o per allungare la distanza media di quelli che già compiono. Si tratta di un fenomeno già emerso in termini infrastrutturali: il tentativo di risolvere i problemi di congestione attraverso un potenziamento dell'offerta di trasporto viene vanificato dall'elasticità della domanda, con nuovo traffico "indotto" che torna a congestionare le nuove strade o quelle esistenti ampliate (Gorham 2007; Plane 1995). Lo stesso meccanismo potrebbe riprodursi a seguito dell'uso degli ITS: la fluidificazione del traffico che essi possono determinare sul breve periodo potrebbe generare un incremento della domanda di mobilità, che a sua volta ridurrebbe sul lungo termine gli effetti positivi degli stessi ITS sulla congestione[5].

Un'altra prospettiva centrale della *smart mobility* è rappresentata dall'innovazione tecnologica dei veicoli, che permetterebbe di ridurne gli impatti ambientali in termini, in particolare, di inquinamento atmosferico e di contributo all'effetto serra. Da questo punto di vista, l'innovazione ha svolto in questi ultimi decenni un ruolo fondamentale. Ad esempio, le emissioni di ossido di zolfo e di azoto dei veicoli Euro 5 attualmente immatricolati sono inferiori di oltre l'80% rispetto a quelle degli Euro 0 che venivano venduti vent'anni fa, ma la riduzione di questi inquinanti atmosferici che si è effettivamente realizzata a livello di Unione europea è stata limitata a circa un 20% (European Environment Agency 2013); una buona parte degli effetti positivi dell'innovazione tecnologica è stata non solo rallentata dai tempi lunghi del rinnovo del parco veicolare (tempi che crescono ulteriormente in questa fase di crisi economica e di forte contrazione dei consumi), ma anche, per così dire, vanificata dall'incremento dei chilometri percorsi dai veicoli, nonché dall'aumento del loro peso medio e della loro potenza, che incidono fino al 40% sui consumi e sulle emissioni. L'automobile continua infatti ad essere vista come uno status symbol, in particolare in relazione alla sua potenza[6]: in provincia di Torino, ad esempio, la quota di autovetture con cilindrata inferiore ai 1.200 cc è scesa dal 37,8% del 2002 al 22,1% del 2011, mentre è cresciuta dal 19,6% al 24,1% quella relativa a cilindrate superiori ai 1.800 cc.

In altre parole, un approccio prevalentemente incentrato sulla diffusione di tecnologie innovative per la mobilità rischia di avere effetti limitati in termini di miglioramento della sostenibilità, se non tiene conto delle dinamiche individuali e sociali attraverso cui tali tecnologie vengono integrate nei comportamenti di mobilità dei cittadini.

## 3 *SMART MOBILITY* ED EQUITÀ SOCIALE

Molti degli impatti negativi dei trasporti sull'ambiente, sulla società e sull'economia non sono costi "interni", sostenuti direttamente da chi compie gli spostamenti (attraverso il pagamento del carburante, delle tariffe autostradali, delle tasse automobilistiche, dei biglietti del trasporto pubblico ecc.), bensì costi esterni, che ricadono su tutta la collettività. Secondo alcune stime, questi costi esterni rappresenterebbero circa un terzo dei costi totali del sistema dei trasporti (Lombard, Molocchi, Buscema, Molinario 2005). Come si è detto, oltre il 90% di questi costi sono generati dal trasporto motorizzato privato, che gode quindi di un vantaggio

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5 Non solo, nella loro impostazione volta a distribuire i flussi in primis sulle strade meno trafficate, gli ITS possono "consigliare" agli automobilisti di percorrere strade secondarie, che finiscono così per diventare pericolose perché non progettate per ospitare i flussi consistenti che si generano quando sono in molti a seguire le indicazioni dei navigatori: in provincia di Torino, ad esempio, la strada provinciale 147 presso Lombriasco e Pancalieri ha registrato recentemente un aumento di traffico insostenibile data la sua sezione, proprio perché proposta dai navigatori in alternativa alla vicina sovraffollata statale 663 ("La strada che piace ai GPS. Era deserta, ora c'è la coda", *La Stampa*, 22 aprile 2013).

6 Anche l'aggressività nella guida può avere un'incidenza significativa: uno stile di guida corretto può ridurre i consumi di un 10-20% (Barth, Boriboonsomsin 2009).

comparativo rispetto agli altri modi di trasporto, i cui costi effettivi sono sostenuti in percentuale maggiore dagli utenti[7].

Una delle strategie su cui punta l'Unione europea per favorire il riequilibrio modale consiste nell'internalizzazione di questi costi esterni dei trasporti, secondo il principio "chi inquina paga": chi effettua uno spostamento dovrebbe pagare direttamente non solo i costi interni, come già avviene, ma anche quelli esterni, senza che debba farsene carico la collettività. Questa strategia è finora stata orientata in primis sul trasporto merci, a partire dal cosiddetto "Greening transport package" adottato nel 2008 e finalizzato a creare un sistema di telepedaggio (interoperabile tra i diversi Stati membri dell'Unione) per imporre ai veicoli merci pesanti tariffe differenziate proporzionalmente agli impatti generati dai loro spostamenti. Nel Libro Bianco sui trasporti del 2011, la Commissione europea ha posto l'obiettivo per il 2020 di "procedere alla piena e obbligatoria internalizzazione dei costi esterni (comprendente, oltre al recupero obbligatorio dei costi di usura, anche i costi relativi all'inquinamento acustico e atmosferico e alla congestione) nel trasporto stradale" (p. 33), anche in ambito urbano, sia per i veicoli commerciali sia per le autovetture.

Finora, nel caso del trasporto passeggeri le esperienze di *road pricing* e *congestion charging* sono state applicate soprattutto nelle aree centrali delle città o su determinate tratte stradali molto congestionate, con l'obiettivo di ridurne i livelli di congestione (Anas, Lindsey 2011). Le prime esperienze sono state condotte a Singapore dagli anni Settanta e successivamente si sono moltiplicate, dal caso di Londra a quello più recente in Italia della cosiddetta "area C" di Milano. In una prospettiva di *smart mobility*, le tecnologie ICT applicate ai trasporti offrono l'opportunità di ampliare e generalizzare l'internalizzazione dei costi esterni attraverso una tariffazione sistematica degli spostamenti, estesa su tutto il territorio (Maerivoet *et al.* 2012): i Paesi Bassi sono stati i primi, nel 2010, ad avviare un percorso in questa direzione. Grazie a *smart card* e navigatori satellitari, ognuno pagherebbe per ogni singolo spostamento motorizzato una tariffa differenziata, modulata in modo da tener conto di parametri quali orario, livello di congestione, tipo di veicolo e di infrastruttura utilizzati, sensibilità delle aree attraversate agli impatti dell'inquinamento atmosferico e acustico (in relazione a densità residenziale e qualità ambientale).

Uno dei problemi finora irrisolti delle misure di *pricing*, siano esse applicate alla circolazione o alla sosta, è la non equità sociale, dal momento che le tariffe non sono generalmente modulate in base al reddito dei singoli (Levinson 2010). Un'applicazione diffusa e sistematica di tali misure sembrerebbe poter esasperare questo limite, ma in realtà le stesse ICT offrono l'opportunità di differenziare le tariffe e quindi di ridurre tali criticità. La città di Tallinn, capitale dell'Estonia, ha introdotto dal 2004 un sistema di pagamento del trasporto pubblico denominato *ID-ticketing*, basato sulle carte di identità elettroniche diffuse a livello nazionale dal 2002 e dotate di un microchip che registra alcuni dati del cittadino. L'utente del trasporto pubblico può attivare il proprio biglietto elettronico tramite una chiamata con il cellulare o su Internet, semplicemente inserendo il codice della propria carta d'identità: la tariffa viene automaticamente personalizzata per diverse categorie individuate a partire dai dati delle carte d'identità (per ora studenti, mamme con tre o più figli, anziani, disabili; in prospettiva, sulla base di indicatori analoghi all'Isee italiano).

[7] Occorre tenere in conto, inoltre, che nel caso dell'auto la quota più importante dei costi è concentrata in pochi momenti (l'acquisto all'inizio, i pagamenti annuali di assicurazione, bollo e tagliandi ecc.) e non viene percepita viaggio per viaggio, diversamente rispetto alla tariffazione del biglietto per una singola tratta del mezzo pubblico. Questa mancata percezione fa erroneamente apparire l'uso dell'auto meno costoso rispetto ad altri modi; non a caso, è stato riscontrato che gli abbonati al *car sharing* (servizio in cui la tariffa per chilometro e per ora è fissata in modo da distribuire sui singoli spostamenti anche i costi di ammortamento, assicurazione, manutenzione ecc. del veicolo) tendono in genere a utilizzare l'auto condivisa per percorrenze inferiori rispetto a quando possedevano un'auto in proprietà, e viceversa utilizzano maggiormente il mezzo pubblico. Ad esempio, nel caso di Torino gli utenti percorrevano in media 11.000 km all'anno con la propria auto prima di aderire al *car sharing*, oggi usano invece il mezzo privato per 8.190 km, l'auto condivisa per 420 km e altri modi per 2.390 km (Romano 2011).

In provincia di Torino è in fase di introduzione, dal 2012, il Biglietto Integrato Piemonte BIP, un sistema di bigliettazione elettronica regionale basato su tecnologia *smart card contactless*, in cui una carta prepagata costituisce il supporto per gli abbonamenti (annuali, mensili, settimanali) al mezzo pubblico e sarà progressivamente estesa per vari servizi di mobilità (*car-sharing*, *bike-sharing*, pedaggi autostradali, eventuali futuri pedaggi per accedere alla ZTL ecc.). Proprio il BIP potrebbe diventare lo strumento per misure di *pricing* generalizzate della mobilità modulate in base al reddito.

Se la *smart mobility* apre dunque interessanti possibilità di riduzione delle iniquità sociali, al tempo stesso presenta però dei rischi di fondo, che potrebbero finire invece per esasperarle a causa del cosiddetto *digital divide*. Com'è noto, l'accesso alle ICT e il loro utilizzo non è oggi uniformemente distribuito tra i vari gruppi sociali[8]: nel caso del Piemonte, ad esempio, le ultime rilevazioni condotte dall'Osservatorio ICT del Piemonte (2012) hanno evidenziato come permangano fortissime differenze nell'utilizzo di Internet a sfavore delle persone più anziane e dei gruppi più deboli in termini di istruzione e di reddito; queste differenze si accentuano se in particolare si considera l'accesso ad Internet tramite gli *smartphone* (figura 1), che sono destinati a diventare in prospettiva lo strumento principale per accedere alle informazioni sulla mobilità, e che gli anziani trovano particolarmente difficili da usare, a causa della struttura *nested* dei loro menu (Hodgson 2012).

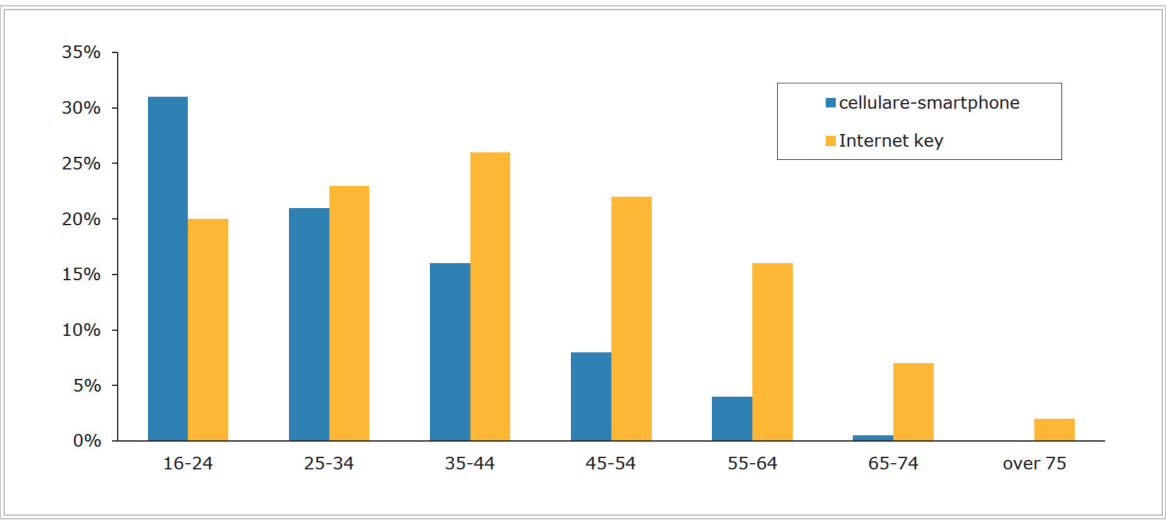


**Fig. 1: Utilizzo di cellulare e Internet key per connettersi a Internet per fascia di età, 2010 (base: tutti i cittadini piemontesi)**

In una società che è già oggi, e sempre di più sarà sul medio e lungo termine, caratterizzata dal fenomeno dell'*ageing*, l'alfabetizzazione informatica costituisce una precondizione essenziale perché una mobilità sempre più *smart* non determini un'accentuazione della polarizzazione sociale, anziché l'auspicata sua riduzione. Rischio tanto più centrale nel caso della mobilità, in quanto il *digital divide* si caratterizza, oltre che per una dimensione sociale, anche per una dimensione spazio-territoriale strettamente intrecciata alla prima: numerosi studi hanno evidenziato la correlazione esistente tra ridotta accessibilità, minore dotazione di infrastrutture telematiche e condizioni socio-economiche svantaggiate. Le aree che presentano minori livelli

8 Un problema di equità sociale si pone anche sulla linea della *smart mobility* legata all'innovazione dei veicoli, nel caso delle cosiddette "zone a traffico limitato ambientale", ossia aree (in genere create nelle parti più centrali delle città, a volte estese fino a coprire l'intero territorio comunale) in cui l'accesso è consentito solo ad automobili che rispettano determinate prestazioni ambientali, in particolare rispetto alle emissioni inquinanti. Nella città di Torino attualmente non possono circolare i veicoli Euro 0 a benzina e quelli diesel Euro 0, Euro 1 ed Euro 2; nella ZTL centrale non possono circolare i veicoli con omologazione inferiore ad Euro 3. Ovviamente queste limitazioni finiscono per danneggiare in misura più significativa coloro che, per motivi economici, hanno maggiore difficoltà a sostituire le proprie autovetture più vecchie con modelli più recenti.

di accessibilità (principalmente in quanto meno servite dal trasporto pubblico: tipicamente, le aree rurali e montane o quelle più marginali nei contesti urbani) da un lato ospitano popolazione con livelli di reddito, di istruzione e di alfabetizzazione informatica minore rispetto alle aree più accessibili; dall'altro lato, sono anche caratterizzate spesso da una minore dotazione di infrastrutture digitali e telematiche, almeno nelle loro versioni più avanzate (Farrington, Farrington 2005; Velaga, Beecroft, Nelson, Corsar, Edwards 2012). Questo intreccio rischia di esasperarsi, se la mobilità viene a essere sempre più fondata sull'integrazione con le ICT.

## 4 *SMART MOBILITY*, POLITICHE SETTORIALI E PROCESSI DI TERRITORIALIZZAZIONE

Se le pratiche individuali e sociali svolgono dunque un ruolo fondamentale nel determinare quanto la mobilità *smart* possa essere anche più sostenibile, diventa cruciale integrare le politiche della *smart mobility* nel quadro più generale delle politiche urbane, che possono influenzare tali pratiche (come del resto già sottolineato per la *smart city* in generale: si veda, ad esempio, Morandi, Rolando, Di Vita 2013).

