

# TeMA

Journal of  
Land Use, Mobility and Environment

The special issue collects the proceedings of the Session "Smart and Resilient Cities: Ideas and Practices from the South of Europe" of the European Conference On Climate Adaptation (ECCA), held in Copenhagen in May 2015. The contributions shed light on the relationships between the emerging paradigms of Smart City and Resilient City, providing hints for developing integrated strategies in the face of climate change.

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## SMART AND RESILIENT CITIES IDEAS AND PRACTICES FROM THE SOUTH OF EUROPE

SPECIAL ISSUE ECCA 2015



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University of Naples Federico II

# SMART AND RESILIENT CITIES

IDEAS AND PRACTICES FROM THE SOUTH OF EUROPE

Special Issue ECCA (2015)



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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.

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.





The *Project Smart Energy Master (SEM) for energy management of territory* has been co-financed by the National Operational Programme for 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 October 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 TeMALab 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 nell'ottobre 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 TeMaLab 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 e rappresenta un elemento aggiuntivo ai *deliverables* del progetto.

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Land Use, Mobility and Environment

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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 journal in the Area 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 is published under a Creative Commons Attribution 3.0 License and is blind peer reviewed at least by two referees selected among high-profile scientists. 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.

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Special Issue ECCA (2015)

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Land Use, Mobility and Environment



European Climate Change Adaptation  
Conference (ECCA) 2015

*Copenhagen, 12-14 May 2015*

## EDITORIAL PREFACE:

### SMART AND RESILIENT CITIES. IDEAS AND PRACTICES FROM THE SOUTH OF EUROPE

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Climate change is nowadays largely recognized as one of the main challenges of the XXI century and its impacts are already severely threatening people, cities, natural and rural ecosystems all over the world. As clearly remarked also in the influential Encyclical “Laudato Sii” by Pope Francis, climate change is a global problem with serious environmental, social, economic and political implications.

For a long time European climate policy has been focusing on mitigation and it was only in the last decade that the growing frequency and consequences of climate-related events pushed the EU to devote larger attention to adaptation, by involving national and local governments in the development of National Adaptation Strategies and more recently of Adaptation Plans at city level. The EU Adaptation strategy was issued in the April 2013 and in October 2014 the Commission launched the Covenant of Mayors Initiative on Climate Change Adaptation, to engage cities in taking action to adapt to climate change. So far, only 134 European cities have joined the initiative and most of them are still at an early stage in the development and implementation of an Adaptation Plan.

The growing relevance of climate issues led to the organization of the first European Climate Change Adaptation Conference (Hamburg, 2013), with the aim to bring together scholars, policy makers and practitioners for developing methods and tools capable to integrate climate into Action. After two years, in May 2015, the Aarhus University and the City of Copenhagen hosted the Second European Conference on Climate Adaptation (ECCA) promoted, among the others, by the European Commission, the European Environment Agency and some European adaptation research projects (BASE, RAMSES and TopDad). The Conference covered a broad range of issues related to climate change adaptation, placing large emphasis on the need for the integration of climate adaptation in science, policy, practice and business.

Due to the congruence with the topics addressed in the last two years by the Tema Journal of Land Use, Mobility and Environment, the Editor in-Chief and Editorial Advisory Board agreed to publish a Special Issue of the Journal collecting the proceedings of one of the Sessions organised in the framework of the second

European Conference on Climate Adaptation (ECCA 2015), focused on “Smart and Resilient Cities. Ideas and practices in the South of Europe”.

The session was addressed to highlight whether and how the emerging paradigms of Smart City and Resilient City may contribute to a better framing of climate strategies at city level and to explore research outcomes, best practices and existing barriers to the development of integrated climate strategies in Southern European Cities.

In respect to the first point, it has to be outlined that so far in Europe numerous Smart City initiatives have been funded in order to reduce GHG emissions and energy consumptions, whereas the Resilient City initiatives have been mainly focused, among others, on adaptation strategies addressed to reduce urban vulnerability to the heterogeneous impacts of climate-related phenomena. Thus, although public safety is one of the main areas of interest of Smart City initiatives and the potential of ICTs for enhancing the cities’ ability to prepare for and adapt to changing climatic conditions is widely recognized, the scientific debate as well as policy developments related to these paradigms are still far apart and very few experiences have been addressed to develop integrated approaches and practices to enhance smartness and resilience in urban areas and, in so doing, to integrate mitigation and adaptation strategies.

The prevailing sectoral approach to mitigation and adaptation issues is clearly conflicting with the more and more shared idea that it is “(...) no longer a question of whether to mitigate climate change or to adapt to it. Both adaptation and mitigation are now essential in reducing the expected impacts of climate change on humans and their environment” (IPCC, 2007). Moreover, in the last decade numerous scholars have stressed the potential for developing synergies between climate change mitigation and adaptation (Klein et al., 2005) and the need to analyze climate change in the wider framework of the Disaster Risk Reduction, placing the latter as “a subset of wider development and sustainability processes” (Kelman et al., 2015). The still on-going debate has paved the way to the growing awareness that several research projects and on-field experiences, by looking at climate mitigation, climate adaptation, disaster risk reduction and sustainability as separate issues, will multiply the efforts, disperse energy and lead to the proliferation of planning tools (Sustainable Energy Action Plans, Adaptation Plans, etc.), scarcely coordinated among each other and hardly embedded into current urban planning processes.

The focus on the South of Europe arises from the awareness that the Mediterranean area is subject to major impacts of climate change that will likely worsen in the next future. Nevertheless, despite the urgent need to promote adaptation strategies capable to enhance cities’ capacities to cope with climate-related events, so far very few Southern European cities have started an adaptation process. Moreover, even though numerous researches and initiatives addressed to increase urban “smartness” have been undertaken in Europe, only 8 Southern European cities out of the 70 European Smart Cities are placed in the smart cities’ ranking, with a very low position.

Hence, the session on the one hand has shed light on the relationships between the paradigms of Smart City and Resilient City as a tool for overcoming current sectoral approaches in favor of integrated strategies, capable to counterbalance the emerging environmental challenges (from climate change impacts to the scarcity of energy resources); on the other hand, it has explored the main obstacles to promote and implement effective climate initiatives in Southern European cities.

Based on the contributions of scholars coming from different disciplinary backgrounds and different areas of Southern Europe, the session has provided at least two significant outcomes: methodological and operational tools for embracing a systemic perspective capable to grasp the complexity of urban areas and to face climate challenge on the city level pursuing a better integration among mitigation and adaptation strategies; a state of the art on mitigation and adaptation practices in Southern European cities, mirroring the significant delay that characterizes the South of Europe.

In detail, the first papers provide a state-of-the-art of mitigation and adaptation policies in some Mediterranean countries: Turkey, Spain and Italy.

The paper “Lessons for a Resilient Future: Roadblocks to Climate Change Adaptation in Turkish Cities”, presents the current level of climate change adaptation efforts in Turkey – which is among the Southern countries that will be seriously affected by the impacts of climate change – highlighting the major barriers that hinder the widespread implementation of adaptation strategies and policies in Turkish cities. It clearly remarks that, despite the importance of adaptation for Turkey, the progress towards adoption of climate change adaptation goals and strategies is very limited both on the national and on the local level. Moreover, it emphasizes that most local governments are taking voluntary actions for mitigating climate change, since a more systematic approach, focused on both mitigation and adaptation goals, has still to be mainstreamed into local governance in Turkey.

The second paper, “Understanding how and why cities engage with climate policy: An analysis of local climate action in Spain and Italy”, investigates the state-of-the-art of urban climate plans in two countries, Spain and Italy, which share numerous similarities, such as cultural and geographical features, climate vulnerabilities, the institutional framework and so on. The research analyses 26 Spanish and 32 Italian cities, focusing on the actions addressed to reduce their contribution to climate change and to increase their resilience to changing weather patterns. The results of the analysis show a trend towards an increasing awareness on climate mitigation (highly focused on energy efficiency and the promotion of cleaner energy sources), while adaptation remains an incipient local policy area in both countries.

Then, the paper “Policies of resilience in the new kind of institutional process by local administrations. The case of Siracusa” analyzes projects and actions undertaken in Sicily over the past few years, with a focus on the Municipality of Syracuse in comparison with that one of Palermo. The paper highlights that, despite the wide range of on-going initiatives, a circular, active, flexible and versatile approach to local development – which is crucial to enhance urban smartness and urban resilience – is still missing.

The second group of contributions is mainly addressing conceptual and methodological tools for empowering cities in the face of climate issues.

The fourth and the fifth papers – both of them developed within the Project “Smart Energy Master for the energetic governance of territory” - focus indeed on the relationships between the smart and the resilient city paradigms and on their potential to enhance cities capacities to cope with climate issues. Namely, the paper “Smartness and Urban Resilience. A Model of Energy Saving” provides a significant contribution to the current debate about energy consumption in urban areas. The Urban Saving Energy Model, based on a systemic approach, allows identifying the physical and environmental elements that mostly influence energy consumption in urban areas and provides policy-makers with an effective tool to fit the relationship between the urban built environment and energy in a more efficient way.

The paper “European Cities Dealing with Climate Issues: Ideas and Tools for a Better Framing of Current Practices”, provides an overview of the state-of-the-art of the mitigation and adaptation initiatives in Italian metropolitan cities. Then, focusing on the concepts of the “smart” and the “resilient” city – as key concepts for reducing CO2 emissions and improving the ability of cities to adapt to climate impacts – and with reference to a conceptual framework for building up a smart and resilient urban system carried out in previous research works (Papa et al., 2015), it analyzes the case studies of Rotterdam and Barcelona, highlighting how this framework may improve our understanding and contribute to better framing the fragmented on-going strategies and initiatives.

Then, the paper titled “Ecotone. The potential of Periurban areas for the resilience of metropolitan region” presents the outcomes of different researches and consulting activities developed by the author in the time-span 2011-2015. In detail, the paper discusses the “Ecotone” metaphor as a conceptual tool for moving

towards a new approach to the development of peri-urban areas, capable to significantly contribute to enhance urban resilience.

The next paper, “Public Private Partnerships for Resilient Communities”, focuses on the role of local institutions in mitigation and adaptation to climate change, considering learning experiences in promoting public-private partnerships into resilient actions. In detail the article, based on some best practices, highlights the close relationship between Public Private Partnerships and participatory processes and how such a relationship may lead to win-win climate responses.

Finally, the article “Exploring issues limiting the use of knowledge in Disaster Risk Reduction” focuses on knowledge, which is crucial for enhancing urban resilience in the context of Disaster Risk Reduction. In detail, it highlights issues that appear to have hampered the development and use of knowledge and discusses what these imply for applying (or not) the concept of smart cities in different contexts.

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## ADAPTATION TO CLIMATE CHANGE: BARRIERS IN THE TURKISH LOCAL CONTEXT

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### ABSTRACT

Climate change is one of the greatest environmental challenges that we face today. A certain level of climate change is now unavoidable. Along with mitigation efforts to curb further global warming, we have to take actions to adapt to the changing climatic conditions. Cities are on the front lines of climate change impacts. Therefore, the role of cities in climate change adaptation has been widely acknowledged in the last two decades. There are various obstacles that prevent city governments to develop adaptation policies. While some of these obstacles are universal, some of them are context-specific.

Based on the review of key policy documents and interviews with public officials, this paper focuses on analyzing the main barriers that prevent Turkish cities to develop and implement effective adaptation policies. The research results indicate that cities in Turkey face very similar barriers with their international counterparts in adaptation policymaking. Among the main barriers in the Turkish local context are lack of institutional and technical capacity as well as awareness and coordination problems among actors of climate policy. Due to such barriers, "municipal voluntarism", which mostly leads to voluntary and spontaneous actions, is the prevailing approach to climate policy development in Turkish cities. A series of reforms should be enacted by the central government to help cities overcome the barriers to climate change adaptation.

### KEYWORDS:

climate change, climate policy, adaptation, cities, barriers, Turkey

## 1 INTRODUCTION

Climate change is one of the greatest environmental challenges of our time. If necessary measures are not taken, devastating impacts may be felt in cities of both developed and developing nations. IPCC (2014) underlines the importance of keeping the ongoing global warming below the critical threshold of 2°C and emphasizes the need to adapt human life to climate change impacts, some of which are already being observed. Cities are the most appropriate places where key measures to mitigate climate change and address its major impacts could be developed and implemented (Balaban, 2012a). As of 2014, 54% of the world's population is urban and that is expected to reach 66% by 2050 (UN DESA, 2014). At the same time, key economic activities are located in urban areas, making cities the major driving force of national economies. In Asia, for instance, 42% of the population that live in cities produce almost 80% of the region's total output of goods and services (UN HABITAT, 2010). The increasing concentrations of people and economic activities in cities generate a high demand for energy use and thus lead to increasing greenhouse gas (GHG) emissions. Cities are known to be responsible for between 67-76% of global energy use and for between 71-76% of energy-related CO<sub>2</sub> emissions (Seto et al., 2014). Furthermore, cities are potentially vulnerable to climate change impacts because they are located on coastal and riverine areas that are highly exposed to environmental challenges. On the other hand, despite being parts of the climate problem, cities can also be an essential part of the climate solution (Balaban, 2012a). Municipalities can control and manage various processes, which may affect GHG emissions and climate vulnerability as part of urban planning and management processes (Bulkeley, 2013).

Since the early-1990s, cities have increasingly been involved in climate change policy development by placing climate change issues on their agendas (Bulkeley et al., 2012). Many municipal authorities have recognized low-carbon urbanism as one of the major targets of their local development plans and policies. The establishment of municipal networks like ICLEI, C40, and the Covenant of Mayors has contributed positively to this process. Such networks have provided the world's cities with opportunities to learn from each other's experiences and share the most relevant and innovative solutions (Bouteligier, 2013).

Two major periods stand out when involvement of cities in climate policymaking is taken into consideration. These periods differ from each other in terms of the governance practices and policy responses applied. The 1990s constituted the first era, which is classified as "municipal voluntarism", whereas by the early 2000s, municipalities in collaboration with other urban actors started to engage in a more structural approach, which is defined as "strategic urbanism" (Bulkeley and Betsill, 2013). The main feature of the first era is that most, if not all, of the urban responses to climate change were taken by municipal authorities voluntarily, based mostly on the efforts of "policy entrepreneurs" (Bulkeley, 2010; Bulkeley & Betsill, 2013). In the second era, municipal authorities started to integrate climate change with wider urban agendas and to develop more structural responses (Bulkeley & Betsill, 2013). With the change from the first to the second wave of municipal activism for climate change, both the geography of urban responses and the actors in urban climate policymaking have changed. While the first era comprised only the initiatives taken by cities in the global north, the second era was characterized by the active involvement of cities from the global south in climate policymaking. In addition, social actors such as private companies, NGO's, etc. started to take part in developing urban responses to climate change in collaboration with municipal governments (Bulkeley & Betsill, 2013).

Nevertheless, the potential of cities to address the climate problem by integrating climate change concerns into urban management is not very easy to realize due to various obstacles (Bai, 2007). Current achievements in urban responses to climate change are limited and not evenly distributed. Betsill and Bulkeley (2007) define this situation as "the stubborn gap between the rhetoric and reality of local climate policy", arguing that the realities of governing climate change on the ground is way behind the policy

discourse of the relevance of urban responses for climate protection. While cities in some contexts have developed relevant and innovative climate policies, progress in cities in some other contexts remains in the initial transition phase. The gap between the rhetoric and the reality of local action for climate protection could even be observed among cities in the same country. A recent research on Dutch cities has shown that even in Netherlands, where urban responses to climate change are growing, there are differences in local climate policy development among the largest 25 municipalities in the country (den Exter, 2015). Turkey is one of the countries where local climate policy development is in its infancy. This paper aims to present the current level of climate policymaking in Turkey and discuss the major obstacles that hinder wider involvement of Turkish cities in climate policy with a particular focus on climate change adaptation.

There is a rich literature arguing the obstacles that impede cities from addressing the climate problem (Bai, 2007; Betsill & Bulkeley, 2007; Moser & Ekstrom, 2010; Galderisi, 2014; Barnett et al., 2015). Bai (2007) distinguishes between scale-related obstacles that tend to be universal and readiness-related obstacles that are specific to cities of the developing world. On the other hand, Betsill and Bulkeley (2007) mention other studies that suggest that local authorities in developed and developing countries face more or less the same obstacles to dealing with climate change. Although mitigation and adaptation have commonalities, they constitute different pathways in climate policy. Despite that, some studies suggest that there are not many differences between the obstacles faced by mitigation and adaptation efforts (Granberg & Elander, 2007; Storbjörk, 2007). At the same time, Barnett et al. (2015) point to “limits” along with “barriers” to climate change adaptation, and draw attention to identify processes, not just factors, that constrain adaptation.