In primo luogo, questa integrazione deve concernere le politiche specifiche del settore dei trasporti, nel quale già in passato spesso si sono contrapposti due approcci: uno è quello che cerca, attraverso piani e politiche settoriali, di riequilibrare la ripartizione modale degli spostamenti verso i mezzi meno impattanti; il secondo è quello che oggi possiamo ricondurre alla *smart mobility*, in quanto tende invece a privilegiare l'innovazione tecnologica per fluidificare il traffico stradale e ridurne gli impatti ambientali, assumendo come troppo costosa e problematica una sua riduzione a favore di altre modalità di spostamento (Poli 2011). Questi due approcci in realtà sono complementari, per due ragioni. Da un lato, gli effetti potenzialmente positivi delle innovazioni nelle tecnologie dei trasporti possono risultare più lenti o minori di quanto stimato, a causa dei tempi e delle dinamiche di appropriazione collettiva di tali tecnologie, come si è detto nel par. 2. Ad esempio, un'analisi di scenario condotta dalla Provincia di Torino (2011) ha provato a simulare che effetti sull'inquinamento avrebbero a Torino il rinnovo del parco veicolare privato e pubblico (stimato sulla base dei tassi medi di rinnovo registrati prima della crisi del 2008) e la fluidificazione del traffico, a parità di flussi veicolari: tra il 2008 e il 2015, le concentrazioni di $PM_{10}$ calerebbero del 6%, scendendo così da 51 a 48 microg/mc, un valore ben distante dalla soglia limite per la salute fissata a 40 microg/mc. Se agli effetti dell'innovazione tecnologica si affiancassero misure di riequilibrio modale (come potenziamento del trasporto collettivo e non motorizzato, estensione della ZTL ecc.), la riduzione delle concentrazioni di $PM_{10}$ sarebbe più che doppia, pari al 13% (pur non ancora sufficiente a raggiungere nel 2015 la soglia obiettivo fissata dall'Unione europea, che verrebbe rispettata solo nel 2020).

Dall'altro lato, proprio da interventi e politiche dei trasporti "più tradizionali" dipende la realizzazione di alcune precondizioni per un efficace funzionamento delle stesse tecnologie *smart*. Ad esempio, Torino è all'avanguardia per la dotazione di impianti semaforici centralizzati, che adeguano in modo dinamico la durata del verde sulla base degli effettivi flussi veicolari misurati, con l'obiettivo di dare la priorità ai mezzi pubblici (Schmöcker, Bell 2010). A oggi, i semafori centralizzati nella città sono 330 (la metà circa dei 655 totali), distribuiti su alcuni dei principali assi di scorrimento fuori dal centro storico, un modo da coprire l'intero tragitto di alcune linee tramviarie. Secondo i test condotti dal consorzio 5T che li gestisce, i semafori centralizzati possono incrementare del 17-20% la velocità commerciale dei mezzi del trasporto pubblico, purché questi viaggino su corsie riservate; senonchè, a fronte di un consistente investimento per installare questa tecnologia, la Città ha trascurato quello – peraltro assai più ridotto – relativo alle corsie riservate, con il risultato che oggi i tram in città mostrano la stessa velocità commerciale di dieci anni prima (fig. 2).

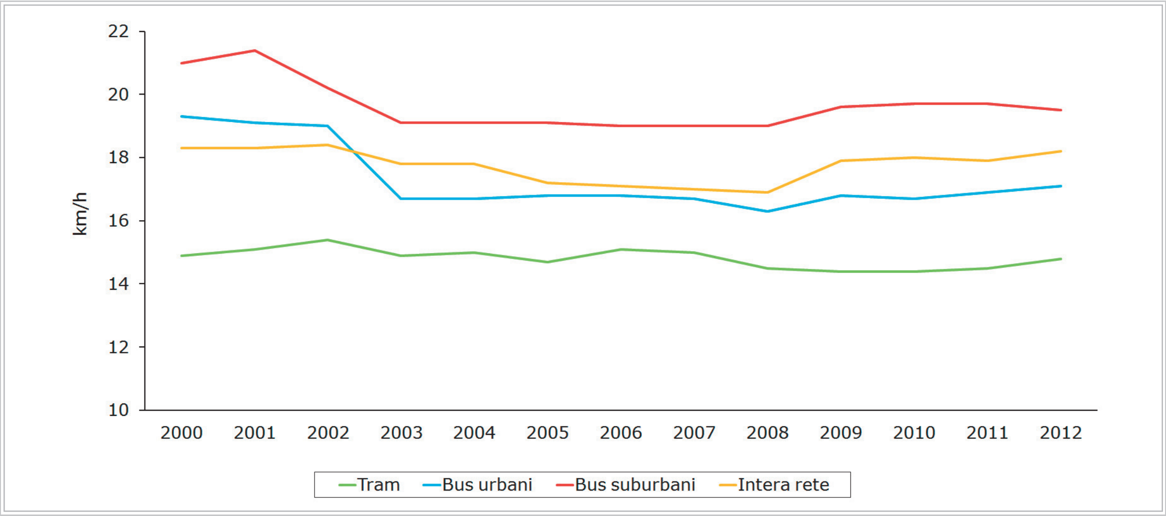


**Fig. 2: Velocità commerciale dei mezzi pubblici nell'area torinese (media della velocità commerciale, in km/h, su 12 mesi)**

Ma il discorso può e dovrebbe essere allargato dall'integrazione con la pianificazione settoriale dei trasporti a quella con la più generale pianificazione territoriale. Si è messo in evidenza nel par. 2 come la costanza dei tempi giornalieri dedicati alla mobilità delle persone determini che un incremento della velocità media degli spostamenti spesso finisca per alimentare i fenomeni di diffusione urbana. Il circolo vizioso tra processi di *sprawl* e dipendenza dall'uso dell'auto è stato ormai ampiamente studiato, così come è stata posta in evidenza l'importanza di un ridisegno degli insediamenti – soprattutto a scala metropolitana – secondo modelli policentrici incentrati sui nodi del trasporto pubblico per favorire forme di mobilità più sostenibili (Banister, Marshall 2007; Boscacci, Camagni, Corda, Moretti 2001; Jenks, Dempsey 2005).

Il movimento della *smart growth*, che alcuni (Vanolo 2013) individuano come uno dei riferimenti teorici e dei precursori della *smart city*, nasceva proprio per proporre quest'alternativa ai processi di diffusione urbana dominanti negli Stati Uniti nella seconda metà del XX secolo. Oggi però, nelle politiche di *smart mobility* questo riferimento all'importanza di un'integrazione con le politiche e la pianificazione territoriale è completamente assente[9], e rischia di minarne l'efficacia, perché non influisce su uno dei determinanti fondamentali delle scelte di mobilità, ossia la localizzazione spaziale delle origini e delle destinazioni degli spostamenti: in altre parole, la fluidificazione del traffico e la riduzione dei livelli di congestione che gli ITS potrebbero garantire sul breve periodo rischiano di essere almeno in parte vanificati, sul medio e lungo periodo, proprio perché potrebbero alimentare ulteriori fenomeni di *sprawl* senza una pianificazione territoriale volta a contenerli.

Ma per evitare che le politiche di *smart mobility* accentuino i fenomeni di polarizzazione sociale e territoriale, è cruciale non solo una loro integrazione con le politiche e i piani dei trasporti e del territorio, ma una loro più generale territorializzazione.

Ciò significa, per esempio, rompere la dinamica centro/periferia connessa al mercato, promuovendo sperimentazioni e applicazioni di innovazioni *smart* del sistema della mobilità non sempre a partire dalle aree più centrali e ricche delle aree metropolitane, ma al contrario in quartieri e zone più marginali, e usare tali innovazioni come leva per una più generale riqualificazione e rigenerazione dell'area. Un approccio di questo tipo è stato usato, per certi versi, nei Contratti di quartiere (promossi dal Ministero dei Lavori Pubblici in Italia nel 1997), in cui la riqualificazione energetica degli edifici è stata uno dei punti di partenza per attivare

[9] Anche perché le politiche per la *smart city* si fermano generalmente alla scala urbana (se non di quartiere) senza prendere in considerazione i territori circostanti, che invece hanno un'importanza cruciale nel determinare i pattern complessivi di mobilità, soprattutto in ambiti metropolitani.

un processo di rigenerazione locale. Le innovazioni di *smart mobility* richiedono spesso un qualche intervento di modifica dello spazio stradale, per dotare l'infrastruttura di sensori o strumenti in grado di interagire con le *app* messe a disposizione degli utenti che si muovono nell'area; questi interventi potrebbero essere strutturati in termini non puramente tecnologici, bensì nell'ottica di un ridisegno di strade e piazze volto a migliorarne qualità e vivibilità, che spesso nelle aree più marginali sono ridotte.
Si pensi all'auto elettrica, uno dei mantra nei discorsi sulla *smart mobility*. Le stime sulle possibilità di una sua diffusione di massa sono alquanto variabili; molto dipenderà da quanto rapidamente verranno superati alcuni limiti delle tecnologie attualmente disponibili (Deloitte 2010). Ad ogni modo, la riflessione sulle implicazioni per la *smart city* dell'affermarsi di questo tipo di mezzo si è per ora quasi esclusivamente limitata alla necessità di un'integrazione con le *smart grid*, indispensabile per garantire che i vantaggi dell'auto elettrica (in termini, in particolare, di inquinamento atmosferico e acustico) siano effettivi, grazie all'uso di energia ricavata da fonti rinnovabili, e non solo derivanti da una delocalizzazione del problema (nel caso l'energia elettrica utilizzata venisse prodotta da centrali termoelettriche che utilizzano combustibili fossili, magari situate a centinaia o migliaia di chilometri di distanza). In realtà, l'auto elettrica ha una differenza fondamentale rispetto a quella tradizionale: deve essere ricaricata durante la sosta.
Che cosa comporta questa differenza per la progettazione dello spazio pubblico? È scontato che debba riprodursi la situazione attuale, con la sosta delle automobili prevalentemente distribuita lungo i marciapiedi, dotati di apposite colonnine per la ricarica? Quali sarebbero gli effetti sulla qualità estetica del paesaggio urbano? E quali forme di conflittualità sociale potrebbero nascere, nel momento in cui la sosta non fosse solo una questione di spazi (dove lasciare l'auto), ma anche di tempi (necessari per garantire la ricarica, indispensabile poi per potere usare il mezzo stesso?).
O potrebbe essere questa l'occasione per ripensare l'occupazione del suolo pubblico legata alla sosta e il rapporto abitazione/auto, secondo modelli già sperimentati in innovativi quartieri *car-free* del Nord Europa: la sosta viene concentrata in appositi parcheggi in struttura, dotati delle infrastrutture per la ricarica e localizzati ai margini delle aree residenziali, con la necessità di percorrere maggiori distanze per accedere alla propria auto da casa (o dal posto di lavoro, dai servizi, ecc.) ma al tempo stesso con l'opportunità di liberare spazio lungo la strada per la mobilità pedonale, per il verde, per gli arredi urbani ecc.? Ed è possibile che sperimentazioni di questo tipo vengano avviate proprio a partire dalle aree più marginali e degradate, dove più è necessario una riqualificazione degli spazi pubblici?
Da un punto di vista socio-economico, poi, la territorializzazione delle politiche di *smart mobility* in aree connotate da situazioni di marginalità diffuse potrebbe significare l'affiancamento delle sperimentazioni con percorsi, da un lato, di una più generale alfabetizzazione informatica dei residenti più deboli, che parta proprio dall'uso dei dispositivi sperimentati; dall'altro lato, di sensibilizzazione culturale rispetto agli impatti ambientali della mobilità: e proprio la possibilità di mostrare, tramite una diffusa dotazione di sensori, come diversi pattern di mobilità in queste aree influiscano sulla qualità dell'aria che viene respirata direttamente da chi ci vive e vi si muove, potrebbero potenziare significativamente l'efficacia delle azioni di educazione per una mobilità più sostenibile.
Ancora, un approccio per aree e distretti può favorire e avviare lo sviluppo di applicazioni innovative sulla mobilità – e non solo – a partire dalle nuove informazioni e infrastrutture messe a disposizione nel progetto[10], costituendo anche occasione di sviluppo locale.

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[10] In molti casi – come nella già citata Tallinn a proposito dell'*ID ticketing*, o a Helsinki, dove è stata elaborata una piattaforma complessiva per la gestione della mobilità e delle relative informazioni ai cittadini – sperimentazioni locali sulla *smart mobility* hanno portato alla formazione di spin off che poi hanno commercializzato a livello nazionale o internazionale le tecnologie create.

## 5 CONCLUSIONI

La *smart mobility* sembra presentare varie potenzialità nel perseguimento di una maggiore sostenibilità dei sistemi di trasporto, in termini economici (ad esempio, fluidificazione del traffico e dei livelli di congestione), sociali (maggiore equità nella distribuzione dei costi e dei benefici degli spostamenti), ambientali (riduzione dei consumi e delle emissioni). Al tempo stesso, l'attualizzazione di queste potenzialità, e l'entità degli impatti positivi che esse determineranno, dipenderà da come le tecnologie, su cui la *smart mobility* è incentrata, verranno incorporate dagli utenti nelle proprie pratiche ed attività quotidiane. In questo articolo si è provato ad argomentare perché non si possa dare per scontato che queste tecnologie, e in particolare la maggiore quantità e qualità delle informazioni che esse garantiranno, si traducano automaticamente in comportamenti di mobilità più sostenibili. Diventa quindi cruciale che al centro delle politiche di *smart mobility* siano posti i cittadini con i loro comportamenti; e che tali politiche siano affiancate ed integrate da altre politiche e strategie (trasportistiche, socio-educative, territoriali ecc.), volte ad indirizzare questi comportamenti verso le traiettorie desiderate.

Concludendo, si vuole ancora sottolineare un aspetto, finora poco affrontato nei discorsi sulla *smart mobility*, relativo alla possibilità che, a seguito della crisi strutturale che il contesto europeo sta attraversando, si vadano ad affermare stabilmente scenari di post-crescita, i quali potrebbero richiedere un ripensamento delle strategie di *smart mobility*.

Il forte rallentamento delle vendite di automobili in questi ultimi 4 anni sta frenando consistentemente il rinnovo del parco veicolare; l'uso dell'automobile potrebbe effettivamente proseguire quella contrazione che si è iniziata a registrare a seguito della crisi, e le ICT potrebbero trovare un'applicazione più fertile e richiesta su altre modalità di spostamento (Audimob 2012).

Il trasporto collettivo urbano è stato finora oggetto di sperimentazioni relative soprattutto al miglioramento della gestione della flotta dei mezzi e alle informazioni per gli utenti, poco o nulla rispetto alle applicazioni che potrebbero essere utilizzate dagli utenti a bordo dei mezzi o alle fermate. Tali innovazioni, soprattutto se pensate per quegli utenti (in primis gli anziani) che più sono vittime del *digital divide*, potrebbero diventare un fattore competitivo per il trasporto pubblico nel riequilibrio modale, e al tempo stesso opportunità di business per le aziende che le sviluppano, sperimentano e applicano con successo a livello locale e hanno poi la possibilità di commercializzarle[11]. Al tempo stesso, proprio il trasporto pubblico è oggetto in questi ultimi anni di forti tagli a causa della contrazione dei finanziamenti statali e regionali, e la sua competitività tende a declinare fortemente al di sotto di una certa soglia di servizio.

Potrebbe dunque concretizzarsi, almeno alla scala locale, un "ritorno" a forme di mobilità imperniate maggiormente sugli spostamenti pedonali e ciclabili: del resto, nell'Unione europea (così come in Italia), il 30% degli spostamenti copre distanze inferiori ai 3 chilometri, il 50% ai 5 chilometri, percorrenze su cui la bicicletta è spesso più competitiva dell'automobile. In questo ambito, la *smart mobility* si è finora incentrata soprattutto sul *bike sharing*[12], mente lo sviluppo di applicazioni per la mobilità pedonale è stata assai limitata: le prospettive sembrano legate soprattutto alla creazione di mappe interattive visualizzabili su

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[11] In quest'ottica, Torino potrebbe ripensare il suo ruolo da "città dell'auto" a "città della *smart mobility*", grazie alle competenze localmente presenti sia nel settore dei mezzi di trasporto (e non solo delle autovetture) sia in quello delle ICT; la prevista privatizzazione di una parte dell'azienda locale del trasporto pubblico, GTT, potrebbe essere l'occasione per coinvolgere partner privati in sperimentazioni che vadano in questa direzione.

[12] I servizi di condivisione di automobili e biciclette, resi possibili grazie a sistemi di gestione incentrati sulle ICT, sono uno degli elementi ricorrenti nelle strategie di *smart mobility*. Torino è una delle città italiane più all'avanguardia sia nel *bike sharing* che nel *car sharing*, tanto come dotazione di mezzi che come numero di utenti. Soprattutto il *car sharing* potrebbe conoscere, in uno scenario di post-crescita, una maggiore diffusione rispetto alla situazione attuale: a Torino, per ora, gli abbonati sono lo 0,3% della popolazione, e i chilometri percorsi dalle auto del servizio sono circa lo 0,1% della distanza complessivamente coperta in città dalla mobilità motorizzata. Anche in Svizzera, il paese europeo dove il *car sharing* ha raggiunto la massima diffusione, a 20 anni dalla sua attivazione gli utenti superano di poco l'1% della popolazione (Loose 2011).