Some of the barriers are institutional, originating from lack of competencies and capacity of the institutions that are in charge of developing adaptation policies. This is quite a common barrier particularly when local governments are considered. Bulkeley and Betsill (2003) found out that local government competencies and capacity were one of the key factors that limit climate policy development at local level in Australia, the UK and the US. According to Holgate (2007), the major barrier faced by city officials in Johannesburg (South Africa) was lack of capacity, as climate change was one of the many responsibilities of the related city official. Besides, there are organizational problems that originate from “a departmental approach” and result in lack of collaboration and coordination among different divisions of a municipality (Balaban and Puppim de Oliveira, 2014). Along with the institutional barriers, there are also significant economic barriers, mainly in terms of inadequate financial resources. In Mexico City, for instance, the institutional capacity problems were coupled with lack of financial resources and funding, and thereby constituted a major barrier to climate protection (Romero-Lankao, 2007). Bai (2007) argues that most cities in developing countries are not ready to deal with global environmental issues, as their financial capacities may not even suffice to address basic local issues, such as sanitation, waste collection, etc.

Previous research have shown that several technical factors might act as barriers to climate policy development. Technical knowledge is critical to develop successful climate protection policies (Betsill & Bulkeley, 2007; Moser & Ekstrom, 2010). Updated and accurate knowledge and information on the extent of the climate problem at local level, including emissions inventories, climatic risks and vulnerabilities, provide a sound basis for policymaking. Otherwise, as in the case of Sweden, uncertainty connected to climatic risks is weighted against short-term economic benefits of attractive waterfront development (Granberg & Elander, 2007). However, many local governments in both developed and developing countries lack the necessary technical knowledge and expertise as well as technological instruments for climate policymaking (Romero-Lankao, 2007; Bai, 2007; Granberg & Elander, 2007). Last but not the least, there are political barriers to develop and implement local climate change policies. Bai (2007) states that the long-term nature of the climate problem forms a contrast with other local issues, and thus lead local politicians to embrace the “not in my term” contention. Especially in developing countries, urgency of other urban problems usually

decreases the priority given to climate change by municipal authorities (Romero-Lankao, 2007). Low awareness of policymakers of climate change is another factor that adds to the problem of lack of political will. In many cities, policymakers tend to think that climate change is a global problem that requires national and global actions rather than local efforts (Bai, 2007).

The literature on barriers to climate policy shows the importance of case studies to find out context-specific barriers. Research on climate policy development in Turkey is quite limited. Particularly, a systematic overview on urban responses to climate change and on factors that impede development of such responses is missing. This paper aims to address this gap by analyzing the main factors that act as barriers to climate change adaptation in Turkish cities.

The paper is mainly based on the interviews made with officials of Ministry of Environment and Urbanization, Ministry of Foreign Affairs, Bursa and Gaziantep Metropolitan Municipalities. Six interviews were conducted with 11 experts in these agencies in 2014 and 2015. The Ministry of Environment and Urbanization is in charge of coordinating the development of national and local policies to address global warming and climate change. The Ministry of Foreign Affairs also has responsibility for protection of natural environment. The Ministry, in collaboration with other agencies, works to develop Turkey's national environment policy in line with international developments and treaties. Bursa and Gaziantep Metropolitan Municipalities can be considered forerunners in local climate policy in Turkey. Gaziantep is the first municipality in Turkey that developed a climate change action plan. Likewise, Bursa Metropolitan Municipality was volunteered to take part in an international project that aimed to build local capacity for climate change adaptation planning in Turkish cities. In addition to the interviews, secondary data and information were also gathered through analysis of various policy documents and expert reports as well as statistical yearbooks, bulletins and webpages of some public agencies. All the documents analyzed are publicly available and authentic.

The next section presents the key facts about Turkey's position on the climate change debate. In the third section, the existing situation in Turkish cities with regard to development of policy responses to address climate change is discussed. Based on the interviews conducted, and the review of the policy documents, main barriers that hinder widespread implementation of climate change adaptation policies and strategies in Turkish cities are argued in the fourth section. Finally, in the conclusion, some policy implications are suggested in order to overcome the barriers discussed in the paper.

## 2 THE CONTEXT OF TURKEY

### 2.1 TURKEY IN THE CONTEXT OF AN INTERNATIONAL CLIMATE REGIME

Turkey became an official party to the United Nations Frame Convention on Climate Change (UNFCCC) on 24 May 2004, and to the Kyoto Protocol on 26 August 2009. Compared to other OECD countries, it has taken quite a long time for Turkey to become a party to both agreements. This was due to the controversial position of Turkey in the Annexes of the UNFCCC. Turkey was included in both Annex I and Annex II as an OECD country. However, as opposed to other nations included in both Annexes, Turkey's contribution to global GHG emissions was lower and also the country was (and is still) facing major socio-economic development challenges. After years of negotiations, Turkey was removed from Annex II of the UNFCCC, and parties were invited to recognize the special conditions which place Turkey in a different position from other Annex I countries at the COP7 meeting in 2001 (MoEU, 2010a). Thereafter, the Turkish government ratified the convention and the protocol.

Turkey does not have emission reduction targets under the Kyoto Protocol. However, national communication documents have been prepared and submitted by the national government since becoming a

party to the convention. The last communication submitted was Turkey's Fifth National Communication (FNC), which was commissioned in the light of the situation in 2011 (MoEU, 2013).

## 2.2 THE NATIONAL POLICY CONTEXT

Although Turkey has become an official party to the international climate regime somewhat later than many other nations, the national government has been taking legal and institutional steps to deal with the climate problem since 2000. Among the first of such steps is the establishment of a Coordination Board on Climate Change in 2001 with the aim of coordinating the public sector's activities on climate change mitigation and adaptation. The board was then restructured in 2004, 2010 and 2012 after Turkey became a party to the UNFCCC and the Kyoto Protocol (MoEU, 2010a). The restructuring process mainly widened the scope of the board by renewing its participant structure and including new representatives from various public and private sector institutions.

The United Nations Joint Program on Enhancing the Capacity of Turkey to Adapt to Climate Change was launched in 2008 to form strategies and strengthen the institutional capacity of Turkey to adapt to climate change (MoEU, 2013). The Joint Program aims to integrate national, regional and local policies within the scope of Turkey's development objectives in a sustainable way.<sup>1</sup> The Program has led to several activities to improve capacities within national and local institutions to predict and manage climatic risks. Following the launch of the Joint Program, in 2009, an important institutional step was taken. A new division was established under the Ministry of Environment and Urbanization, namely the Department of Climate Change, to deal with mitigation and adaptation policies at the national level.

The main central policy document for climate change in Turkey is the National Climate Change Strategy Document (NCCSD), which was prepared with participation of various actors in public and private sectors in 2009-10. The Strategy Document, which covers the period from 2010 to 2020, acts as a guide for mitigating and adapting to climate change, and includes emission reduction strategies, adaptation, financing and technology policies within the limits of national possibilities (MoEU, 2013). The strategy document proposed the preparation of a national action for climate change (MoEU, 2010a). Based on this recommendation, The National Climate Change Action Plan (NCCAP) was prepared with a wide range of stakeholders under the coordination of the Ministry of Environment and Urbanization and published in July 2011.

Another important policy document at national level is the National Climate Change Adaptation Strategy and Action Plan, which was approved by the Ministry of Environment and Urbanization in 2012 for the period of 2011-2023. The Adaptation Strategy and Action Plan was developed under the UN Joint Program on Enhancing the Capacity of Turkey to Adapt to Climate Change. Based on the technical and scientific studies and preparations, the adaptation strategy focuses on the following five fields as the most crucial policy fields for climate change adaptation in Turkey (MoEU, 2014):

- Water Resources Management;
- Agricultural Sector and Food Security;
- Ecosystem Services, Biodiversity and Forestry;
- Natural Disaster Risk Management;
- Public Health.

All in all, in terms of legal and institutional reforms, Turkey is not far behind its international counterparts. As in many other nations, which are actively responding to the climate problem, key plans and policy documents have already been prepared and introduced by the national governments. Whether or not these documents have led to positive outcomes in practice is still not clear.

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<sup>1</sup> Please see the project website: <http://www.mdgfund.org/program/enhancingcapacityturkeyadaptclimatechange>



### 2.3 TURKEY'S CONTRIBUTION TO CLIMATE CHANGE

Turkey is an emerging economy and its energy demand is increasing with its overall economic growth. However, the level of energy consumption in Turkey is less than that of OECD countries and the world average. According to International Energy Agency (IEA) data (MoEU, 2013), Turkey's primary energy consumption was 1.39 TEP/person in 2008, which is below the world average (1.83 TEP/person) and the OECD average (4.56 TEP/person).

Likewise, Turkey's per capita GHG emissions are among the lowest in the OECD and UNFCCC Annex I countries, indicating a lower historical responsibility for global warming than the advanced nations. For instance, in 2012, the OECD average of GHGs per capita was 12.47 tonnes, whereas Turkey's per capita GHGs was 5.85 tonnes, the lowest among all OECD countries (OECDStat, 2015).<sup>2</sup> Despite the lower historical responsibility, there was a stable increase in Turkey's GHG emissions between 1990 and 2012, except for 1994, 1999, 2001 and 2008 when reductions were observed mainly due to economic crises (MoEU, 2013). Turkey's total GHG emissions in 1990 were 188 million tonnes of CO<sub>2</sub> eq (LULUCF excluded). This increased to 298 million tonnes of CO<sub>2</sub> eq in 2000, 403 million tonnes of CO<sub>2</sub> eq in 2010 and finally 439 million tonnes of CO<sub>2</sub> eq in 2012 (Table 1).