*smartphone*, che portino chi cammina a scegliere i percorsi anche in funzione della presenza di conoscenti nei dintorni (individuabili a partire dai GPS), di informazioni inviate dalle attività commerciali della zona ecc.; in altre parole, innovazioni fortemente integrate con la dimensione urbana locale (Hodgson 2012).
In sintesi, se davvero dovesse affermarsi uno scenario di post-crescita, la *smart mobility* potrebbe assumere evoluzioni e sviluppi alquanto diversi da quelli attualmente previsti e inseguiti dal mercato; in particolare, l'effettiva efficacia ed efficienza dei sistemi di mobilità potrebbe risultare meno dipendente dall'innovatività delle tecnologie che li caratterizzano, mentre acquisirebbe ancora più centralità l'integrazione di queste ultime con la pianificazione territoriale e della mobilità.

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TeMA
Journal of
Land Use, Mobility and Environment

TeMA 3 (2013) 355-370
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1980

review paper received 15 November 2013, accepted 30 November 2013

www.tema.unina.it

# EU SMART CITY GOVERNANCE

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ABSTRACT

In recent years European Commission has developed a set of documents for Members States tracing, directly or indirectly, recommendations for the transformation of the European city.
The paper wants to outline which future EU draws for the city, a future often suggested as Smart City. This aim is achieved through an integrated and contextual reading of addresses and strategies contained in the last documents elaborated by European Commission.
Although the three main documents (Cohesion Policy 2014-2020 of European Community, Digital Agenda for Europe and European Urban Agenda) face the issue of the future development of European cities from different points of view, which are respectively social cohesion, ICT and urban dimension, each of them pays particular attention to urban and territorial dimension, identified by the name of Smart City.
In other words, the paper aims at drawing the evolution scenario of Smart Cities that can be delineated through the contextual reading of the three documents. To this end, the paper is divided into three parts: the first part briefly describes the general contents of the three European economic planning tools; the second part illustrates the scenarios for the future of the European city contained in each document; the third part seeks to trace the evolution of the Smart City issue developed by the set of the three instruments, in order to provide the framework of European Community for the near future of our cities.

KEYWORDS:
Smart Cities, urban development, cohesion policy, Digital Agenda, Urban Agenda, ICT

## 1 THE EU 2020 FRAMEWORK FOR ACTION

This section describes the main contents of three strategic documents for urban and territorial development as they deal with issues of extreme importance for the future of the European cities: the legislative proposals for EU Cohesion Policy 2014-2020 which promotes integrated urban policies and defines the financial and operational tools necessary for their implementation; the Digital Agenda (2010) which looks at urban and regional development in terms of digital infrastructurization of the territory with the aim to exploit the economic and social potential of ICT; the Urban Agenda (2011), which provides the recommendations for strengthening the role of cities and relocating the urban question at the center of the European Union development strategies. It is worth noting that although the European Commission has in recent years developed several documents that deal with the theme of Member States future growth, for instance the program for research and innovation Horizon 2020, the paper describes the ones that pay particular attention to urban and regional planning.

Before proceeding with the description of the document contents is considered appropriate to classify them within the broader framework of action that the European Union intends to implement by 2020. The European policy framework for the next decade is defined by the strategy launched in March 2010 "Europe 2020, a strategy for smart, sustainable and inclusive growth[1]": its five major objectives identify the goals that EU intends to achieve in 2020 and the seven Flagship Initiatives[2] represent the path that the Commission, together with Member States, will follow to implement them. The development of this strategy is closely linked to the financial planning of EU as the Flagship Initiatives not have their own budget, and their realization depends on effective coordination and management of different financial resources both at European and local level (EP, 2012). In this context on June 29th 2011, the European Commission adopted a proposal for the new multiannual financial framework 2014-2020: "A budget for delivering the Europe 2020 Strategy" in which the Cohesion Policy plays a pivotal role as it provides both operational and financial tools needed to implement the initiatives promoted by Europe 2020. The Cohesion Policy, as defined in the Treaty on the Functioning of the European Union (2008), has as its objective the strengthening of its economic, social and territorial cohesion in order to reduce the disparities between the levels of development of the various regions and to promote equal opportunities among citizens. To achieve this objective, the Cohesion Policy provides specific financial tools, the so-called Structural Funds:

- the European Regional Development Fund (ERDF), which supports the regional and local development through co-financing of investments in areas such as research, development and innovation, ICT, energy, transport infrastructure and sustainable urban development;
- the European Social Fund (ESF) aimed at promoting the employment, education and training, social inclusion, as well as improving the efficiency of public administration;
- the Cohesion Fund (CF), which supports projects in the energy sector, relating to energy efficiency and the use of renewable energy; it is addressed to the Member States whose per capita GDP is less than 90% of the EU average;
- the Agricultural Fund for Rural Development (EAFRD) and the European Maritime and Fisheries Fund (EMFF) respectively for the development of the agriculture and fisheries sector.

[1] COM(2010) 2020

[2] Innovation Union; Youth on the move; Digital Agenda; Resource Efficient Europe; An industrial policy for the globalisation era; An agenda for new skills and jobs; European platform against poverty

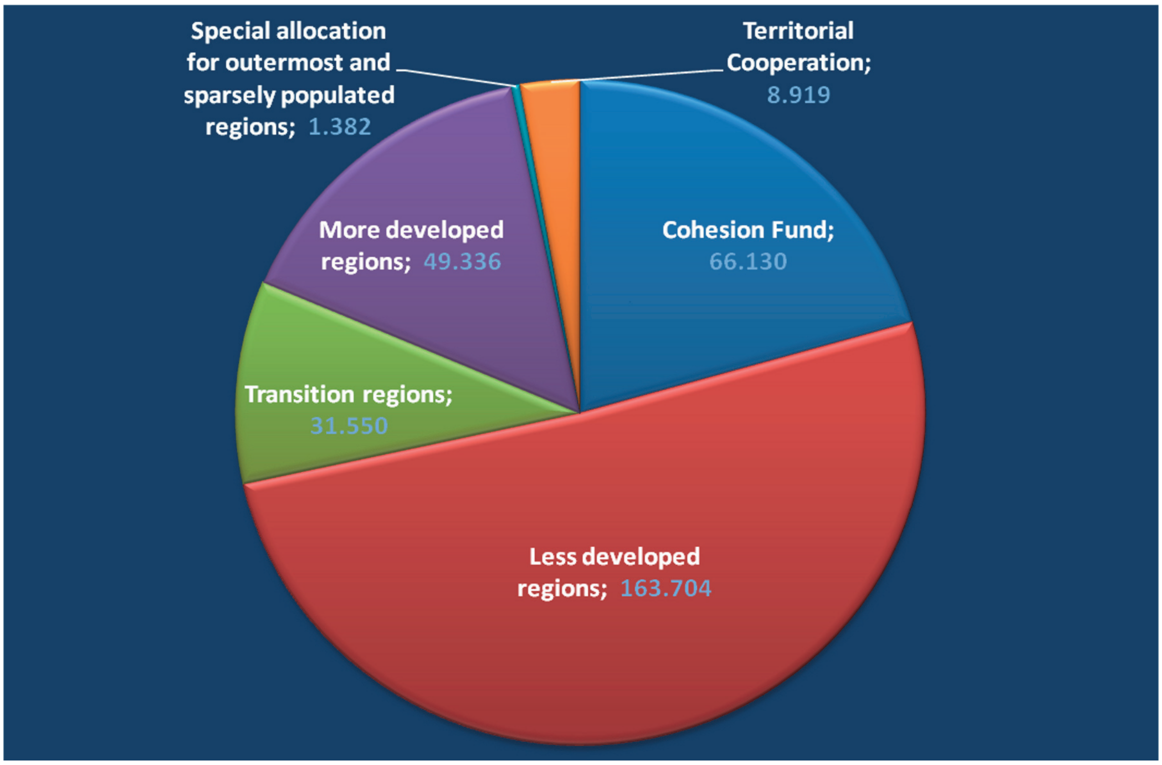


**Fig. 1: Total allocations of Cohesion Policy 2014-2020 (million €, 2011 prices), amounts subject to final adoption of MFF and sectoral legislations**

The legislative proposals for the social, economic and territorial cohesion policy[3] consists of: a regulation setting out common rules for the Structural Funds[4] and three specific regulations for the ERDF, the ESF and the CF[5]. The Structural Funds are grouped together into a "Common Strategic Framework" (CSF) in order "to maximise the contribution of the CSF Funds and to provide clear strategic direction to the programming process at the level of Member States and the regions" (EC, 2012a). At the same time, the CSF is set up to facilitate sectoral and territorial coordination of Union intervention under the CSF Funds and with other relevant Union policies and instruments.

The directions for use the CSF Funds at the national level will be established by each Member State within the so called "Partnership Contracts" to be concluded with the EC for the period between 1st January 2014 and 31th December 2020. The Regional Operational Programmes of the single funds will be implemented at the regional level on the basis of the Partnership Contracts. It is worth focusing on the terms used to characterize the three operational tools proposed as they represent the key concepts of the new Cohesion Policy. The Common Framework is defined as "strategic" because it provides a strategic direction to the funds programming process in order to facilitate the sectoral and territorial coordination of EU interventions.

At the national level is emphasized the concept of "partnership" between the different parties involved at various levels of planning (regional and local authorities, economic and social actors, non-governmental organizations, etc.). In the overall framework of Cohesion Policy, the partnership process is considered to be a priority so that in order to support its development the EC provides for a European Code of Conduct on Partnership (ECCP) which will lay down a framework within which the Member States shall pursue implementation of the partnership principle (EC, 2013a). Finally the "operational" tools are delegated to

[3] COM(2011)615; COM(2012)496; SWD(2012) 61
[4] COM(2012)496
[5] COM(2011) 614; COM(2011) 607; COM(2011) 612

regional and local authorities in order to ensure the necessary flexibility to meet their local needs and to give sufficient attention to local specificities. This approach strengthens the local level compared to the previous programming cycles and it aims at greater synergy and coherence of individual POR within the national strategy.

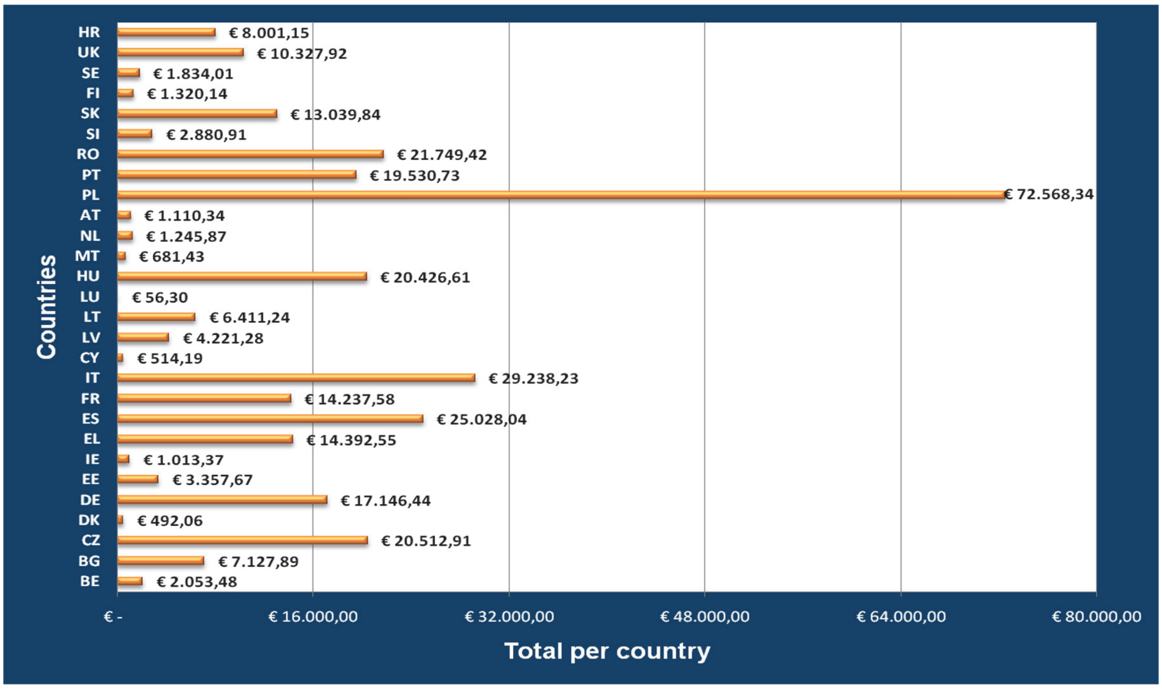


**Fig. 2: Total allocations of Cohesion Policy 2014-2020 (million €, 2011 prices) for each Member State referred to July 2013**

The main innovations introduced by the Cohesion Policy 2014-2020 are the focus on results, a greater use of conditionality and the coordination among CSF Funds and with other relevant Union policies and instruments (EC, 2012a). With regard to the first point, the new EU Cohesion Policy assigns a primary role to the process of monitoring and verifying the results; for this reason the Commission plans to concentrate the new programs on a limited number of priorities and to define a set of indicators to assess the progress made towards the achievement of the programs objectives. In addition, in order to focus more on results the proposed programs and instruments introduce the principle of conditionality that will take the form of both so-called ex ante conditions that must be in place before funds are disbursed, and so-called ex post conditions that bind the provision of additional funds to the achievement of pre-established results. The lack of progress will also rise to the suspension or cancellation of funding. The European Commission plans to assign the 5% of the cohesion budget to the most virtuous Member States and regions, during the mid-term performance review planned in 2017 and 2019.

The Commission's proposals have, therefore, adopted the principle defined by the Barca Report (Barca, 2009) according to which "the multi-sectoral nature of place-based development policy requires horizontal coordination and reciprocal commitment at every level of government. Contracts, both vertical and horizontal, and conditionalities for the granting of funds are a defining feature of multilevel governance".

A "policy of conditional transfers" is then re-launched according to which the transfer of resources shall be subject to ex ante conditions in order to ensure that the provided funds have the conditions to exert maximum benefit, and at the same time, it depends also on the achievement of certain objectives (ex-post conditions) (Regione Molise, 2013). The importance assigned to the coordination of Cohesion Policy with other Union policies and instruments came from the need to address two issues that the EC has had to deal with in the planning of economic resources for 2014 -2020: on the one hand, the reduction of the available funds compared to previous cycles (340 Million Euros[6], about 8,3% less than in the period 2007-2013) and, on the other, the economic crisis that limits the possibilities of co-financing of the Member States. As a matter of fact, "the lack of synergies between different policy instruments related to overlapping thematic fields was one of the main reasons of the Lisbon Strategy failure" (EP, 2010). To this end there are new coordination mechanisms that provide for the involvement of the managing authorities responsible for other CSF Funds to avoid overlap, the establishment of e-governance, as well as identifying areas of intervention in which the Funds may be combined in a complementary manner. To maximize the contribution of the CSF Funds for a smart, sustainable and inclusive growth, the Cohesion Policy also provides that Member States identify how their programs can contribute to achieve the Europe 2020 and the Flagship Initiatives objectives, thereby avoiding the duplication of efforts and taking full advantage of the possibilities of combining different instruments to support individual projects.

| Europe 2020 | Thematic objectives of the CSF | Structural Funds | Reference to other relevant Union policies and programs |
|---|---|---|---|
| **Smart growth**: developing an economy based on knowledge and innovation | 1) Strengthening research, technological development and innovation | ERDF and EAFRD | Horizon 2020<br>Smart Specialization Platform<br>Joint Programming Initiatives<br>ESFRI<br>Innovation Union Flagship Initiative |
| | 2) Enhancing access to, and use and quality of information and communication technologies | | Horizon 2020<br>Connection Europe Facility<br>Digital Agenda for Europe |
| | 3) Enhancing the competitiveness of SMA and of the agricultural and fisheries and aquaculture sector | | Small Business ACT<br>EU Project for SMA |
| **Sustainable growth**: promoting a more resource efficient, greener and more competitive economy; | 4) Supporting the shift towards a low-carbon economy in all sectors | | Energy saving Directives<br>Strategic Energy Technology Plan<br>Energy Roadmap 2050<br>European Emission Trading Scheme, NER 300 Programme, LIFE |
| | 5) Promoting climate change adaptation, risk prevention and management | | Climate change White Paper<br>LIFE |
| | 6) Protecting the environment and promoting resource efficiency | | Water, Waste and Air Quality Directives<br>LIFE<br>Nature 2000<br>Resource Efficient Europe FI<br>Creative Europe |
| | 7) Promoting sustainable transport and removing bottlenecks in key network infrastructures | ERDF | Connection Europe Facility<br>Horizon 2020<br>Resource Efficient Europe<br>Transport White Paper 2011 |
| **Inclusive growth**: fostering a high-employment economy delivering social and territorial cohesion | 8) Promoting employment a nd supporting labour mobility | ERDF, EAFRD, ESF | Employment Guideline 7 2020<br>Program for Social Change and Innovation<br>Erasmus for all |
| | 9) Promoting social inclusion and combating poverty | | Program for Social Change and Innovation<br>Erasmus for all<br>Asylum and Migration Fund |
| | 10) Investing in education, skills and lifelong learning | | Erasmus for all |
| | 11) Enhancing institutional capacity and an efficient public administration | | |

**Fig. 3: The UE CSF Funds 2014-2020: thematic objectives grouped on the basis both of Europe 2020 priorities and relationship with European Funds and policies.**

To provide guidelines on how to coordinate Cohesion Policy with the Flagship Initiatives, the European Parliament has prepared a study entitled "How to integrate the EU flagship initiatives into Cohesion Policy" which shows that although the proposals of Cohesion Policy are oriented towards the coordination among the CSF Funds and the Europe 2020 objectives, "flagship initiatives are currently only sporadically integrated into the legislative proposals for the 2014-20 Cohesion Policy Framework" (EP, 2012).