Turkey's per capita emissions have also been increasing since 1990. While per capita GHG emissions amounted to 3.42 tonnes of CO<sub>2</sub> eq. in 1990, it increased to 4.4 tonnes of CO<sub>2</sub> eq in 2000 and 5.9 tonnes of CO<sub>2</sub> eq in 2012 (MoEU, 2013). However, Turkey's per capita emissions are still below the OECD average.

The energy sector is the major emitter of GHGs in Turkey. From 1990 to 2012, GHGs from the energy sector more than doubled, increasing from 132.8 million to 308.6 million tonnes of CO<sub>2</sub> eq (Table 1). Most of the energy sector emissions are due to fossil fuel combustion.

SECTORS	1990	1995	2000	2005	2009	2010	2011	2012
Energy	132.88	161.50	213.23	242.41	279.01	285.14	301.34	308.60
Industry	15.44	24.21	24.37	28.78	33.16	55.67	58.61	62.77
Agriculture	30.39	29.23	27.85	26.28	26.10	27.13	28.83	32.28
Waste	9.72	23.88	32.64	33.27	32.88	35.56	35.31	36.22
Compared to 1990 levels	100	126.74	158.19	175.52	196.96	214.13	225.06	233.44
Total	188.43	238.82	298.09	330.74	371.15	403.49	424.09	439.87

Table 1 Aggregated GHG Emissions by Sectors, million tonnes of CO<sub>2</sub> eq. excl. LULUCF (TurkStat, 2013)

### 2.4 LIKELY IMPACTS OF CLIMATE CHANGE IN TURKEY

There are no precise and updated scientific data and information on the potential impacts of climate change at local level in Turkey. In most policy documents, broad estimations are based on regional and global scenarios and expectations. Turkey's First National Communication on Climate Change, prepared in 2007, mentions that the likely impacts of climate change in Turkey may include increasing summer temperatures, loss of surface water, droughts, coastal erosion and floods (MoEF, 2007).

However, Turkey is geographically a broad country and includes diverse environmental and climatic varieties. Therefore, conduct of studies at the local level in order to determine the potential impacts of climate change in major regions is a must. Such studies will certainly make effective contributions to the preparation processes of better and more accurate adaptation strategies. In this respect, a Participatory Vulnerability

<sup>2</sup> The data were extracted from OECD.Stat on 15 June 2015.  
Available at: [https://stats.oecd.org/Index.aspx?DataSetCode=AIR\\_GHG](https://stats.oecd.org/Index.aspx?DataSetCode=AIR_GHG)

Analysis (PVA)<sup>3</sup> has been carried out in several provinces located in different geographic regions in order to find impacts of climate change and vulnerability in Turkey (MoEU, 2010b). The analysis has been conducted under the UN Joint Programme on Enhancing the Capacity of Turkey to Adapt to Climate Change under the coordination of the Ministry of Environment and Urbanization. The stakeholder responses indicated the most common impacts in Turkey as follows (MoEU, 2010b):

- Temperature increases causing warmer winters with less snow;
- Heat waves and greater drought frequency;
- Increasing irregularity in rainfall patterns;
- Reduction in surface and fresh water resources due to previous impacts;
- Greater frequency of floods due to sudden and heavy rainfall;
- Gradual shifting of the seasons.

The same climate events create different challenges for urban areas and populations compared with rural populations. In Turkey, urban areas are expected to be seriously affected by climate change impacts. First of all, Turkey is a flood-prone country, where both riverine and flash floods are often observed in many cities (Senol-Balaban, 2009). Climate change is expected to increase flood risks in Turkish cities (Balaban, 2010). We have already been observing unexpected flood events and losses mainly due to sudden and heavy rains that overload the infrastructure systems of cities. At the other extreme, heat waves due to temperature increases and drought conditions due to lack of rain over extended periods are expected to hit many cities in Turkey. Moreover, heat waves and drought may result in over-exploitation of water resources and deepen water shortage, which is already a major problem for Turkish cities. Turkey is a peninsular country, where a considerable part of the population is concentrated in coastal areas. Therefore, rising sea levels, coastal flooding and salty water mixing with fresh water resources are also serious challenges for numerous Turkish cities. Finally, many Turkish cities suffer from air pollution that may increase as the temperature rises. Some of these likely impacts are already with us. In recent years, Turkey has faced a number of severe weather events. For instance, a severe heat wave and drought in 2007 across the Marmara region caused an increase in food prices across Turkey. Besides, an erratic flood in Istanbul in 2009 caused many casualties and economic damage. Both national and local governments have undertaken, and still undertake, actions and initiatives to address climate change, although in an insufficient manner. The next section elaborates on such actions and initiatives recently taken by Turkish cities

### 3 URBAN RESPONSES TO CLIMATE CHANGE IN TURKEY

A recent research project that aimed to analyze the involvement of Turkish Metropolitan Municipalities in climate change mitigation and adaptation indicates that most of the municipalities are involved in climate change policy in some way (Gedikli & Balaban, 2014). However, the responses or actions they undertake show great variety. Energy, waste management and urban transport are the most popular sectors, where several municipal authorities have undertaken responses or developed strategies in relation to climate change. Such responses include energy efficiency measures, renewable energy generation utilities, energy generation from residual waste and gas in landfill and wastewater treatment sites, light rail systems and tram projects, bike routes, etc. (Gedikli and Balaban, 2014).

Furthermore, the research also highlighted that in almost all the cities, where urban responses to climate change are being taken, more priority is given to mitigation than adaptation (Gedikli & Balaban, 2014). While current urban responses predominantly aim to mitigate GHG emissions, actions for climate adaptation are

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<sup>3</sup> PVA is a systematic process that involves local communities and other stakeholders in a rapid examination of their vulnerability to climate change, and at the same time facilitates the identification of actions that can reduce local vulnerability to climate change.

barely visible in local policy documents in Turkey. This statement has also been verified by officials of the Ministry of Environment and Urbanization who were interviewed as part of the research presented in this paper. So, municipal authorities in Turkey give more priority to mitigation than adaptation at present. Such a situation is also observed in other international contexts (Betsill & Bulkeley, 2007). Granberg and Elander (2007) argue that Swedish municipalities have given a high-priority to mitigation than adaptation, and adopted climate mitigation goals in line with the guiding principles at the national level. One possible reason for the priority given to mitigation may be that mitigation policies are relatively easier to develop and implement than adaptation ones at initial stages of climate policy development. Policies and strategies for climate change adaptation usually require long-term and structural efforts to transform urban systems. Without mainstreaming climate change into all relevant aspects of urban development, such structural and systemic efforts cannot be made.

On the other hand, one recent initiative for climate change adaptation in Turkey is a joint international project, which was hosted by Bursa Metropolitan Municipality. The project was funded by the UK Foreign & Commonwealth Office (FCO) in Ankara and led by Ricardo-AEA with the support of Bluecern (Ricardo-AEA, 2014)<sup>4</sup>. The Ministry of Environment and Urbanization, as the principle institution in charge of climate policy in Turkey, has coordinated and supported the project. The National Climate Change Adaptation Strategy and Action Plan of Turkey recognizes that cities will be crucial in helping the country adapt to climate change. The action plan also pointed to the need to help municipal governments develop their own adaptation strategies in such a way as to initiate a process to understand the risks and vulnerabilities to climate change and to develop a coordinated response. In this respect, the joint international project aimed to build capacity and provide support to the Bursa Metropolitan Municipality, which volunteered to develop their city-level climate change adaptation strategy and action plan (Ricardo-AEA, 2014). The lessons learned from the pilot case of Bursa were used to develop a Cities Adaptation Support Package (CASP) and a Roadmap able to guide other municipalities through the processes towards city-level climate change adaptation plans and a national urban adaptation programme for cities. Nevertheless, no progress has been made since the completion of the project. Neither the Ministry nor Bursa City has made follow-up events and actions.

#### 4 BARRIERS TO CLIMATE CHANGE ADAPTATION IN TURKISH CITIES

Climate change adaptation is an emerging policy field in Turkey. The legal and institutional reforms, specific policies and funding schemes that are required for climate change adaptation are recently being discussed by national and local governments. Current progress at national level is limited to the development of a national action plan and the establishment of a specific division for adaptation under the Ministry of Environment and Urbanization. Furthermore, through the collaboration of MoEU and Bursa City, a pilot project on capacity development for adaptation policymaking has been conducted and a guideline has been produced to help municipal governments develop their local strategies to address the risks and vulnerabilities to climate change. Other than these, there are no remarkable actions and projects on climate change adaptation at any level of governance in Turkey.

On the other hand, risk mitigation and management is an important policy concern for national and local governments in Turkey. Turkish cities are prone to several natural hazards such as earthquakes, floods and landslides. There is a central agency in Turkey, named Disaster and Emergency Management Presidency

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<sup>4</sup> The Foreign & Commonwealth Office (FCO) aims to promote action on global issues in areas of strategic importance to the UK. As Turkey is one of the FCO's priority countries, the office provides funding to certain projects in Turkey. Ricardo-AEA is a global sustainability consultancy with expertise in energy and climate change. The firm has provided training and support to Bursa – through workshops, study visits, on-going remote coaching, stakeholder engagement and dissemination. Bluecern is an international sustainability consultancy with a strong presence in both Turkey and the UK, working on a range of projects in both countries and with strong relationships with the Turkish Government (Ricardo-AEA, 2014).

(AFAD), which is in charge of risk and disaster management as the sole authority. AFAD works for preventing disasters and minimizing disaster-related damages, for planning and coordinating the post-disaster response as well as for promoting cooperation among various government agencies. Although AFAD is a central agency, it also works at the local level with 81 provincial branches across Turkey in addition to 11 search and rescue units (see AFAD's webpage; <https://www.afad.gov.tr/EN/IcerikDetay.aspx?ID=1>). Significant efforts have been made by AFAD to improve Turkey's disaster management system either by solely or in cooperation with a range of government institutions and non-governmental organizations. Nevertheless, mitigation and management of earthquake and flood risks so far dominated the scope of AFAD's efforts. Climate change is not visible in AFAD's agenda at present. In AFAD's Strategic Plan for the Period of 2013-2017, climate change is mentioned only a couple of times as one of the emerging issues that will have an impact on AFAD's works and administrative strategies (AFAD, 2012). Furthermore, there is no department in the agency, which is directly in charge of climate change adaptation or of mainstreaming climate change in Turkey's disaster management system. Therefore, climate change adaptation and disaster risk management were and are being carried out as separate policy fields in Turkey. On the other hand, several case studies emphasized the need for mainstreaming adaptation strategies into existing policies and programs, especially the disaster risk management and land-use planning processes (Galderisi, 2014). Climate change adaptation measures are usually categorized as "soft-adaptation" and "hard-adaptation" measures (OECD, 2015). "Soft-adaptation" is characterized by "soft" solutions such as empowering local communities, educating target groups and information sharing, capacity building, policy and strategy development and institutional arrangements (Sovacool, 2011; OECD, 2015). On the other hand, "hard-adaptation" measures are more complex and capital-intensive, and based on use of specific technologies to build, improve or enforce artificial human-built infrastructure systems (Sovacool, 2011). Based on the current level of climate change adaptation policy development in Turkey, it could be stated that both national and local governments in Turkey are mostly working for developing "soft adaptation" measures. "Soft" measures, especially community involvement and capacity building schemes, are crucial for an effective climate change adaptation policy. However, "soft-adaptation" measures taken so far in Turkey are limited to development of some non-binding policy and strategy documents as well as guidelines. The interviews conducted with public officials have confirmed the limited and fragmented nature of the current "soft-adaptation" measures in Turkey and also the need for improving them. Although "soft" measures are of central importance for effective adaptation, they should be supplemented by "hard" solutions. There has to be a good balance of "soft" and "hard" measures in an effective climate policy development, depending on the local circumstances and needs. Such a balance between "soft" and "hard" measures is defined as "combined adaptation", which is argued to provide the best results (OECD, 2015). "Hard" measures for climate change adaptation are still not on the agenda of governmental authorities in Turkey. It should be noted that the structural measures and actions taken by AFAD as part of the agency's disaster risk management agenda have no explicit link with climate change adaptation. In other words, climate change adaptation is not a major concern for disaster risk management efforts in Turkey. As in many countries, several barriers could be identified in Turkey that hinder the widespread adoption of climate change adaptation goals and strategies in cities. These barriers are mostly in line with the international experience. In the following section, major barriers in the governance of climate change adaptation in Turkey are discussed.

#### 4.1 INSTITUTIONAL BARRIERS

The low level of involvement of Turkish municipalities in climate change adaptation is not surprising. The dominant approach to climate policymaking in Turkey at present is "municipal voluntarism" (Gedikli and

Balaban, 2014). Municipal voluntarism is an important approach that could enable cities to undertake actions and develop policies to address the climate problem. However, this sort of policy approach mostly leads to voluntary, spontaneous or easy-to-implement actions for climate change mitigation. Betsill and Bulkeley (2007) argue that during when municipal voluntarism dominated climate policymaking worldwide, most, if not all, of the actions taken in cities were mitigation-oriented, including finance mechanisms to reduce energy use, standards to improve energy efficiency, development of renewable energy projects, etc.

Climate change adaptation, on the other hand, requires structural measures and systemic efforts to transform urban systems so as to increase the resilience of cities to climate change impacts. For instance, without building an extensive green space network, cities may not be able to address heat stress and flash flood risks. Despite its merits to initiate and push forward the climate change agenda at local level, municipal voluntarism is not a sufficient policy approach to deal with fundamental aspects of climate change adaptation, such as determination of local climate change risks and impacts, as well as structural requirements for adaptation (i.e. provision of an extensive green space network). Therefore, for better and wider achievements in climate change adaptation in Turkish cities, an integrated approach that mainstreams climate change-related objectives into the key sectors and fields of urban policymaking is required.

At present, there are no binding laws or regulations forcing national and local governments in Turkey to develop specific policies and take particular actions to address impacts of climate change. The current policy frameworks are voluntary schemes and public agencies and local governments are only advised to follow the principles and targets set forth within these frameworks. Voluntary schemes may work well in some contexts, but they are not very appropriate for Turkey. "Name and shame" type policies or voluntary schemes do not perform well in Turkey. Binding legal frameworks at the national level, which are still missing, are required to enable local governments to take action. Furthermore, the role given to the Climate Change Department of the MoEU is only limited to coordination. During the interviews, the officials of the Climate Change Department pointed to the need for an institutional reform that would empower the department and move its role beyond coordination.

In Turkey, there are several institutions, one way or another, linked with climate adaptation policy. MoEU is the main coordinating agency of the climate policy. While AFAD is the sole authority responsible for risk management, State Hydraulic Works also have duties with regard to river basin and flood management. Municipal authorities are in charge of developing and implementing spatial plans at several scales ranging from neighborhood scale to metropolitan scales. On the other hand, there are designated zones in cities, which are not under control of municipal authorities but other central agencies. Mass Housing Administration (TOKI), for instance, carries out real estate and housing projects in many cities with little or no coordination with municipalities. Such a fragmented governance structure usually undermines the development and implementation of environmental policies. To avoid this, an effective coordination of actions and policies of different public agencies is required. Otherwise, as in the case of Turkey, repetition of efforts or contradictory actions may occur in the same locality as a result of institutional chaos.

## 4.2 ECONOMIC BARRIERS

Adaptation is a costly process, and in most cases, adaptation policies do not promise greater economic benefits. If economic benefits do occur, they may come in the long term. Therefore, local governments are usually in need of financial resources to develop and implement their adaptation policies at the outset. Such finance and funding opportunities are yet to be developed in Turkey. Central government provides no direct funds to local governments to be used for particular policy agendas like climate change adaptation.

The insufficiency of the financial resources for local governments is a major problem of local governance in Turkey. Municipalities are highly dependent on central government in terms of their revenues and



expenditures. The main source of income of local governments is the annual grants provided by the central government. Around 5 percent of the total national tax revenues are allocated to local governments based mainly on the population criteria. This usually runs against small and mid-size cities, especially where local needs are disproportionate with population size. For instance, small-size cities like Edirne and Bartın with a population around 150.000 inhabitants are located along rivers that frequently flood. Due to their limited population, financial capacities of these cities remain also limited, and needless to say, such small cities in Turkey cannot take the necessary actions and measures to reduce their vulnerability to climate change.

#### 4.3 TECHNICAL BARRIERS

The importance of technical knowledge and expertise in climate policy development is acknowledged in the literature (see section 1). Maybe the first step to technical capacity development at local level is to raise awareness of the key policy and decision-makers. There is an awareness problem among public officials, especially those at the local level in Turkey. Many city governments lack the institutional capacity to plan for and manage the future spatial development in their jurisdictions (Balaban, 2012a). Small and mid-size cities usually complain of a lack of in house expertise to deal with complicated issues of urban and environmental policy. The current staff, on the other hand, is not well-informed or well-aware of the key issues of the climate problem. Officials of the MoEU, who were interviewed in this research, confirmed the awareness problem among local officials and mentioned that they were planning for further efforts to enhance local institutional capacity and raise awareness of local officials. The local officials, who were interviewed, also confirmed the awareness problem. Furthermore, when it comes to climate change, most officials think that mitigation is the sole dimension of policymaking. Awareness among local policymakers and staff of the links between local environmental problems and climate change is still low.