[6] Expressed in constant 2011 prices.

In the draft of the CSF, the Digital Agenda[7] is one of the four Flagship Initiatives explicitly mentioned in the thematic objective 2 "Enhancing access to, and use and quality of information and communication technologies". This objective is directly attributable to the thematic priorities of the Digital Agenda:

- encouraging investments in the development of infrastructure networks;
- developing digital contents and services to improve the quality of life of citizens and businesses through easy access to online learning (e-Learning), teaching (e-Education), administration (e-Government) and health (e-health).

Digital Agenda identified 101 specific policy actions structured in 7 domains: the digital single market, interoperability and standards, trust and security, fast and ultra-fast internet access, research and innovation, digital literacy, skills and inclusion and ICT-enabled benefits for EU society. To effectively implement the 101 actions, the European Commission plans to fund them with the resources allocated in the budget proposal for the Multiannual Financial Framework (MFF) for the period 2014-2020 (COM (2012) 784). The economic resources to draw upon are related to four types of the CSF Funds: ERDF, ESF and EAFRD.

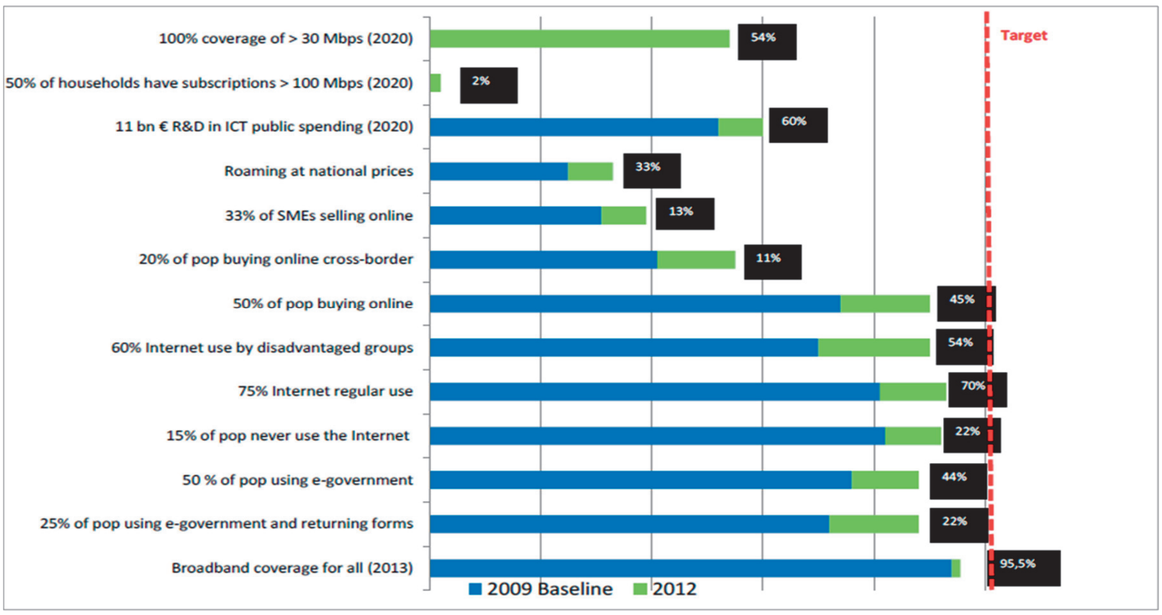


**Fig. 4: How the EU scores on the Digital Agenda targets**

The help of the ERDF is primarily oriented to support the development of next generation access networks (NGA), e-Government and ICT applications that can help to overcome some of the biggest challenges for the next decade as the reduction of carbon emissions and the energy efficiency improvement. ESF provides instead financial support to promote the use of ICT and to contribute actively to the development of digital literacy. Investments in ICT within the EAFRD are geared mainly to improve the accessibility, utilization and quality of ICT in rural areas through the extension of broadband infrastructure and the promotion of digital skills among farmers, the managers of forests and rural companies. Progress on implementing the Digital Agenda is measured in the annual Digital Agenda Scoreboard. The last Scoreboard, assessing overall impact on the basis of the key performance targets, has been published in June 2013, reporting on the progress of those actions between June 2012 and May 2013 (Pinto, Mazzeo, 2013). As can be seen in Figure 4 almost all targets are about to be achieved. During the past three years, the use of the network has increased steadily, especially among the most disadvantaged groups and the coverage of broadband network is almost

[7] COM(2010) 245, COM(2012) 784

complete. Network users use increasingly internet to make their purchases online, but also to take advantage of eGovernment services. Currently, CE has completed 61 of the 101 actions, while eight have been erased and the remaining 32 are nearing completion. To align the technological and innovation possibilities with a better and more inclusive governance, the European Parliament proposes the definition of a European Urban Agenda[8] giving the city a major role in the design and implementation of the future European Cohesion Policy. The proposal submitted by the resolution of 23rd June 2011, points out that "local elected authorities have direct political accountability in terms of strategic decision-making and investing public resources" and that "in order to reach the goals of the Cohesion Policy and EU 2020 Strategy there must be obligatory involvement of local elected bodies in the strategic decision-making process, close involvement in drawing up operational programmes and broad use of the option of subdelegated responsibilities in the implementation and evaluation of the Cohesion Policy" (EP, 2011). Urban Agenda is in fact the "urban dimension" of European Cohesion Policy, that represents the tool through which European Union intends to coordinate urban policies of the Member States by focusing on a bottom-up approach, which, according to some authors, better reflects the orientation of the Smart Cities of the future (Siegle 2012). In other words, through the Urban Agenda, European Parliament defines the path to follow, in order to achieve a multi-level bottom-up governance that supports the development of innovative technological infrastructure contained within the European Digital Agenda. This proposal invokes the thought of some scholars about smart cities: "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" (Papa, Gargiulo, Galderisi, 2013).

European Parliament proposes to concentrate on three objectives for the development of the urban dimension: firstly supporting urban areas to develop their basic physical infrastructure as a prerequisite for growth, by focusing both on the economic diversification and energy and environmental sustainability; secondly helping urban areas to modernize their economic, social and environmental characteristics, through smart investments in infrastructure and services based on technological progress closely related to national, regional and local needs; thirdly redeveloping urban areas by recovering industrial sites and contaminated lands. The achievement of these goals during the next planning cycle 2014-2020 assumes that the different administrative authorities involved, cooperate in order to:

- develop a multi-level governance aiming at a greater involvement of regional and local authorities and of society in the design, implementation, communication and evaluation of urban development strategies;
- promote the training of urban and local authorities that provide information on the programs and initiatives of urban policy;
- resort to a "smart urban development" by exploiting the great potential of modernization of infrastructural investments through intelligent technologies;
- steer the planning process towards an "integrated strategic" dimension, in order to facilitate local authorities in the transition from an approach in terms of individual projects in an intersectoral one; for this purpose European Parliament "calls on Commission to make legally binding integrated urban planning when projects are co-financed with EU funds";
- initiate new partnerships between the public and private sectors and innovative strategies for urban infrastructural development in order to attract investment and stimulate the economy.

[8] 2010/2158 (INI)

## 2 THE SMART CITY IN THE EUROPEAN UNION DOCUMENTS

This section discusses the scenarios for the future of the European city proposed by each document, with the aim of identifying specific references to issues of urban development and the Smart City. Although in most cases there is not any explicit reference to the term "smart city", the forecasts of city development contained both in the guidelines and recommendations of the European documents are clearly related to those aspects that many authors identify as characterizing factors of the Smart City. Digital Agenda objectives, aimed at improving the quality of life of citizens and businesses through the development of the economic and social potential of ICT, are connected to the vision of Smart City proposed by Batty: "a city in which ICT is merged with traditional infrastructures, coordinated and integrated using new digital technologies" (Batty, 2012). Urban Agenda approach for the coordination of urban policies of the Member States aims at the integration across all levels of governance, as well as the mentioned bottom-up approach proposed by Siegle. In this regard, Nam and Pardo also stated that "coordination of policies across all levels of governance is of vital importance to innovation in a city" (Nam and Pardo, 2011).

A direct reference to territorial issues is made by the Cohesion Policy that, for the first time, in 2009, introduced the territorial dimension in its denomination, as a necessary completion to the objectives of economic and social cohesion. This decision demonstrates the EC willingness to focus on cities and urban areas that effectively come under European Union competence, thanks to both the Treaty on the Functioning of the EU (2008) and the Treaty of Lisbon (2009). The proposals contained in the package of regulations of the Cohesion Policy 2014-2020 related to the field of urban development are mainly oriented to promote integrated policies for sustainable development: "the multiple dimensions - environmental, economic, social and cultural - of urban life are intertwined, therefore a positive urban development can only be achieved through an integrated approach" (EC, 2011).

The main suggestions made to this end mainly concern the adoption of integrated investment strategies oriented to a more strategic and holistic approach: "Such an approach is especially important at this time, given the seriousness of the challenges European cities currently face, such as specific demographic changes, the consequences of economic stagnation in terms of job creations and social progress, and the impact of climate change" (EC, 2011).

Among the five funds within the Common Strategic Framework, the ERDF is aimed at supporting sustainable urban development at regional and local levels. From reading the investment priorities of the ERDF, the main features of the future European city the can be drawn as: a city characterized by a high quality and affordability to innovative communication technologies, based on a low-carbon economy in all sectors, promoting investments specifically related to the adaptation to climate change and the smart and sustainable urban transport, investing in research and innovation and promoting the employment and social inclusion. The tools that the EC introduces to strengthen the territorial dimension of Cohesion Policy are the following:

- Integrated Territorial Investments (ITI) represent a simplified financing, through which EU allocates 5% of ERDF resources for integrated actions for sustainable urban development. It is a new delivery mode to bundle funding that allows to "draw on funding from several priority axes of one or more operational programs" (EC, 2011). Indeed, ITI can associate together different funding linked to strategic objectives, in order to facilitate the implementation of an integrated strategy for sustainable development in a specific territory;
- an Urban Development Platform, comprising 300 cities based on a list prepared by Member States in their Partnership Contracts to promote both the creation of networks between cities and the exchange of territorial good governance practices within the EU;

– innovative urban actions subject to a ceiling of 0,2% of the total ERDF allocation. The innovative urban actions shall be urban pilot projects, demonstration projects and related studies of European interest.

Cohesion Policy also provides a different allocation of funds in relation to GDP per capita, through the identification of three types of regions, in order to allow a balanced development between different European regions: more developed regions whose GDP per capita is higher than 90% of EU average; transition regions, with GDP per capita is between 75% and 90% of EU average, less developed regions whose GDP per capita is below 75% of EU average.

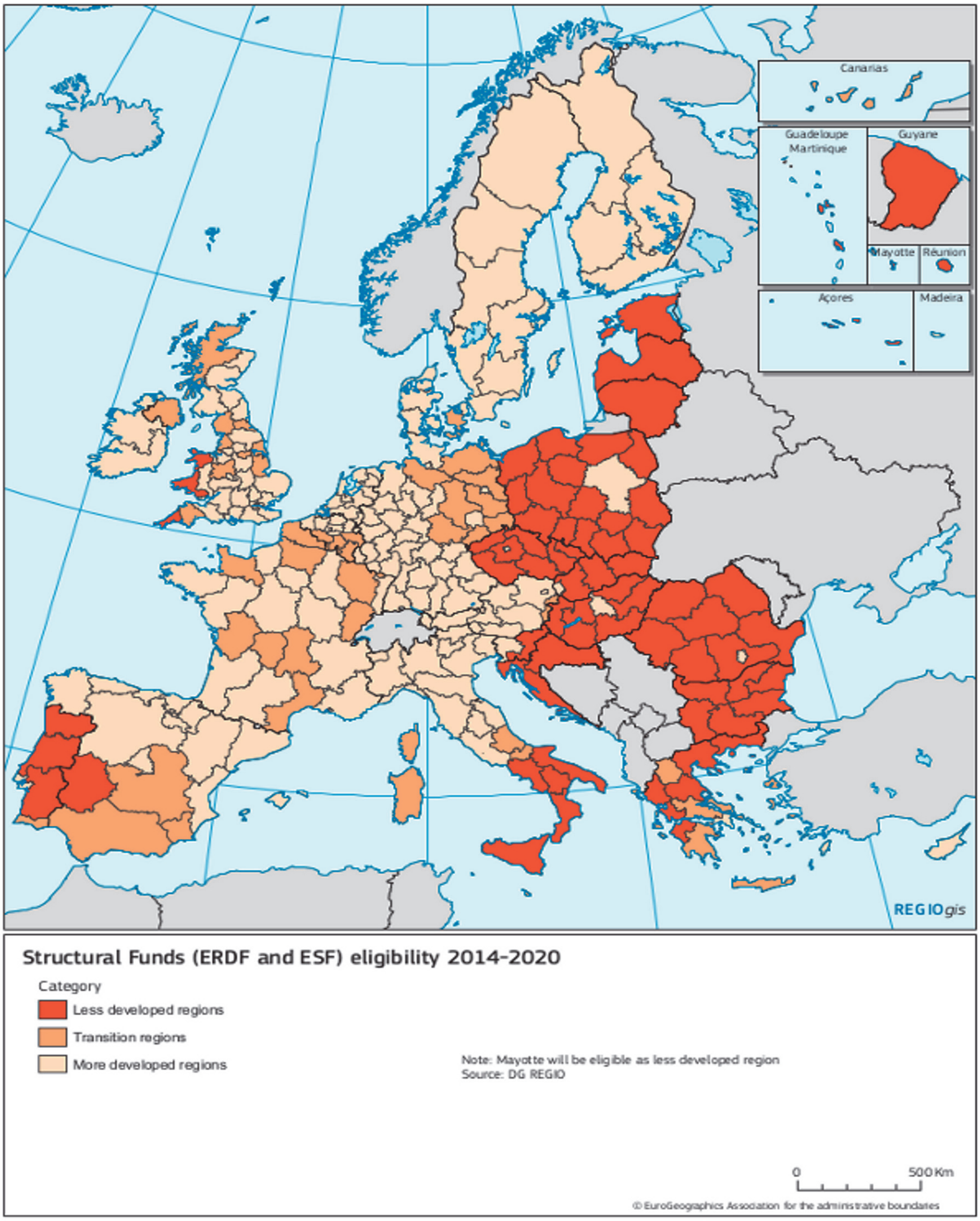


**Fig. 5: Classification of Member States in more developed regions, transition regions and Less developed regions**

For each type of region Cohesion Policy allocates different rates of funding depending on the sectors where these regions should focus mainly: research and innovation (R&I) and competitiveness of small and medium-sized enterprises (60%) represent the main investment sectors for the more developed regions and transition region, while only 20% has been allocated for energy efficiency and renewable energy. These rates increase to 44% and 6% respectively for less developed regions.