#### 4.4. POLITICAL BARRIERS

Most progress in climate change mitigation and adaptation in Turkey is observed in small and mid-size cities (Gedikli & Balaban, 2014). Major metropolitan cities like Ankara and Istanbul are known for their reluctance to tackle the climate problem. The major reason for this is that Turkey's dominant economic growth paradigm has made a significant impact on urban development processes in major cities. Since the early 2000s, the major economic policy of the national government in Turkey has been to increase vitality in various sectors by means of domestic consumption. Economic activities that trigger consumption-led growth have been given high priority in the national government's economic programme. These activities include construction and real estate investments. Both sectors received intense support from the state in the recent decade to trigger consumption and economic growth in various sectors of the economy (Balaban, 2012b). Major metropolitan cities in the country have served, and are still serving, as major arenas of a construction-led economic growth paradigm.

This growth paradigm resulted in an irrational growth in building construction and large-scale infrastructure projects in major cities. Planning controls and development restrictions have been eased or removed to foster economic growth (Balaban, 2012b). The interviewees at central and local agencies mentioned that most of the urban development and regeneration projects that were developed in the recent decade are contradictory to climate change policy. Over the last decade, Turkey has seen investments in building and projects that run counter to climate change mitigation and adaptation. For instance, the current large-scale urban projects in Istanbul, including the third airport and the third bridge over the Bosphorus, are in clear contradiction to the climate change agenda, as they have already led to loss of forestland, wetlands and natural habitats in the northern part of the city. Likewise, in Ankara, the residential vacancy rate increased to 30% due to the construction of suburban housing projects, leading to huge patterns of urban sprawl.

The growth in building construction could have been an important opportunity to make cities more climate-resilient. As argued by Balaban and Puppim de Oliveira (2014), local governments can use urban regeneration projects as opportunities to develop climate-friendly quarters within existing built-up areas of cities. To do so, climate change concerns have to be incorporated into legal and policy frameworks that guide building construction and regeneration projects. In Turkey, only a few energy efficiency concerns are recently included in rules and regulation concerning building construction. The Urban Regeneration Act (Law No: 6306), which was enacted in May 2012, refers to disaster risk management but the guidelines set forth in the law to address disaster risks by means of urban regeneration projects are only limited to redevelopment of areas that are deemed “risky” or “unsafe”. Definition of “disaster risk” in the law is reduced to earthquake risk, and climate and weather-related risks are ignored in risk definition. Climate change mitigation and adaptation is not mentioned anywhere in the law. Since its enactment, the academic community and NGOs criticized the Urban Regeneration Act based on the contradictions between the purposes and the practical outcomes of the law. Most critics argue that although the law enables national and local governments to develop regeneration projects over disaster-prone areas, the existing projects based on the law are predominantly profit-oriented real estate projects in attractive parts of cities. In a nutshell, Turkey has experienced a construction boom in the last decade, which provided an opportunity to make cities more climate-friendly, but that opportunity has been wasted mainly because climate change concerns have not been incorporated into urban redevelopment and building construction agenda.

Among the main political barriers in Turkey is the behavior of the general public with regard to environmental issues, climate change in particular. The awareness of the general public in Turkey of climate change is quite low (Balaban, 2012a). Citizens are not well-informed or well-educated about the reasons and outcomes of ongoing global warming and climate change. The officials in central and local agencies, who were interviewed in this research, pointed to the low awareness of the general public concerning climate change as a major problem in climate policymaking. Both the MoEU and municipalities give high priority to awareness-raising and aim to develop campaigns to raise awareness of especially the young age people.

On the other hand, even if people are informed, in most cases, they don't pay much attention to such long-term challenges as climate change. This is mainly because many urban residents are dealing with several urgent and short-term problems like unemployment, poverty, societal polarization, etc. Recently, the Turkish Statistical Institute announced that 22.4% of the households in Turkey live below the poverty line (TurkStat, 2014). Besides, as of March 2015, the official unemployment rate has been declared as 10.6% (TurkStat, 2015). Especially among young people (aged between 15 and 24 years), the unemployment rate goes up to almost 20% (TurkStat, 2015). Therefore, there is no substantial demand or push from society to force the public sector to address climate change.

## 5 CONCLUDING REMARKS

Turkey will be seriously affected by the impacts of climate change. As a highly urbanized country, cities are at most risk from climate change in Turkey. Climate change adaptation has to be a major policy goal for both national and local governments. Despite the importance of adaptation for Turkey, progress towards the adoption of climate change adaptation goals and strategies is very limited. Although key policy documents have been developed and enacted by the national government, practical outcomes at the local level are yet to come. Local governments face various barriers, which prevent them to develop a systemic approach to climate change adaptation by mainstreaming adaptation into key sectors of urban development.

Most of the barriers observed in the Turkish case are in line with the international experience. Turkish local governments suffer from insufficient human, technical and financial resources to develop systemic and structural responses to climate change impacts. Furthermore, there are no binding regulations and

guidelines that force municipalities to mainstream climate change concerns into existing policy frameworks on risk management and urban planning. Lack of awareness is another main barrier in the Turkish local context. Awareness problem has two dimensions; one is the awareness problem among public officials and the other among the general public. People give more priority to economic and social problems they face, such as unemployment, poverty and social polarization, than climate change vulnerability. Last but not the least, the recent construction boom in Turkey, which resulted in massive urban (re)development and renewal projects in many cities, has turned into a wasted opportunity, as climate change concerns had almost no impact on these projects. When the growing attention on low-carbon city and green building concepts at the international level is considered, the last point could be regarded as a barrier specific to the Turkish case.

A series of reforms by the central government are required in order to overcome the barriers to climate change adaptation in the Turkish local context. First of all, a strong political will should be in place at the national level. Policy and decision-makers should give a high priority to climate change adaptation in their agenda. Following the generation of a strong political will and commitment, binding regulations should be enacted with the aim of strengthening the links between climate policy and other policy fields like disaster risk management, urban planning, housing construction, etc. For instance, climate change adaptation goals and strategies should be incorporated into Urban Development Act and its associated ordinances.

City governments usually follow each other and tend to copy or transfer interesting projects in their jurisdictions. This tendency could be used as an opportunity to widespread climate change adaptation initiatives among cities. For instance, the Japanese government has introduced a national programme named "Environmental Model Cities" so as to reward cities, which take innovative actions or measures for environmental protection (Takemoto, 2011). The rewarding of forerunners as "model towns" is assumed to encourage other cities, where there is limited progress in addressing environmental challenges. Such a programme could be introduced by the MoEU in Turkey, where good reputation usually motivates city governments.

Furthermore, strong links should be set between policymakers and research community. There are examples of collaboration between universities and local governments in Turkey. However, it is mostly the large metropolitan cities that collaborate with the academic community, not the small and mid-size cities that suffer from insufficient technical resources. The gap between policymakers in small and mid-size cities and the researchers needs to be bridged by means of partnerships between universities and municipalities. Such partnerships can also create significant opportunities to raise awareness and understanding of local officials of climate change issues. There are not serious obstacles to prevent such partnerships in Turkey. What is required is the mechanisms and funds that will encourage cities and universities to collaborate. The policy implications mentioned here should be turned into well-designed and sound policies. To do so, further research is required.

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## IMAGE SOURCES

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## UNDERSTANDING HOW AND WHY CITIES ENGAGE WITH CLIMATE POLICY

### AN ANALYSIS OF LOCAL CLIMATE ACTION IN SPAIN AND ITALY

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#### ABSTRACT

Cities significantly contribute to climate change and at the same time have governance capacity to act efficiently in the fields of mitigation and adaptation. Their capacity is being increasingly recognized by international institutions and has been pointed out as crucial in the multi-level government scenario of the European Union (EU). Addressing the challenges of climate change at urban level is a complex issue which requires a holistic approach to strategic urban planning. Understanding why and how cities start action can help to identify the barriers they face when addressing climate change, and how national governments, regions and international bodies can support local authorities in their climate fight. This work aims to contribute to the provision of the knowledge needed to gain a better and deeper insight into urban climate action. The study investigates the state-of-the-art of urban climate plans in Spain and Italy, two countries which share similarities on many levels (i.e. cultural, geographical, climate vulnerabilities, urban configurations and institutional framework). The research analyses cities that are included in the Eurostat Urban Audit (UA), 26 in Spain and 32 in Italy, focusing on the actions taken by large and medium municipalities in reducing their contribution to climate change and becoming more resilient to changing weather patterns. The results of the analysis show a trend towards increasing awareness of climate mitigation (highly focused on energy efficiency and the promotion of cleaner energy sources), while adaptation remains a local policy area in its infancy in both countries. The study also identifies the beneficial influence of national and international climate city networks.

#### KEYWORDS:

Urban climate policy, mitigation plan, adaptation plan, Spain, Italy

## 1 INTRODUCTION

Cities are increasingly being recognized as important actors in the efforts towards climate change mitigation and adaptation (UN-Habitat, 2014; OECD, 2014; UNEP and UN-Habitat, 2009; C40, 2015). Urban areas are major contributors to climate change, although they cover less than 2% of the earth's surface (UN Habitat, 2012). Indeed, they account for between 71% and 76% of CO<sub>2</sub> emissions from global final energy use and between 67 – 76% of global energy use (Seto et al., 2014). At the same time, because more than half of the world's population is urban, cities are highly vulnerable to climate change, as they represent concentrations not only of people but also of assets and infrastructures. Being drivers of climate change and vulnerable to it cities see the need and the responsibility to take action. Moreover, cities and larger urban areas are to a large degree (ranging across countries) self-governed administrative units assumed to be able to act more independently and potentially more quickly than international consortia, such as the United Nations Framework Convention on Climate Change (NFCCC) (Kousky and Schneider, 2003).

High-level and large-scale international events and processes bear witness to the increasing importance of cities in the fight against climate change. For example, the Open Working Group of the UN Sustainable Development Goals (SDGs) explicitly suggests "*Mak[ing] cities and human settlements inclusive, safe, resilient and sustainable*" as SDG #11 and "*Tak[ing] urgent action to combat climate change and its impacts*" as SDG#13 (UN DESA, 2014). The Sustainable Development Solutions Network (an independent advisory body to the SDGs) calls to "*empower inclusive, productive and resilient cities*" and to "*curb human induced climate change and ensure clean energy*" (SDSN, 2013). Furthermore, the UN-Habitat's Cities and Climate Change Initiative (CCCI) is preparing Guidelines for City Climate Action Plans (UN-Habitat, 2015) to be launched at the Conference of the Parties (COP21) in Paris.

Recognizing this key role, local governments have taken on more responsibility to mitigate and adapt to climate change. In December 2009, for the first time, during COP15 in Copenhagen, a large group of mayors took part in a Climate Summit for Mayors jointly organized by the city of Copenhagen, C40, and ICLEI. Subsequently, many cities have begun to undertake a path of effective action that is bringing in innovative interventions and policy strategies. These actions frequently open up new fields of economic activity and opportunities for community participation at local level, and show that cities are at the forefront of climate change mitigation and adaptation actions. However, and despite the risks and cost of taking no action, many more cities are struggling to introduce climate issues in their policy agenda on a sustained and sound basis.

Understanding why, and how, cities start action can help to identify the barriers they face when addressing climate change, and what kind of initiative has to be undertaken by upper tiers of government and international bodies to support local authorities in their climate fight. Though research has increasingly been focussing on responding to this necessity in recent years (Heidrich et al. 2013; Reckien et al., 2014b; Reckien et al. 2015), efforts need to be increased in order to be able to fully answer these questions.

In this context, this paper aims to contribute to shedding light on the efforts undertaken by Spanish and Italian cities in tackling climate change throughout the last decade. The specific objective is to understand whether large and medium cities have acted in the field of climate policy in Spain and Italy, and what kind of action they have developed. This objective is relevant in the current scenario, in which the United Nations (UN) is preparing to negotiate a new international agreement in Paris (December 2015) to be implemented from 2020. Within that agreement the involvement of local governments is considered crucial.

Italy and Spain were chosen because they share important similarities in terms of climate vulnerability and urban configurations. These conditions make it plausible to assume that cities in both countries face similar climate change challenges and risks and, therefore, need to develop similar efforts (financial, administrative, political, technical, etc.) in order to implement efficient policies. Spain and Italy also share political and

historical conditions resulting in similar contemporary governance structures, and both are integrated in the climate change policy of the European Union (EU).

This paper is structured as follows: Section 2 explains the data and method, while Section 3 addresses the EU's climate framework and the action developed by the central governments and regions in both Spain and Italy. This section aims to establish the context for the policy and the governance systems in which the analysed cities have been acting. It builds on the work developed in De Gregorio et al. (2014). Section 4 examines the mitigation plans developed by Spanish and Italian cities, while Section 5 develops the study of the adaptation plans. These two sections further develop the work undertaken in Olazabal et al. (2014). Section 6 discusses the outputs of the analysis while Section 7 contains the conclusions.

## 2 DATA AND METHODS

This work analyses the current state of climate action (mitigation and adaptation) of large and medium-sized cities in Italy and Spain. Large and medium-sized cities are assumed to have the technical expertise within their administrative structures (or can have easy access to technical expertise) and the relevant financial resources needed to undertake action in these two fields. They are also the municipalities with greater capacity to mobilize other relevant stakeholders and engage them in local mitigation and adaptation.

To develop this study, we took the sample of 26 Spanish<sup>1</sup> and 32 Italian<sup>2</sup> cities that are included in the Urban Audit (UA)<sup>3</sup>. UA cities are assumed to be a regionally and population balanced sample of cities within European countries, and thus also of Italian and Spanish cities. The cities were originally selected in the context of a wider research work by Reckien et al. (2014a) studying urban Climate Change Mitigation (CCM) and Adaptation (CCA) plans and actions across 200 cities in 11 European countries. This study goes further by additionally analysing Climate Change Mitigation-Related (CCMR) and Adaptation-Related (CCAR) plans, and in providing an update to the original dataset, accounting for the latest development from January 2013 to June 2015.

The database used in the context of this work (Reckien et al., 2014a, updated as of January 2013) includes different types of indicators including: i) the plans active in the cities (year of approval, topics covered and emission reduction targets<sup>4</sup>, etc.), and ii) membership of relevant networks (Covenant of Mayors –CoM–, Spanish Network of Cities for Climate –RECC–, and Climate Alliance). In addition, results were also analysed using cluster analysis. This is a technique of multivariate statistical analysis that makes it possible to analyse

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<sup>1</sup> Alicante (AL), Badajoz (BD), Barcelona (BA), Bilbao (BI), Córdoba (CO), A Coruña (CR), Gijón (GI), Las Palmas (LP), L'Hospitalet de Llobregat (LH), Logroño (LO), Madrid (MD), Málaga (MA), Murcia (MU), Oviedo (OV), Palma de Mallorca (PL), Pamplona/Iruña (PA), Santa Cruz de Tenerife (SC), Santander (SA), Santiago de Compostela (SC), Sevilla (SE), Toledo (TO), Valencia (VA), Valladolid (VL), Vigo (VG), Vitoria-Gasteiz (VI), Zaragoza (ZA).

<sup>2</sup> Ancona (AN), Bari (BA), Bologna (BO), Brescia (BS), Cagliari (CA), Campobasso (CB), Caserta (CE), Catania (CT), Catanzaro (CZ), Cremona (CR), Firenze (FI), Foggia (FG), Genova (GE), L'Aquila (AQ), Milano (MI), Modena (MO), Napoli (NA), Palermo (PA), Padova (PD), Perugia (PG), Pescara (PE), Potenza (PZ), Reggio Calabria (RC), Roma (RO), Sassari (SS), Salerno (SA), Taranto (TA), Trento (TN), Torino (TO), Trieste (TS), Venezia (VE), Verona (VR).

<sup>3</sup> The UA database was developed and is maintained by the European Commission, Eurostat and the national statistical offices.

<sup>4</sup> Regarding the "emission reduction targets indicator" in the plans, it is important to clarify that all Spanish cities express their emission targets as % of CO<sub>2</sub> equivalent (henceforth, CO<sub>2</sub>e). All Italian cities, in contrast (except Rome), express emission targets as % of CO<sub>2</sub>. Figures in CO<sub>2</sub>e account for the mix of greenhouse gases taking the Global Warming Potential (GWP) of the CO<sub>2</sub> as reference (see Forster et al. 2007). According to Eurostat (Eurostat, 2013), "carbon dioxide accounted for 82.4% of EU-27 greenhouse gas emissions in 2010, followed by methane (8.5%), nitrous oxide (7.1%) and fluorinated gases (2.0%)" ([http://epp.eurostat.ec.europa.eu/statistics\\_explained/index.php/Climate\\_change\\_statistics](http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Climate_change_statistics); Last accessed June 30, 2015). Cerutti et al. (2013) argue that this can be used to justify a reliable comparison of both measurements, nevertheless bearing in mind that other gas emissions are underestimated if only CO<sub>2</sub> is considered. Assuming that no emission abatement measure can reduce only CO<sub>2</sub>, in this work we consider these figures to be comparable in order to reduce the scope and ambitiousness of the Italian and Spanish local mitigation projects. Eurostat Climate Change Statistics. URL: [http://epp.eurostat.ec.europa.eu/statistics\\_explained/index.php/Climate\\_change\\_statistics](http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Climate_change_statistics) (Last accessed June 30, 2015).

homogeneous groups within a data set. Depending on the type of data (qualitative or quantitative), different indices of similarity or distance can be applied to the data being analysed, which is organised in a matrix consisting of objects and descriptors. The initial matrix constitutes of binary data, characterizing the presence (1) or absence (0) of topics. The Sokal and Michener index (Sokal and Michener, 1958) is used to measure the similarity between the objects whereas the “complete linkage” algorithm is used for the clustering.