The condition ex-ante for the investment support in research and innovation (R&I) and in information and communication technologies (ICT) is represented by the smart specialization. This concept has received more and more attention by EU policy for growth and economic development; in fact, in 2005 some documents drawn up for the development of the Lisbon Strategy, referred to the smart specialization as an element to enhance the competitiveness of regions (D. Foray, David PA, Hall B., 2009). The objective of smart specialization is the sustainable economic growth of the regions through a more efficient use of structural funds, by joining efforts in the field of innovation support, and increasing synergy between EU policies and national and regional ones.

The application of smart specialization is aimed at defining regional strategies for the enhancement of those sectors in which the single territories are able to excel. Regions and Member States must draw up a document oriented to: outline the strategy for smart specialization, identify the specializations that are more consistent with their own resources and capabilities and define public and private investment expected, especially related to research and innovation technology. In order to delineate their strategies, policy-makers can refer to the European platform supporting research and innovation, the Smart Specialisation Platform (S3Platform), which promotes collaboration among different administrative authorities and EU researchers and collaborates with international agencies such as the OECD and the World Bank. The main goal of this tool is to fill the innovation gap between Europe regions: according to the EU Regional Innovation Scoreboard, just one in ten invests 3% of its GDP in R&I and the percentage of innovative SMEs differs greatly from country to country.

The future of European cities outlined in the Digital Agenda is instead a future based on the development of economic and social potential of ICT. Goals contained in the Digital Agenda are geared to stimulate innovation and economic growth and improve citizen and company quality of life through a better health care, safer and more efficient transport, a cleaner environment, new communication opportunities and easier access to public services and cultural content. According to EC "the development of high-speed networks today has the same revolutionary impact that the development of electricity networks and transport had a century ago" (EC, 2010).

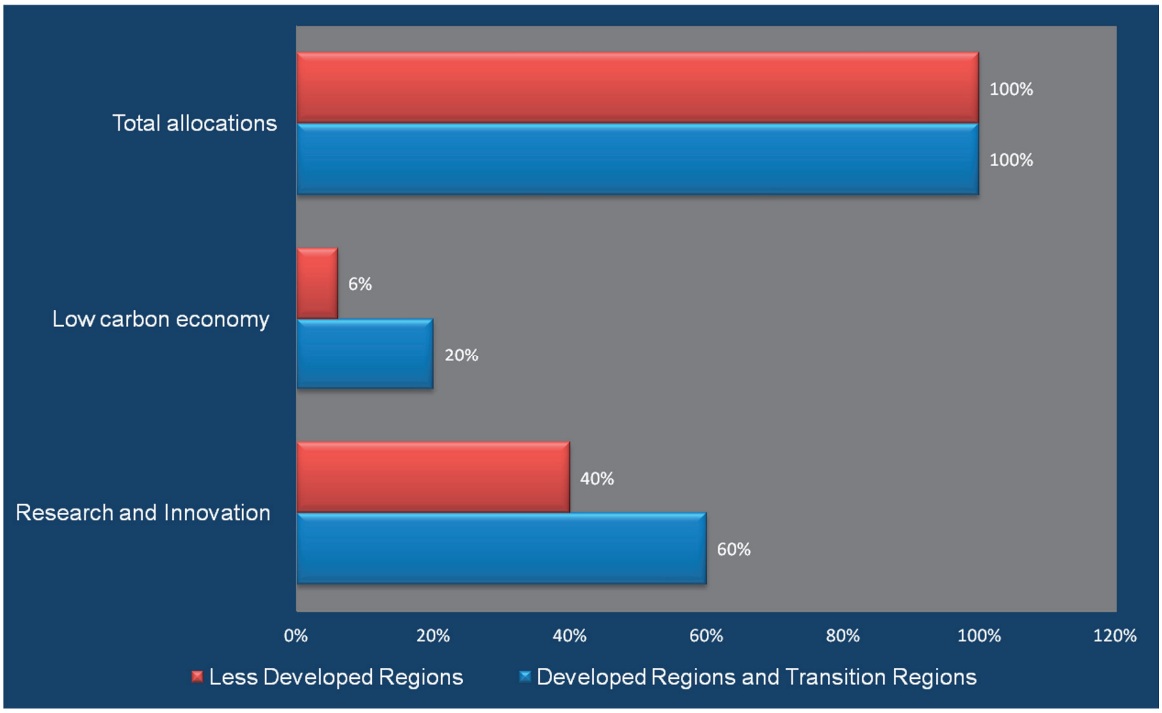


**Fig. 6: Concentration of ERDF proposed for 2014-2020**

European cities to be more competitive in the near future should to be characterized by:

- e-government services, (administrative procedures, electronic public procurement, public health, etc.) available to all European citizens to reduce cost and time and to encourage participation;
- intelligent transport systems (ITS) to reduce congestion and energy consumption;
- large-scale spread of smart grids and meters, zero energy buildings and intelligent systems for managing street lighting, in order to achieve energy saving goals and reduction of greenhouse gas emissions.

The EC considers appropriate to promote cooperation between the ICT industry, other sectors and public administrations in order to accelerate the development and widespread use of ICT based solutions for smart grids and meters, near zero energy buildings and intelligent transportation systems.

The ICT sector in fact provides these organizations for the modeling, analysing, monitoring and visualizing tools to assess the energy performance and emissions of buildings, vehicles, companies and cities. Smart grids, however, need to have a knowledgement and a social capital who knows how to operate, in order to prevent that a lack of expertise by users in the field of computer literacy could be an obstacle to the development of this potential.

To this end, this EU document considers essential "to educate European citizens to use ICT and digital media. This calls for multi-stakeholder partnerships, increased learning, recognition about digital competences in formal education and training systems, as well as awareness raising and effective ICT training and certification outside formal education systems" (EC, 2010). In order to support awareness raising activities, EC has established the European Week of Digital Skills.

Among the three documents analyzed the Urban Agenda represents explicitly the urban dimension of EU policies. The prototype of the city targeted to a smart, sustainable and inclusive growth is a city that invests in infrastructure and services based on technological innovations, its priorities are closely related to the specific national, regional and local needs, as well as energy and environmental sustainability.

Therefore according to Urban Agenda the future urban and territorial development of Europe should:

- be based on a multi-level governance;
- sub-delegate to local authorities for the adoption of strategic decisions and investment of public resources;
- focus on integrated strategic planning, facilitating local authorities in the transition from an approach in terms of individual projects to a cross-sectoral approach, “with greater strategic depth in order to enhance their potential for endogenous development” (EC, 2011);
- start new partnerships between the public and private sectors in order to attract investment and stimulate the economy.

The importance of this document within the European urban and regional policy framework is to recognize urban areas as places and drivers of change and to reformulate the objectives and policies of the European Union in key of urban development.

## 3 EU GOVERNANCE ACTIONS ORIENTED TO SMART CITY

Over the past decade EU's efforts have been focused on solving specific problems (climate change, air pollution, etc.), in order to improve life in the Member States; the urgency to afford these issues is strongly linked to the entity of their effects, on the one hand, and to the increasing public attention, on the other hand. The realization that the development of effective actions of resolution requires the integration between different aspects, so far dealt with individually, has allowed EU to consider as fundamental the territorial dimension and, therefore, to give city a privileged role within Community policies and programs.

For this reason, EU has defined the strategy and the objectives that wants to achieve by 2020 basing on integrated and coordinated actions at the urban scale and these targets are well-established not only at European level but at Member State level too. Europe 2020 strategy represents the first attempt to sort and organize the set of Community policies related to different sectors of intervention.

EU has recently started to get out of a sector-based logic, by adopting one that is more effective and commensurate with the multi-dimensionality and complexity of problems that has to face: the consequence of the transition to a holistic and systemic approach, therefore, has had as consequence the emergence of the urban question as a priority issue.

In addition to feel the need to “work” in an integrated manner to curb the negative effects of numerous phenomena in place, the awareness that the roots of many problems should be mainly found in the functioning and organization of urban systems has come up.

In other words, the step that EU is trying to accomplish is to propose new forms of urban development and governance in order to prevent the problems that until now have been solved *a posteriori*. This process is still at an early stage as many aspects of urban development have not been determined yet, and, for example, there is not any definition at EU level of “territorial cohesion”. Actually, the most interesting aspect for scholars and urban planners is the recognition of the central role played by the city in the process of economic and social growth of European Union. Even though cities are the places where problems such as unemployment, pollution, poverty and segregation are more pronounced, at the same time they are defined as “the engines of the European economy”, are regarded as “catalysts of creativity and innovation” and have a crucial role “in the implementation of the Europe 2020 Strategy” (EP, 2011).

Although the scientific debate on Smart Cities is still underdeveloped, the aspects that EU considers essential within its urban and territorial development policy can be defined by referring them both to the debate on Smart Cities so far developed, and sectors and applications that industries and companies tag as Smart.

Therefore is still premature to expect that at the European level “urban development” is meant a “smart” development; this adjective is, in fact, most commonly used to denote single elements of the urban system (transport infrastructure, ICT and energy), rather than the overall organization of the city. Based on this consideration, we tried to identify features and governance actions oriented to connote the city as smart, through the integrated reading of EU documents. 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).

Most these features are contained in the three documents analyzed and their integrated reading allows to extrapolate the four main actions, listed below, that European cities should be undertaken in the near future, in order to achieve a smart, sustainable and inclusive growth:

- adopting models of multi-level governance through the distribution of responsibilities between different government and institutional levels;
- promoting integrated urban policies by adopting a holistic and strategic approach;
- focusing on new information and communication technologies (ICT) in order to provide citizens for new media opportunities and easier access to the public and cultural contents;
- ensuring a sustainable territorial development based on the efficient use of resources.

According to the model proposed in the first action, the highest levels of government establish general development guidelines and wide discretion is left to the lower levels (Sabel and Zeitlin, 2008). In this way the development actions can more easily adapt to specific and urban settings that, it is hoped, should also coordinate horizontally all subjects and local institutions that play a decisive role in the identification of citizen preferences of specific territories (Barca, 2009). The multi-level governance has been mainly developed in the domain of EU cohesion policies that support the active role of governments and local communities in the direct management of the interventions. In this regard, in particular, the Urban Agenda emphasizes that the "local needs" are the "European priorities" and that multi-level governance "properly functioning" and a high participation of regional and local authorities can lead to the success of urban development policies.

The second action refers to the integration both of interventions in urban and economic resources made available by the EU, that are indispensable for their implementation. EU gives cities the opportunity to design and implement strategies fully integrated by providing multi-fund operational tools and cross-financing. If "the city is time and space", as stated in Cohesion Policy document, the integration should take place both at spatial level (region, metropolitan area, district) and at temporal level, combining short and long term strategies depending on the specificity of the actions. In addition, a strategic approach to plan urban development scenarios should be adopted, starting from the specific characteristics of each urban area and sharing the development prospects with the several actors involved on the basis of partnership principle. Finally, the definition of policies should require a holistic approach suited to the complexity of urban areas; this kind of approach would mitigate not only the negative externalities produced within urban systems, but also would reorganize the urban system through a more effective network of relationships between the elements that compose it, in order to act on the causes rather than the effects.

According to the third action great attention should be payed to some peculiar characteristics that since the beginning of the scientific debate have featured a smart city. The main difference between a smart city and a "sustainable city" is the use of ICTs (Papa, Gargiulo, Galderisi, 2013) which may derive from the fact that the concept of smart city has begun to attract interest when the ICTs first reached a wide audience in European countries (Nijkamp et al, 2009). Unlike those who believed that ICTs would have replaced social relations and created an intangible space alternative to the physical, evidence have exclusively revealed the complementary nature of these technologies to the functioning of urban systems. Thus, ICTs are a support tool to the development of human activities and their use, as well as reaffirmed in the Digital Agenda, is aimed at improving the quality of life of citizens, thanks to greater efficiency and speed of services that these technologies are able to offer. Following this approach, within the objectives of Digital Agenda there is not only the digital infrastructurization of the Member States but also the activation of a process of digital literacy so that "social background or skills are not a barrier to the development of potential" offered by ICTs. The city is "designed and equipped as a great functional and territorial infrastructure to support the society and economy of the country" (Niger, 2012), and the role of ICTs is not to erase the relationships and social exchanges but rather to make the basic services more affordable and more efficient such as education, health, transport, etc. As well as the machines have not replaced the man during the industrial revolution, ICT cannot replace "analog" interactions, but only make things easier.

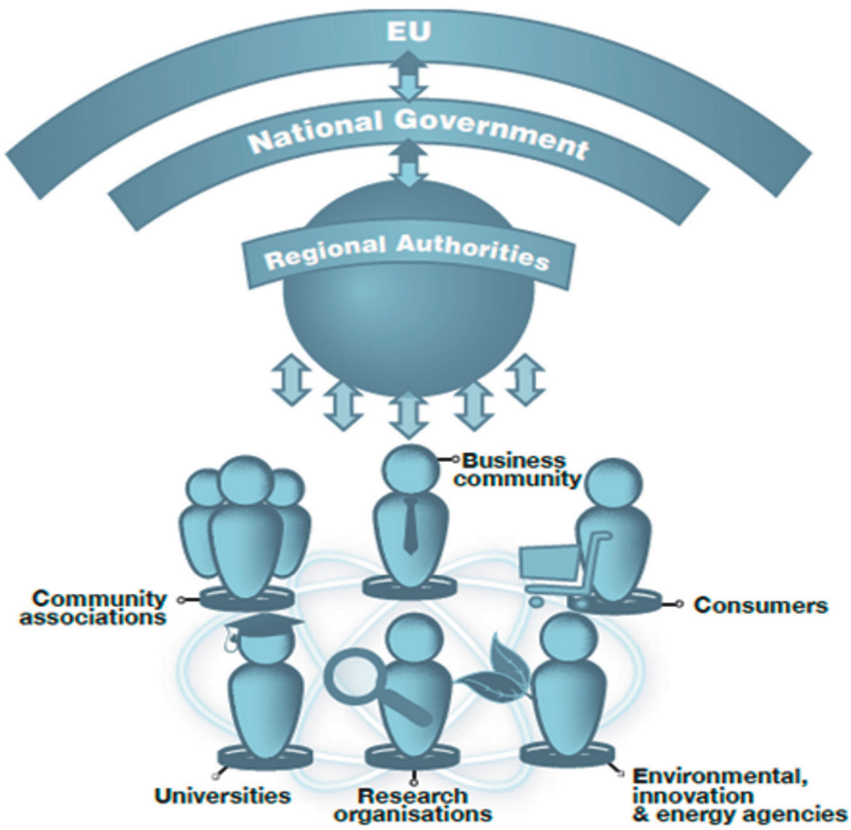


**Fig. 7: Connecting regional actors for the promotion of sustainable growth**

Finally, the fourth action of sustainable growth is one of the three priority areas on which the Europe 2020 Strategy is based on, and is oriented to promote a more efficient economy in terms of resources through the deployment of smart grids and green technologies, carbon emission reduction of and improving energy efficiency. It is clear that the achievement of sustainable growth objectives is closely linked to the concept of technological innovation seen as "the key to succeeding in the de-coupling of growth from environmental degradation and consumption research" (EC, 2012b). At the same time technological innovation is the factor that allows to link the environmental and economic goals permitting that smart and sustainable growth can occur hand in hand. EU privileges regional and local levels to connect the sustainable and smart development, thanks to technological innovation. Local actors have, in fact, a greater knowledge of the territorial specificities and can therefore propose specific guidelines on how to prevent and adapt to environmental challenges. To this end, among the investment priorities at local level, ERDF take into account investments in infrastructure providing basic services to citizens in the areas of energy, environment, transport and information and communication technologies (ICTs). Urban Agenda also notes that cities can make a substantial contribution to the fight against climate change, for example through intelligent systems for local public transport, energy refurbishment of buildings, and a sustainable urban planning that minimizes distances from work, from urban infrastructure, etc..

Moreover, the Urban Agenda as well as the Digital Agenda, draws attention to the great potential of ICT in order to deal with climate change, reduce energy consumption and improve transport efficiency. ICT, in fact, "may promote structural change towards products and services that require a more limited use of resources, towards the realization of energy savings in buildings and electricity networks and more efficient and less energy-intensive intelligent transport systems" (EC, 2010a).

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# TeMA

Journal of
Land Use, Mobility and Environment

TeMA 3 (2013) 371-396
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/1944



# REVIEWS PAGES

## SMART CITIES, RESEARCHES, PROJECTS AND GOOD PRACTICES FOR NETWORKS AND INFRASTRUCTURE

The Reviews Pages keeps the readers up-to-date on developments in five reports: web, books, urban practices, law, news and events. Each report deals with the specific subject proposed in the TeMA issue. These reviews are specialist in nature but contain enough introductory material to make the main points intelligible to a non-specialist. The reader will not only be able to distinguish important developments and trends but will also find a sufficient number of references to the original literature, web and other resources .

**01_WEB RESOURCES**
The web report offers the readers web pages which are directly connected with the issue theme.

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**02_BOOKS**
The books review suggests brand new publications related with the theme of the journal number.

author: FLORIANA ZUCARO
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**03_LAWS**
The Law section proposes a critical synthesis of the normative aspect of the issue theme.

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**04_URBAN PRACTICES**
Urban practices describes the most innovative application in practice of the journal theme.

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**05_NEWS AND EVENTS**
News and events section keeps the readers up-to-date on congresses, events and exhibition related to the journal theme.

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# 01

SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR NETWORKS AND INFRASTRUCTURES

# REVIEW PAGES: WEB RESOURCES

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In this number

## NETWORKS AND INFRASTRUCTURE FOR SMART CITIES

Networks and infrastructure services are responsible for the level of livability of a smart city: utilities such as energy, water, mobility, and communications are fundamental services that make a city attractive and comfortable.

In terms of energy efficiency, smart city equals to smart grid. A smart grid is a sophisticated network of sensors that is able to reduce energy waste giving more control of energy consumption to users. Adopting and implementing smart grid technology allows cities to better manage the production and distribution of electricity, with a low environmental load.

Together with energy waste, water waste is no more sustainable for our planet: as the world's population increases water resources shrink. For this reason, a wide range of innovative solution for water management have been developed and the water conservation plan of Songdo, the new city built from scratch in South Korea, is an example.

Mobility represents another important aspect that influences the quality of life in cities; improving the way people and goods travel into and around the city is essential. The term mobility management refers to different actions to be implemented: first of all, decrease congestion and resulting pollution, then offer people multiple types of urban transportation reducing the need to use the car, optimize travel safety and efficiency and improve capacity.

In order to make possible the connection of all cities' services, including energy, water and transportation, a communication network is indispensable. Connecting all sorts of things, both human and physical, helps to coordinate services and it improves their security and productivity while simultaneously preserves the natural environment. Just think of videoconferencing, a communication network widely available today; it is a useful tool for companies and it has positive impacts on work efficiency as well as on the environment because it reduces the need to travel to bring people together.

Thinking of a more distant future, communication systems will allow connecting all kind of objects within a network, without requiring human interaction: this is also known under the name of Internet of Things (IoT).In this issue, it was decided to choose three websites, two of which analyze only one specific utility of the infrastructural system, in particular smartgrids.eu is the European portal for the promotion of smart grid technology and theinternetofthings.eu aims to become a point of reference in the debate about IoT, differently, the last website, stateofgreen.com, covers all the different infrastructural services (energy, water, environment, etc.) but only referring to the Danish experience.

## SMART GRID EUROPEAN TECHNOLOGY PLATFORM

www.smartgrids.eu

The Smart Grids European Technology Platform (ETP SG) was established in 2005, when the European Commission Directorate General for Research, along with more than 100 stakeholders involved in the electricity networks sector, formulated the ETP's guiding principles, aiming to coordinate EU-level related initiatives.

One year later, in 2006, the Vision paper for ETP Smart Grids was presented, followed by the Strategic Research Agenda, in 2007. These acts intend to promote innovation in the European electricity networks, keeping an eye on the environmental targets and promoting the introduction of smart grids on the political agenda in the world.

More detailed information about ETP SG are provided in the section *ETP* of its website, where its mission and objectives are described, as well as its structure and activities. Furthermore, users can easily download the presentation brochure and other official documents, such as the Vision and the Strategic Research Agenda.

For those who are not very familiar with the smart grid matter, it is possible to know more about it reading the answers to over twenty-five frequently asked questions collected in the *FAQ* section of the ETP portal.

Many different EU initiatives have been developed to encourage the main goal of the Platform, that is "fostering and supporting the research and development of SmartGrids Technologies in Europe with a perspective towards 2035". One of the most relevant initiatives is the European Strategic Energy Technology Plan (SET-Plan), which aims to change the current energy system, making low-carbon technologies more convenient. The complete list of the major European initiatives is available in the section *EU Initiatives* of the portal, where a detailed description of each program is provided.

For those interested in actively participate in the platform, there are many possibilities to do it and you can find the most appropriate way for you in the section *Get Involved* of the website.

For example, you can subscribe to the ETP SG newsletter and be informed about news, or become a member of one of the two current active working groups. Another way to get involved in the project is to attend ETP events, public consultation and general assemblies or become a sponsor or partner of its activities. Moreover, if your real interest is to develop a smart grid project, and not just get involved, it might be useful to consult the section *EU Projects*, which includes direct links to several websites of the European Commission, providing a sample of EU Smart Grids Projects.In an age of economic uncertainty, the development of a smart grid initiative often requires financial support; with this aim, plenty of EU funding instruments are available and can be consulted in the section *Funding* of the portal.The Smart Grids European Technology Platform represents an important point of reference to promote smart grid initiatives in our Continent, as well as to identify the top priorities that EU is required to implement as soon as possible, and its website is a useful tool for those who are interested in the subject and want to develop a smart grid project in Europe.

## THE INTERNET OF THINGS - COUNCIL

https://www.theinternetofthings.eu

The Internet of Things (IoT) is a fairly new concept, recently become popular. It refers to objects equipped with identifying devices, which can communicate and be managed by computers.
What if your alarm sounds in advance because there is traffic on your way to work? Or the pill container alerts you when you forget to take it? The IoT is this and much more.
Each object provided with a RFID tag is connected to the Internet and is able to exchange data and information, acquiring a virtual identity that together with the physical helps to reduce the gap between analog and digital world. If presented in this way, the IoT appears as an attractive scenario, but there are still many doubts and misgivings about it: proponents argue that IoT creates social innovation, while critics are concerned about the privacy risks that would arise, in fact, data and information provided by RFID can be used by anyone if governments do not establish security and privacy requirements.
The debate is still opened and theinternetofthings.eu offers a platform for exchanging ideas and opinions about this question.
Theinternetofthings.eu is managed by the Council of the Internet of Things, which defines itself as "a loose group of professionals that want to host the full range of emotions and conceptual clarity that comes with grasping the territory, the full logistical, business, social and philosophical implications of the Internet of Things"; the Council is a think thank that counts over one hundred members and its mission is to develop a new perspective of the IoT that takes into account the positions of those in favor and those against.
The website consists of a large number of articles gathered in the *home* and in other four sections: *internet of things, who, what and mission*, depending on the topic.
The insights collected in the *home* are taken from different sources, like blogs, online communities or official websites; only a small excerpt from the original is published and individual authors are indicated in the title of each article. The *home* is updated almost daily and users interested in the date of publication of a paper should consult the source, where it is mentioned.

The section *internet of things* includes fifteen articles written by the Council describing the IoT from different perspectives: from the urban point of view to the individual.

Information about the Council, its birth and development, can be found in the sections *who, what* and *mission.* A very interesting initiative of the Council is the annual competition presented in the section *Contest*, but, unfortunately, the last to have been organized is that of 2011, on Panopticon. After the success of 2011 contest, it would be desirable to organize a new edition.

In the future, the idea of the Internet of Things will be more and more discussed and actual and the professionals who are part of the Council will continue to play an important role in initiating the debate on this topic.

State of Green
Join the Future. Think Denmark

STATE OF GREEN
http://www.stateofgreen.com/en

State of Green is a public-private consortium that involves the Danish Government, other Danish institutions and several commercial partners; it was born to put together all the "players in the field of energy, climate, water and environment".

Stateofgreen.com aims to be a global landmark for those who want to learn from the Danish experience. Not surprisingly, Denmark represents the most motivated country in terms of environmental sustainability, at global level: if it keeps the commitment of becoming independent of fossil fuels by 2050, Denmark will be the first state worldwide.

When you open the home page of Stateofgreen.com it is possible to explore the website by choosing between three main sections: *Solutions, Products* and *Profiles*. The portal offers an extraordinarily extensive database gathering more than thousands of solutions, products and profiles; it is possible to customize your search choosing the type of filtering that best suits you, for example, you can sort the database by alphabet or most recent, as well as filter it by theme, such as *Intelligent Energy, Heating & Cooling,* or *Solar & Other Renewables*. Another original way to browse the database is to display it on Google map; this tool is available for Solutions and Profiles, but not for Products.

A wide sample of projects implemented all over the world, from Greenland to Mozambique, is collected in the section *Solutions*. One of the most viewed project regards the construction of "World's First" Smart Grid system on the Faroe Islands: a virtual power plant will supply the Islands with energy, integrating the wind generation expected over the next two years. Together with this solution, there are also many other interesting initiatives, for example the Danish capital's cloudburst mitigation plans, the renovation of the Scandinavian Design College, or the construction of the largest energy-efficient supermarket in Sweden.

With regard to the section *Products*, the list collects a large number of tools used for energy-saving activities like turbines, soot blowers, heat exchangers, and so on. New generation materials are also included in the database: rubber granulate mixed with polyurethane for playground applications or modified asphalt (Road+) for new roads are just two examples.

In the end, the section *Profiles* is devoted to companies working in the field of green economy which are involved in the innovative solutions and/or products presented in the previous sections.

Another way to explore Stateofgreen.com, other than select one on the three main sections, is to choose between eight specific sectors: *Intelligent Energy, Energy Efficiency, Heating & Cooling, Water, Bioenergy, Wind Power, Solar & Other Renewables, Resources & Environment*. For each sector, the portal offers a descriptive sheet including an interactive video, news and direct links to the related solutions and products.

For those who are not satisfied with the content offered by the website, but want more, there is the opportunity to live the Danish experience firsthand, with the *State of Green tours*. Over four thousands of people, including journalists, businesses and politicians, have already visited Denmark and had the opportunity to find inspiration by the excellent results the country obtained in terms of energy saving and sustainability.

Danish commitment to share its experience with other countries in the world is an example of forward-looking policy; good practices that have already been successfully implemented somewhere are a heritage to be shared, because they can create development in another part of the world.

## IMAGE SOURCES

The images are from: http://www.iteresgroup.com/services/smart-grid/; http://www.paneuro.net/smart-grids-european-technology-platform/; http://rusland.um.dk/en.aspx; http://www.zdnet.com/the-internet-of-things-sizing-up-the-business-opportunities-7000009301/.

# 02

## SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR NETWORKS AND INFRASTUCTURE

## REVIEW PAGES: BOOKS

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In this number

### SMART GRIDS AND SMART TRANSPORT NETWORKS

City development is inextricably linked to technological innovation: most cities' grow is due to new work or special production technologies that required a specific spatial location and their destiny was influenced by the greater or lesser capacity to adapt its economic and social structure to the evolution of existing technologies or the emergence of new technologies which quickly replaced the previous. In addition to playing a central role in the evolution of technologies, cities are also the location where most future and actual challenges have been taking place and in this perspective the widespread use of new technologies, especially information and communications technologies (ICT), can be considered as the pillar for making up a smart city. According to literature, the concept of smart city developed during the last decade is a combination of ideas about how ICT can increase efficiency and competitiveness of urban systems (Batty et al. 2012). A lot of cities, together with technology companies, are focusing on becoming smart, making the effort to coordinate, couple and integrate several kinds of technologies that have synergies in their functioning, in order to find out new opportunities which will improve the quality of life. Regarding it, Pike Research estimates that smart city technology market will grow from 6,1$ billion annually in 2012 to 20,2$ billion in 2020. Nevertheless it is worth noting, as it has been made in the first issue of this year, that the "smartness" of a city depends on people who live there and not merely in the technologies that are used. However, without analyzing the relationship between new technologies and urban transformations, this section wants to focus on the investments and progresses that have been making both in the sector of electricity networks, the smart grids, and transport. According to the International Energy Agency (IEA), energy efficiency is one of the largest influencing factors for achieving the ambitious targets for $CO_2$ reduction and transport sector is strictly linked to the energy issue. In this perspective, three documents are proposed: the first proposal is a report related to European smart grid projects; the second one describes how smart technologies could play a vital role in bringing the vision for convenient, joined up, multi-modal sustainable mobility; the third is a EC assessment on the developments of the infrastructure for electric, hydrogen and natural gas vehicles.

**Title: Smart Grid projects in Europe: lessons learned and current developments**
Author/editor: AA VV
Publisher: Joint Research Center
Download: http://jrc.ec.europe.eu
Publication year: 2013
ISBN code: 978-92-79-28604-9

The Joint Research Centre (JRC), the in-house science service of the European Commission, has just published this 2012 update of the inventory of smart grid projects, in order to establish an open platform for the collection and dissemination of project information involving all Member States, international organizations and energy operators. The JRC was able to set up the most updated and comprehensive database of smart grid projects (281) and smart metering pilots and roll-outs (91), through both a survey distributed to European associations, system operators, utilities and Member State representatives and a wide search of project information. The report comprises a wide range of projects, attesting how smart grids can help use more renewable resources, accommodate electric vehicles, give more control to consumers over their energy consumption, avoid blackouts and restore power quickly when outages occur. All the projects analyzed relate to new technologies and resources to make the electricity grid smarter, (according to the concept of smart grids developed in 2006 by the European Technology Platform for Smart Grids) and they have been focused on the applications enabled by them, policy goals, consumer involvement and social impacts, in order to provide a more correct assessment of the projects. A key finding of the report is a significant geographical imbalance: the smart grid projects are irregularly spread across Europe, with the vast majority of investments, amounting to about 5.5 billion €, made in old Member States, while new Member States (EU 12, mostly in Eastern Europe) tend to slow up. This situation can represent a weakness for Europe that should deal with the slow progress being made in EU 12 more efficiently, in order to reach the objectives of an integrated market. Italy is among the seven countries where 70% of all projects have been realized: the public investments in research and development (R&D) projects have been increasing since 2010, thanks to European financing instruments (European Regional Funding and Seventh Framework Programme) and innovation or energy ministries of each country. The opportunity to cooperate with companies and organizations of different countries involved in a multinational project has also fostered the national public investments in smart grids. Therefore smart grid projects have been driving by government grants and other public support (about 55% of the total budget comes from non-private funding sources) revealing just how important that backing is to stimulate private investment. The report confirm the finding of another recent report on smart grids (Pike Research's), which estimates that Europe will invest around 56 billion € in smart grid technology by 2020. EU directive establishing that member states have to replace the 80% of their meters with the smart ones, is driving the growth of investments and development projects in this sector: Europe has invested at least 5 billion € in smart meters, including 2.1 billion € for Italy's rollout of 36 million smart meters from 2001 to 2008. The report describes briefly 20 good practices, in order to demonstrate under which conditions energy efficiency measures can be implemented successfully. In all these case studies the cooperation and participation of stakeholders and clear demonstrations of the ability of the industry to address privacy and security concerns are the key elements to foster progress in the smart grid sector, in order to provide the necessary underpinning to Europe meeting its 20-20-20 goals.


**Title: Smart Mobility for a 21st Century America: strategies for maximizing technology to minimize congestion, reduce emissions, and increase efficiency**
Author/ editor: AA VV
Publisher: Transportation for America
Download: http://t4america.org/
Publication year: 2010
ISBN code: n.d.

The goal of this report is to provide policy recommendations for the Congress and the USA government that had to prepare the new transportation bill, in order to emphasize how establishing national targets for reducing congestion and emissions through programmatic changes and funding incentives can accelerate the development of innovative, new information systems and technology solutions: "investment in technology and innovation can help to solve nation's most critical transportation problems".
The report has been made up by several American leading transport organizations dedicated to advancing the research of transport systems and it has released in conjunction with the IBM Smarter Transportation Virtual Forum to discuss urban mobility and the growing spread of technology solutions. The report in fact aims at demonstrating how emerging technologies can increase capacity on congested highways, help commuters avoid traffic delays, and expand and improve transportation options while saving money and creating jobs. According to several studies related to saving money in transport sector through the use of innovation technology, the report highlights that intelligent transportation systems (ITS) and other smart technologies are cost effective and quick to deploy: for instance, synchronized and adaptive traffic signals allow to yield a 40$ return in time and fuel savings for every 1$ invested, while also reducing $CO_2$ emissions by up to 22% and travel delays by 25% or more. Instead of describing improvements to vehicles and cleaner fuels, which are the most talked-about technological innovations, the attention is focused on smart technologies are being deployed today to improve system efficiency and reduce travel delays, provide more convenient access to transportation alternatives, and even customize routes based on real-time traffic conditions. These innovations are grouped into five categories, according to the target to reach:
making transportation systems more efficient;
providing more travel options and multimodal connectivity;
providing travelers with real-time, more accurate and more connected information related to transportation system;
making pricing and payments more convenient and efficient;
reducing trips and traffic.
The report suggests adopting a plan to incorporate technologically advanced solutions throughout the transportation system, in order to "leverage existing capabilities and create a seamless interoperable network".
According to the five categories of innovation just described, the report illustrates more than ten case studies, referred both to America and Europe countries, to explain how smart mobility solutions can give benefits to regions, cities and business. In conclusion, by reading the information provided and taking a look at the case studies, planners and decision makers can know ideas and solutions that could be implemented to intelligently strengthen mobility options in their local communities, through linking technology and transport systems to increase efficiency, affordability and accessibility.

**Title: Impact Assessment-accompanying the document Proposal for a Directive on the deployment of alternative fuels infrastructure**
Author/editor: AA.VV.
Publisher: European Commission
Download: http://ec.europa.eu/transport/themes/urban/cpt/
Publication year: 2013
ISBN code: n.d.

Within this package's measures Clean Power for Transport Package launched by EC in July 2013, in order to create a single market for innovative and alternative fuels, there is an Impact Assessment that evaluates cost and benefits of different policy options and finds best conditions for a comprehensive coverage of the main alternative fuel options. This report demonstrates that the infrastructure for electric, hydrogen and natural gas vehicles is likely to remain insufficient for what broad market take-up would require. In order to provide a solution, the reasons that prevent the deployment of alternative fuels are discussed: the high price of vehicles, the lack of recharging infrastructure, caused by several market failures, and the poor consumer acceptance, which is strongly affected by the availability of recharging stations. All these three factors create a vicious circle: investors do not invest in alternative fuel infrastructure because of an insufficient number of vehicles and vessels, the manufacturing industry does not offer alternative fuel vehicles and vessels at competitive prices as there is insufficient consumer demand, and consumers do not purchase the vehicles and vessels for lacking of dedicated infrastructure. This endless circuit requires a great coordination among the different subjects involved, such as happened in some demonstration projects in which car-makers and electricity utilities have joined their forces to provide consumers with a full package of vehicle, home charging point and a few public charging stations. In this way, the final consumers, who need to be convinced about the attractiveness of alternative fuel vehicles, will tend to purchase them only if they are assured about the availability of sufficient recharging/refuelling infrastructure. The current state of play of infrastructure networks is not nearly encouraging: most Member States do not have a significant number of charging points and the electricity charging infrastructure has been continuing developing in a fragmented way. The existent network of private and public charging points is expected to increase significantly only in France, while in the rest of EU, only 600.000 points are expected to be deployed by 2020, further aggravating the already existing imbalance among Member States. The situation is even worse both for hydrogen and gas: in the first case 90 refuelling stations are mainly located in Denmark, Germany, the Benelux states and the United Kingdom. Nevertheless, several Member States such as Denmark and Germany, have been working on detailed plans for hydrogen, thanks to industry projections that show that hydrogen fuel cell vehicles can become cost-competitive with conventional vehicles in the medium-term infrastructure deployment. Regarding liquid gas there are totally 20 terminal, while just Italy and Germany have stations for compressed gas. In order to ensure the provision of a sufficient infrastructure network the EC has identified four policy options; among them, the one that could accelerate the market development of alternative fuels and ensure that investments have a larger impact on economic growth in Europe, is related to the definition of basic criteria for minimum infrastructure coverage for Member States.

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# 03

SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR NETWORKS AND INFRASTRUCTURE

## REVIEW PAGES: LAWS

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In this number

## ALTERNATIVE FUEL INFRASTRUCTURE EXPANSION: NEW NETWORKS FOR CHARGING ELECTRIC VEHICLES

In this issue, the laws section examines the European regulations and the new energy government of the territory tools set up for the development and the implementation of infrastructure networks for charging electric-powered vehicles. The aim is to provide a comprehensive picture of the role that the law has on the spread of this kind of infrastructures in Europe and in Italy.

Future electricity networks will play a key role for the achievement of the goal set by the EU for 2020: to transmit and distribute about 35% of electricity from dispersed and concentrated renewable energy sources. To do that, electricity networks have to respond to three interrelated challenges: creating a pan-European market; integrating a massive increase of renewable energy sources; and managing interactions between millions of suppliers and customers, including owners of electrical vehicles (EC 2011).

The contents have been organized as follows: the first paragraph illustrates the European regulatory framework for the development of cleaner fuels and related infrastructure, the so-called “Clean Power for Transport package” (2013), made up to facilitate the development of a single market for alternative fuels for transport in Europe including the appropriate infrastructure.

The second paragraph analyzes the specific measures relating to recharging infrastructure for electric vehicles contained within one of the documents that make up the regulatory instrument package: the “proposal for a Directive on the deployment of alternative fuels infrastructure” (COM(2013)18) that establishes a common framework of measures for the deployment of alternative fuels infrastructure in the European Union.

The third paragraph is dedicated to the description of the implementation of these provisions in Italy (through the law n.134/2012) and it examines the main contents of the "National Infrastructural Plan for recharging electric vehicles " that is aimed at implementing infrastructure networks for recharging electric-powered vehicles and measures to recovery the building stock for the development of the networks.

## CLEAN POWER FOR TRANSPORT: ALTERNATIVE FUELS FOR SUSTAINABLE MOBILITY IN EUROPE

According to the United Nations Economic Commission for Europe (UNECE 2009), the global car fleet is predicted to grow from 800 million to 1,6 billion vehicles by 2030. Negative externalities from the transport sector are therefore one of the main factors to mitigate in order to achieve the objectives that the EU has set for 2020 on the reduction of greenhouse gas emissions, energy efficiency and use of renewable energy.

In view of the scope of change required for a low carbon transport system, the European Commission in the report "Infrastructure for alternative fuels" (2011) analyzes the current regulatory framework and identifies the gaps that prevent the achievement of such change. These gaps can be attributed to the different technological choices made up in these years by some Member States to promote alternative fuels that lead to: isolated national or regional markets, fragmentation of the internal market for alternative fuels and technology "border lines", which inhibit mobility with alternative fuels across Europe. In addition, directives and communications prepared by the European Commission have so far focused mainly on setting emission performance standards for new passenger cars (reg. 443/2009), on vehicle technology development (COM (2010) 186), on the identification of the main alternative fuels to oil (COM(2013)17), whilst the build-up of the necessary infrastructures has been neglected. The CARS 21 High Level Group report of 6 June 2012 states that the lack of a Union-wide harmonised alternative fuel infrastructure hampers the market introduction of vehicles using alternative fuels and delays their environmental benefits.

To fill these gaps the European Union provides a specific strategy on alternative fuel infrastructure with the Clean Power for Transport Package that has three main goals: to overcome transport dependency on oil, introduce alternative fuels in order to lower greenhouse gases (GHG) emissions, and to kick start the market for alternative fuels in the EU. The Clean Power for Transport Package falls within the broader Europe 2020 flagship initiative "Resource-efficient Europe" which seeks to promote new technologies to decarbonise the transport sector (COM (2010)186) and it is in line with the White Paper "Roadmap to a Single European Transport Area" (COM(2011)144) that sets a target of 60% greenhouse gas emissions reduction from transport by 2050.

In particular, the Clean Power for Transport Package is made up of:

- the Communication "European alternative fuels strategy" (COM(2013)17) that evaluates the main alternative fuel options available to substitute oil whilst contributing to reduce greenhouse gas (GHG) emissions from transport, and suggests a comprehensive list of measures to promote the market development of alternative fuels in Europe;
- a proposal for a "Directive on the deployment of alternative fuels infrastructure" (COM(2013)18), aimed at ensuring the build-up of alternative fuel infrastructure and the implementation of common technical specifications for this infrastructure in the Union (Allsaar 2013);
- an Impact Assessment report (SWD(2013)5/2) that evaluates cost and benefits of different policy options and find best conditions for a comprehensive coverage of the main alternative fuel options.

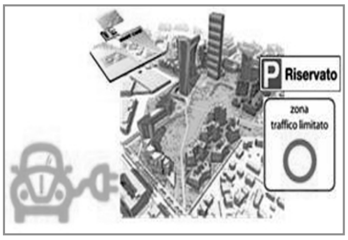

# THE DEPLOYMENT OF RECHARGING INFRASTRUCTURE FOR ELECTRIC VEHICLES: THE EUROPEAN STRATEGY

The proposal for a Directive on the deployment of alternative fuels infrastructure establishes a common framework of measures for the expansion of alternative fuels infrastructure in the Union "in order to break the oil dependence of transport and sets out minimum requirements on alternative fuels infrastructure build-up and common technical specifications, including recharging points for electric vehicles" (EU 2013).

The most detailed measures are provided in the field of electric vehicles technology that has a significant potential to radically address a number of challenges facing the European Union (global warming, dependency from fossil fuels, etc.) and it appears to be most promising for urban use (EU 2010). The regulations concerning the electricity supply for transport provide that each Member State shall ensure a minimum number of recharging points for electric vehicles according to the urbanization rate of the State. It follows that states such as Germany, Italy and the UK, where there are the highest rates of urbanization, should establish a minimum number of recharging points equal to more than one thousand units, unlike states such as the Netherlands or Poland whose minimum is equal to approximately 40,000 units. In addition, to realize an effective recharging network at European level the proposal provide investment in electric recharging points based on common standards in order to allow all electric vehicles to be charged and to communicate with the electricity grid anywhere in the EU and also with all types of chargers.

In addition, each Member State shall adopt a national policy framework for the market development of alternative fuels and their infrastructure, that will contain at least the following elements:

- measures to support the build-up of alternative fuels infrastructures, such as building permits, parking lots permits, fuel stations concessions;
- policy measures supporting the implementation of the national policy framework such as direct incentives for purchase of alternative fuels means of transport or building of the infrastructure, possibility of tax incentives to promote alternative fuels means of transport and infrastructure; demand side non-financial incentives: e.g. preferential access to restricted areas, parking policy, dedicated lanes;
- deployment and manufacturing support measures, such as yearly public budget allocated for alternative fuels infrastructure deployment, differentiated by fuel and transport mode (road, rail, water and air) or yearly public budget allocated to support manufacturing plants for alternative fuels technologies;
- 2020 national targets for the deployment of alternative fuels in the different transport modes (road, rail, water and air) and for the relevant infrastructure;
- national targets, established year by year, for the deployment of alternative fuels in the different transport modes and for the relevant infrastructure in order to achieve 2020 national targets;
- number of alternative fuel vehicles expected by 2020.




## THE ITALIAN NATIONAL POLICY FRAMEWORK FOR ALTERNATIVE FUELS AND THEIR INFRASTRUCTURES

The transposition of the European Directives on alternative fuels infrastructure in the Italian law system is due to the low n.134/2012 governing "Urgent Measures for the nation growth", more known as "Development Decree". This law dedicates a specific Chapter (Capo IV bis ) to legislations aimed at promoting the development of sustainable mobility through specific measures to encourage the development of recharging infrastructures for electric vehicles and the deployment of public and private low-carbon fleets, with particular reference to the urban context. Article 17-septies, in particular, introduces the "National infrastructural Plan for recharging electric vehicles (PNire)" in order to ensure minimum levels of accessibility to the recharging electric-powered vehicles infrastructure throughout the country.

The PNire is aimed at implementing infrastructure networks for recharging electric-powered vehicles and measures to recovery the building stock for the development of the networks. To implement the plan, the Government has put in place funding for a total of € 50 million. The funding provided by the Ministry amounted to € 20 million for 2013 and to € 15 million for each of the years 2014 and 2015.

The PNire will be implemented in two phases: the first phase (2013-2016) concerns the definition and the draw up of the Plan; during the second phase (2017-2020) is planned to complete the construction of the charging infrastructure networks in order to cover the entire national territory and to enable a large-scale deployment of electric vehicles. Regarding the criteria used for the location of the charging infrastructure, the Plan gives priority to the construction of the infrastructures in urban and metropolitan areas in the short term (1-2 years), then it provides to expand the focus on highways and suburban areas in the medium and long term (3-5 years). The development of the charging networks will be sized on the basis of the urbanization of different areas; in this regard the Plan defined a set of attributes and variables that must be taken into account to identify the minimum number of charging infrastructure (both public and private) needed to cover a given geographical area in the country. The attributes to be identified for each reference area are: the population, the population density, the territorial extension and the working population. The variables to cross with the attributes are, instead: motorization rate, the percentage of electric vehicles and the level of $CO_2$ emissions in the given area.

Important changes are introduced also in the field of urban and regional planning. The PNire provides for the review and the integration of the Mobility Plan and Urban Development Plans with specific provisions on electric mobility. In particular, the competent administrations must provide for the integration of the local and regional mobility Plan with a special section dedicated to electric mobility, or alternatively, they should develop a specific plan of electric mobility. On the other hand from the urban point of view the Plan expects to adequate the urban planning instruments with minimum standards regarding the amount of public facilities for charging electric vehicles. In addition, by 1 June 2014 the release of the building permit will undergone to the implementation of electric vehicle charging stations which facilitate the connection of a car from each parking space and from each box car (MIT 2013).

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# 04

SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR NETWORKS AND INFRASTRUCTURE

# REVIEW PAGES: URBAN PRACTICES

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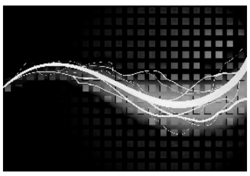

In this number

## SMART INFRASTRUCTURES: THREE CASE STUDIES

Climate changes, rising energy prices and technology advances are driving the change to new levels of efficiency and innovation in infrastructures management. In this context, the concept of "smart infrastructure" or "smart system" has attracted considerable attention over the past few years.

Smart infrastructures are currently a hot topic under discussion by governments, researchers, media and others. However, a generally accepted definition of "smart infrastructures" has not been established yet.

In our opinion, a smart infrastructure is an infrastructure that uses a feedback loop of data to improve its performances. More in details, a smart infrastructure uses ICT-based technologies such as sensors, meters, digital controls and analytic tools to reduce the overall running operational costs.

More efficient and environmentally friendlier systems for managing, among other things, commuter traffic, electric grids, waterways and waste collection have been recently developed in cities around Europe, United States and Asia.

In this paper, we present three relevant case studies of smart infrastructures:

- Thessaloniki's intelligent urban mobility management system;
- Malta smart energy and water grid;
- Philadelphia smart waste collection system.

The case studies aim to analyze the currently emerging opportunities offered by this new approach to smart and sustainable infrastructures management and to identify common successful factors. In this regard, an active citizen engagement trough technology, as well as a strong collaboration between key players (i.e. local governments, public utilities, research centers and large companies) have emerged as important common conditions for the successful implementation of a smart infrastructure.

With different strategies and different solutions, the case studies analysed have shown how smart technologies such as low-cost sensors for real-time collection, clever software for analytics and visualizations as well dynamic control systems can be key factors to tackle efficiency and environmental issues and pave the way to a smarter and greener environment.


# THE THESSALONIKI'S INTELLIGENT URBAN MOBILITY MANAGEMENT SYSTEM

The city of Thessaloniki has experienced an increasing growth in traffic congestion and urban pollution over the last years. These traffic and environmental problems have created a direct negative impact on the economic development and functional character in the central area of the city (Morfoulaki et al., 2011).

In 2009, the Hellenic city launched an ambitious project aimed to reduce the negative influence of traffic congestion and gaseous pollutants. Smart technologies, real-time data and travel behavioural changes are the key ingredients of the Thessaloniki Urban Mobility Management System (TUMMS), a collaborative project involving the key players of the city dealing with urban mobility, transport and environment. Indeed the project is the result of a unified effort between research centers (the Hellenic Institute of Transport, the National Observatory of Athens and the Norwegian Centre for Transport Research), local and regional authorities (the Municipality of Thessaloniki and the Region of Central Macedonia) and transport authority (Thessaloniki's Integrated Transport Authority). The system aims, through the services provided, to help travellers move around the city easily, avoiding the traffic congested areas, to raise the environmental public consciousness and to promote public transportation and alternative ways of transport (walking and cycling). At the same time, through intelligent traffic management and control in the central area of Thessaloniki, the system aims to improve the flow of vehicle traffic and the safety. The Intelligent system is divided into two separate service Centers that act complementary and parallel: the Center for Urban Mobility and the Traffic Control Center. The Center for Urban mobility aims to promote, enhance and facilitate the access to transport services for the end users. In particular, the Center informs citizen about alternative routes when planning their journey, providing them with the optimal solution using real time data and suggesting them the most environmentally friendly route. Targeted solutions is one of the most innovative factors. Indeed, the travellers can define several criteria while consulting the service. They can choose the transport mode of them preference (car, public transport, combined transport, walking or cycling), the maximum desired walking distance (100, 200 or 300 meters) and different types of routes (the fastest route, the shortest route in length, the most environmentally friendly route or the most cost efficient route in terms of fuel consumption). The total travel time is calculated based on real-time traffic data of the road network, while the information are provided through information points, mobile phones and through the centre's website. Furthermore the Centres provides travel information services such as real time traffic conditions of the road network, daily air quality conditions of the city, public transport information related to bus routes, timetables and bus stop areas. The Traffic Control Center aims to manage the traffic demand using real-time traffic data. Indeed, real-time traffic data are collected from cameras and speed sensors and elaborated in order to develop dynamic management of traffic lights, to estimate the traffic condition for future periods within a day, to manage traffic around road incidents.

One of the most innovative element of the TUMMS is the direct involvement of citizens in planning their trips, giving them the right and the opportunity to actively contribute to the improvement of the

environmental quality of the city. In doing this, the Center also provides special urban mobility training programs that aim to form a new culture for urban mobility in the city.
The TUMMS is recognized to be an essential and active intervention on environmentally friendly management of urban transport demand and is delivering excellent performances.  The use of public transport means for trips to and from the centre of Thessaloniki is increased from 25% to 45% over the past two years, while the atmospheric air pollutants are decreased by 20% in in the city centre (Mitsakis and Grau, 2011).

## MALTA SMART ENERGY AND WATER GRID

Malta has no connections with the European electricity grid and its electricity is actually generated entirely by imported fossil fuel—insufficient to support its growing economy and unsustainable environmentally for the long term. In addition, its power and water systems (and markets) are intricately linked: the country depends on electrically powered desalination plants for over half of its water supply. For this reason, about 40% of the cost of water on Malta is directly related to energy production cost. Furthermore, rising sea levels and over-exploitation are threatening Malta's limited freshwater supplies.
In 2008, The Maltese national electricity and water utilities - Enemalta Corp. and Water Services Corp. - have selected IBM for a five-year agreement to design and deliver a nationwide Smart Grid implementation aimed to improve the operational efficiency of both the water and power supply systems, to lower energy and water costs and to reduce greenhouse gas emissions. These benefits will be achieved through a large investment in smart technologies that will work together in order to create a data-driven system for the intelligent management and control of the water and power supply. Indeed, by integrating the two systems, it will be possible to identify both water leaks and electricity losses in the grid, allowing the utilities to more intelligently plan their investments in the network and reduce inefficiency.
The project involves replacing 250,000 analogic electric meters with smarter meters and connect these and the existing meters to advanced information technology applications. An analytic tool will transform sensor data into valuable information. With this vast amounts of information that the system will generates, government officials, the utilities, and citizens will be able to make more informed decisions. These technological solutions will be integrated with new back-office applications for finance, billing and cash processes.
One interesting aspect of the project deals with the consumers' involvement in saving water and energy. The actual consumption and billing data will be available to customers via a web platform and compared with that of people with similar households. In this way the project aim helping customers understand their own consumption patterns and raising them awareness about their energy and water use and behavior.

# PHILADELPHIA SMART WASTE COLLECTION SYSTEM

Waste management is a basic requirement of ecologically sustainable development for city and town in US, which are among the highest waste producers in the world (Hoornweg, Bhada-Tata 2012). The city of Philadelphia has experienced increasing cost of waste collection over the past years as result of thousands of wasting trips to pick up partially full trash beans. In 2009, the City of Philadelphia installed a network of 1,000 solar waste and recycling stations produced by the Big Belly Solar Company aimed to optimize the waste collection system, to reduce carbon footprint and to make public spaces more attractive for citizens, businesses and visitors. The project uses real-time data and analytics to drive operational planning and resource allocation in a more efficient way. Each waste station is composed by one or more modular smart beans that can contain up to five time more trash than a conventional basket of the same volume thanks to an inside-built waste compactor. This allowed an increased on-site capacity and substantial reduction in collection points that result much easier to manage. Each bean is equipped with a sensor and a wireless transmitter for data collection and dump bins remote management. Energy is supplied to the bins through a rechargeable battery and a photovoltaic solar panel. The modular system allows designing right-size capacity waste station according to the location characteristics in a more fiscally responsible way. The smart collection system is based on the monitoring of the fill levels of each waste and recycling container in real time using wireless sensor devices. The sensors continuously send readings on the waste levels to the waste management company server, which analyses when and how the containers should be emptied. The information goes straight to the waste management company's logistics system that can calculate a precise time and route so that the waste management company can optimise the use of its collection vehicles. The system has originated significant savings, along with environmental impact reduction and making the separate collection of waste easier. In particular, the system has helped to achieve savings of about 30% in waste collection costs, derived from reduced collection frequency, including fuel, staff hours, equipment usage and street wear-and-tear reductions. This means a saving of 1 million dollars per year that allowed paying the initial investment in about three years.

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## IMAGE SOURCES

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# 05

## SMART CITIES: RESEARCHES, PROJECTS AND GOOD PRACTICES FOR NETWORKS AND INFRASTRUCTURE

# REVIEW PAGES: NEWS AND EVENTS

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In this number
## SMART NETWORKS AND INFRASTRUCTURE

In recent years the use of smart technologies is rapidly spread in the field of networks and systems infrastructure dedicated to the transport of goods, informations and people. in this case, as for other sectors, also the types of application are numerous and the economic and environmental benefits resulting from their use are many and easily quantifiable. So, given the complexity of large infrastructure composed by a large number of technological elements and not, that they must continually interact between them in an efficiently and effective, having to ensure higher levels of services. So the investments in the field of smart infrastructures by the companies and institutions that deal with research, both on the part of the administrative authorities is increasing. One of the conditions that favors the employment of smart technologies is also the immediate economic and environmental impacts that could be obtained from their use. In fact there are many examples of the application of these technologies that have led to immediate positive. An example is the collaboration between General Electric and the Norfolk Southern rail company, through the application of smart systems for monitoring, control and management of the railway transport, has been able to significantly reduce all the elements that constitute a source of most economic expenditure and pollution. The positive effects generated have allowed the optimization of the use of the means of transport by rail, with the reduction of the times of non-use, improving the safety and comfort of travel, through the use of sensors on the infrastructures and means in such a way to interface. The application of these technical solutions allowed to increase on average of 10-20% of the traveling speed of trains, with an annual reduction of total cost of ownership of about $ 200 million. Another solution is proposed by Cisco, in collaboration with the Austrian highways network has developed a system of sensors and signals along the highway networks to able to provide immediate information to network managers and users the system was developed to operate even in extreme weather conditions. In some cases, it can optimize the use and management of infrastructures even with interventions intangible, one of the many examples is the development of dedicated applications for mobile electronic devices. For example, as the case with the collaboration between IBM and Air Canada, which has led to the development of an application that allows airline passengers to carry out all the procedures for check-in directly from your Smart Phone or Tablet, in this way it is possible to reduce the waiting at the airport. So the possibilities of the application are many and not reguarding only the transportation infrastructures, but also complex systems of water management, water supply, waste, emergency and a full range of services through the use of smart technologies. In the next years this procedure will increase their efficiency and also to allow a greater number of people to access.

Given the great interest that is developing against the use of smart solutions dedicated to major infrastructure. There are numerous events worldwide and continental planned for the coming months. The following are some of the most important fairs and congresses and interesting organized in Europe and the world.

One of the sectors most interested of the use of new smart solutions are the transport infrastructure. In the coming months, one of the first events scheduled, dedicated to this sector and the IT Solutions for Public Passenger transport, will take place in Karlsruhe, Germany from 18 to 20 February. The event is organized from UITP (International Association of Public Transport), the international network of the public transport companies, policy makers, scientific institutes and all those part of the public transport sector. It is a platform for international cooperation on these issues, with more than 3,400 members from 92 countries. This event now in its third edition, is held every two years, to show the industrial advances of smart technological that will contribute in the near future to make public transport more sustainable, efficient, safe. The edition of this year aims to present the latest innovations relating to sales systems and management of tickets, collection and analysis of travel data, models of business management, with particular attention to all those solutions that allow the integration of existing technologies for the creation of new services.

Another important event dedicated to transport infrastructure is the Smart Rail Congress & Expo, which will take place in Amsterdam February 24 to 26, this event contains two different events Signalling and Train Control and Railway Telecoms. The Signalling and Train Control is the main event on this subject in the world, with a participation in the previous editions of more than 400 railway experts, in the main exhibition themes and discussion this year will be:

- improve ROI from ERTMS with innovative financing;
- reduce costs and delays through successful project management;
- increase capacity and efficency with effective traffic management;
- maximise safety through improved testing and certification;
- ensure competitiveness through operational Harmonising rules.

While the second event of the Railway Telecoms, took part in previous editions of over 200 industry experts, the main issues that will be discussed are:

- increase ridership by putting the passenger at the heart of developments;
- future proof systems and roll out next generation technology;
- reduce costs and improve service through system convergence;
- enhance capacity and greater reliability through automation;
- improve operational performance with the next generation of GSM –R.

In relation to the infrastructure for smart transport systems and mobility management, will take place in Amsterdam, from 25 to 28 March, the Intertraffic, one of the largest exhibitions of world on these issues. The event takes place every two years allows during the four day event professionals from all over the world to meet and discuss these issues and industry leaders to present the latest products. Given the importance that covers the use of smart solutions in the field of mobility and that their application has become essential for the functioning of the city during the event will be organized a focus to explore the complexity of urban mobility and the role that advanced technologies are playing in providing innovative solutions to support the development of cities .

The realization of Smart Grid has the objective of ensuring the maximum reliability for networks to prevent and manage critical situations. In fact, in the coming months are also planning a series of events focused on the use of smart solutions related to the general theme of the Smart Grid. In particular, one of the upcoming international events planned is the World Smart Energy Week to be held in Tokyo from 26 to 28 February. The organizers have grouped during this expo 8 different events dedicated to smart energy issues. For this edition, the organizers provide the presence of over 2,100 exhibitors and more than 90,000 visitors. During the World Smart Energy Week will take place the 4th INT'L SMART GRID EXPO, where exhibitors will display the latest technologies and services related to Smart Grid.

Another important conference focused on Smart Grid is the 5th Smart Grid Summit to be held in Malaga in Spain from 29 to 30 April. To this conference participate every year the main European companies that deal with the distribution of energy, the authorities and investors. The Smart Grid projects will also develope worldwide. The discussion sessions of the conference during the days will be organized in different discussions:

- Smart Cities and Regions;
- Customer Management;
- Operational excellence;
- Creating ICT platforms for sustainable growth;
- Microgeneration.

Another event related to the Smart Grid will take place in Istanbul from 8 and 9 May, the event will also participate in the industry's leading companies. This event will be an opportunity to start the discussion on the advantages and disadvantages expected from the development and use of Smart Grid. Some debates will be carried out also on rules that regulate the development and use of the Smart Grid and the administrative and technical barriers associated with them.

An essential role for the development of all these new opportunities offered by technological evolution is covered by the networks of communication that allow the various technological systems to communicate and interact with each other. In fact it can say that what has allowed in recent years to start the development of smart solutions was the invention of the internet, which with its spread has allowed a greater number of people to exchange a growing amount of information in real time. The evolution of the combined use of the communication networks and automation technologies have led to the birth of the concept of the Internet of Things. The goal is to ensure that the electronic world draw a map of the real world, through the assignment of an electronic to identity to the various objects and physical locations. So in the near future the objects that surround us will have to be recognizable and be able to communicate with the each others, so you can react appropriately to stimuli to which they are subjected. The evolution of all this will lead, as stated by Neil Gross in 1999, "In the next century, planet earth will do an electronic skin . It will use the Internet as a scaffold to support and transmit its sensations ."

The revolution that will generate over the next few years the technology of the Internet of Things derives from the possibility to apply this technology in any industry, from the care of their own health care of the garden of the house, to the management of large infrastructure projects , and both the change the current mentality which believes that is only man, the only one able to be able to enter information into computer systems, to make them work properly. Despite the Internet of Things is a very recent, already are numerous and high-level projects undertaken all over the world, and companies such as Cisco are evolving and expanding even more this concept through the Internet of Things by Internet of Everything, with the objective of developing smart grids, that allow be related directly and without barriers the people, the objects, the processes and the data.

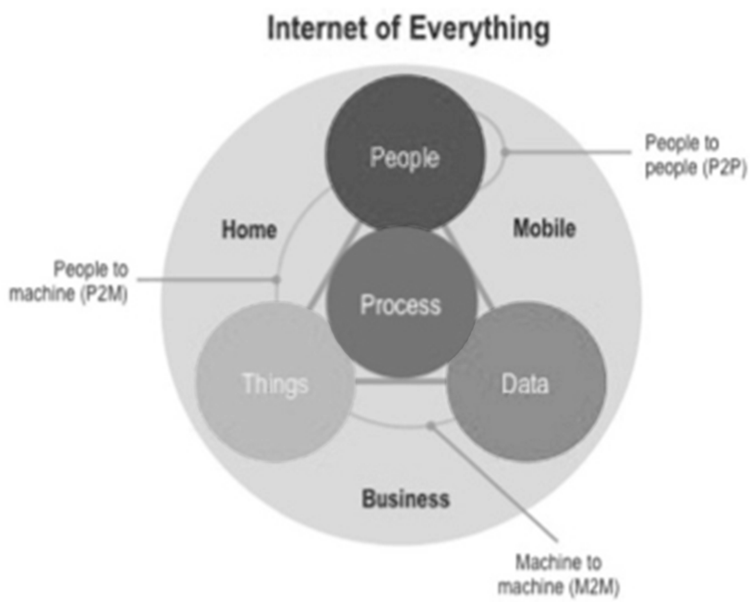


**Fig.1: IoE Brings Together People, Process, Data, and Things To Make Networked Connections More Relevant and Valuable**

One of the major events that will take place in the coming months which will address the issues of the Internet of Things is the IEEE World Forum on Internet of Things, will be held in Seoul in South Korea from 6 to 8 March. This event is organized by the IEEE (Institute of Eletronics and Eletronical Engeneers), this organization present throughout the world and founded in 1884, is divided into regional and thematic sections. The IEEE is the largest professional company in the world, which deals with promote technological innovation and excellence in the electronics industry and energy sectors. The IEEE World Forum on Internet of Things is organized to show the state of scientific research in the Internet of Things and will be divided into several sessions, tutorials and exhibits. It is addressed to all researchers and practitioners from the academia, the industry and the public sector, which are keen to be able to present their research work and innovation, so as to share with all participants of conference their experiences developed in this sector.

IT SOLUTIONS FOR PUBLIC TRASPORT
Where: Karlsruhe - Germany
When: 18 - 20 February 2014

SMART RAIL CONGRESS & EXPO
Where: Amsterdam - Holland
When: 24 – 26 February 2014

WORLD SMART ENERGY WEEK
Where: Tokyo - Japan
WHEN: 26 - 28 February 2014

2014 IEEE WORLD FORUM ON INTERNET OF THINGS
Where: Seoul – South Korea
When: 6 - 8 March 2014

INTERTRAFFIC
Where: Amsterdam – Holland
When: 25 - 28 March 2014

SMART GRIDS SUMMIT 2014
Where: NH Malaga - Spain
When: 29 - 30 April 2014

INTERNATIONAL SMART GRID CONGRESS AND EXHIBITION
Where: Istanbul - Turkey
When: 8 - 9 May 2014

## WEB SITES

http://globaltransportforum.com/smart-rail-europe/

http://www.ieee.org

http://sites.ieee.org/wf-iot/

http://www.intertraffic.com

http://www.it-trans.org

http://www.icsgistanbul.com/

http://thesmartgridssummit.com/

http://wsew.jp/en/

## IMAGE SOURCE

The image of figure 1 is from: http://www.cisco.com/web/about/ac79/innov/IoE.html

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