### 3 GENERAL CONTEXT OF CLIMATE ACTION IN SPAIN AND ITALY

#### 3.1 THE COMMON FRAMEWORK: EU CLIMATE POLICY

EU commitment to climate change stems from international concern for, and the negotiations that resulted in, the adoption of the UNFCCC in 1992. In fact, it was in the early 1990's that the EU and most of its Member States started to develop “serious” climate change action (Oberthür and Dupont, 2011), adopting a position that has been described as that of a major stakeholder and even of a major leader in international climate policy.

In order to sustain international commitment, the EU continues in its efforts to underpin that through the development of a climate change policy for its territory. From the entry into force of the Kyoto Protocol<sup>5</sup> (ibid.) the EU has implemented an emission-trading scheme in which all EU Member States must participate, has developed a comprehensive package of policy measures to reduce greenhouse gases (GHG) emissions under the European Climate Change Programme (ECCP)<sup>6</sup>, and has made efforts to set up an EU adaptation policy. The evolution of the action taken resulted in the reaffirmation of the EU's leadership ambitions, when in March 2007 the European Council announced a unilateral GHG emissions reduction programme that set EU targets for 2020. Through this programme, EU leaders committed themselves to a highly energy-efficient, low carbon economy. This set of targets was enacted through the climate and energy package in 2009 and aims for a 20% reduction of overall GHG emissions by its 27 Member States compared to the 1990 levels. The EU has offered to increase this emissions reduction to 30% if other major economies agree to contribute to a global emissions reduction effort (European Commission, 2012a). Today, the EU is driving a transition towards a low carbon economy, and strict targets have been set for the EU as a whole and for all the Member States. In particular, with the Energy roadmap 2050, the EU commits itself to reducing GHG emissions to 80-95% below 1990 levels by 2050<sup>7</sup>.

EU efforts have also been made regarding adaptation action. The Green Paper on Climate Change Adaptation (COM(2007) 354 final) and later the White Paper on Adapting to Climate Change: Towards a European Framework for Action (COM(2009) 147 final), laid the basis for a common framework on adaptation, identifying its vulnerability to the impact of climate change and setting out a number of measures to enhance the EU's resilience. As a key deliverable of the White Paper, in March 2012, a web-based European Climate Adaptation Platform (Climate-ADAPT) was launched, providing, and making available to citizens, policy makers and professionals, the latest data on adaptation actions in the EU, alongside several useful policy support tools.

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<sup>5</sup> It is worth observing that “neither the Kyoto Protocol (KP) nor the UNFCCC contain specific references to local government or city level actions to meet the Protocol commitments. There are only a few references to local level involvement; for example, Article 10 in the KP recognizes that regional programmes may have a role in improving the quality of local emission factors” (Sassen, 2013, p. 241).

<sup>6</sup> The first ECCP was launched in June 2000 and went on until 2004 aiming to implement the Kyoto Protocol on EU territory (European Commission, 2012b). The Second European Climate Change Programme (ECCP II) explored further cost-effective options for reducing greenhouse gas emissions as well as adaptation to the effects of climate change in synergy with the EU's Lisbon strategy for increasing economic growth and job creation (European Commission, 2011).

<sup>7</sup> <http://www.roadmap2050.eu/> (Last accessed June 30, 2015)



The European adaptation framework was completed with the launch of the Strategy on Adaptation to Climate Change (April 2013) that provides EU policy makers with comprehensive guidelines on the process of developing, implementing and reviewing adaptation strategies for facing climate change.

In order to be implemented, the approaches developed and the decisions taken by the EU institutions have to be introduced in the national frameworks of the Member States.

In the framework of the climate change policy developed by the EU over the years, cities have to play a significant role, since *"cities are key players in the reduction of CO2 emissions and the fight against climate change"* (EC, 2011, p. 5). The European Commission envisages climate action at urban level as an important aspect that has to be included and mainstreamed in the concept of integrated urban development and integrated urban regeneration provided by the Toledo Declaration<sup>8</sup> (ibid.). In fact, the development of the climate policy of the EU has been constructed according to a multi-level vision that aims to enhance the collaboration of all the levels of government to tackle and adapt to climate change, e.g. underlined by the European Commissioner for Climate Action, Connie Hedegaard, in April 2013, at the Conference held around the launch of the EU Strategy on Adaptation to climate change. She said: *"we have to act, and we have to act together"* highlighting that climate change requires actions at all levels of government (EC, 2013c, p. 6).

### 3.2 GENERAL CONTEXT OF CLIMATE ACTION IN SPAIN

Spain has an institutional multi-level fragmented framework in which climate change policy seems to be an exception (De Gregorio et al, 2014). The main reason for this particular situation is that the Central Government has to rely on the involvement of regional governments and municipalities in order to fulfil its international commitments. This fact is even more evident as regions and cities have jurisdiction over housing, mobility, urban planning and spatial planning, etc.

Spain ratified the Kyoto Protocol in 2002, making a commitment to limit emissions growth over the period 2008-2012 by 15% compared with 1990. Since then the Central Government has started to develop the country's climate change policy, implementing as of 2004 a collaborative vision through the creation of four arenas of negotiation and collaboration in order to assure the involvement of all relevant tiers of government in the fulfilment of Spanish Climate Change objectives. It also created the Spanish Office for Climate Change (OECC) with the main role of creating synergies between the activities and tasks of these arenas for vertical and horizontal collaboration and climate action mainstreaming. All these entities develop a relevant role in supporting Central Government in climate decision-making.

The Central Government also developed a number of documents and strategies that contributed to laying the foundations of the institutional approach to climate change in the country. In 2007 it passed the Spanish Strategy on Climate Change and Clean Energy (SSCCCE) as part of the Spanish Sustainable Development Strategy. The SSCCCE includes a broad range of measures that contribute to sustainable development within the scope of climate change and clean energy. It aims to set the framework to give coherence to national, regional and local policies on climate change in the medium to long term (2007-2012-2020) and particularly to the implementation of a number of planning instruments among which it is worth mentioning the National Plan for Adaptation to Climate Change (2006), the National Allocation Plans 2005-2007 and 2008-2012 (2005 and 2008), and the Strategic Lines to Fight Climate Change (2008), and Climate Plans and Strategies of the Autonomous Communities.

The National Plan for Adaptation to Climate Change (MARM, 2006) is the tool that set the approach and guidelines to undertake adaptive action. It aims to face the large vulnerability of the Spanish territory to the adverse effects of climate change by providing a reference framework for the coordination of different public

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<sup>8</sup> <http://www.eukn.org/> (Last accessed June 30, 2015)



administrations in their activities towards climate impact assessments, vulnerability studies and adaptation to climate change.

Through the development of the above-mentioned collaborative bodies, plans and initiatives, the Central Government has been able to develop a number of measures that, respecting the competences of the regions, have influenced local action to a relevant extent. These initiatives have mainly consisted of: (i) calls based on national funds in return for performance criteria; (ii) the promotion of information and knowledge exchange and the dissemination of best practices; and (iii) the creation of the Spanish Network of Cities for Climate (RECC). The latter can be seen as the most explicit line of action launched by the Central government to promote the engagement of Spanish cities in the development of a climate policy. The Network was constituted in 2004 with the aim of fostering the development of local policies to fight climate change through the adoption of 5 main axes of action, i.e., mobility, building, urban planning, energy and waste. The Autonomous Communities have implemented a relevant number of mitigation measures. Almost all of them have also developed Energy Plans. As in many other policy areas, relevant differences can be identified in the way the 17 Autonomous Communities have developed their action, though in general the regions understood their role as a government task that they have to necessarily share with the Central Government in order to meet the national goals (De Gregorio et al, 2014).

As a result of this overall scenario, a multi-level collaborative framework has been created on a national scale, without the effective integration of the local level. In fact, a review of the regional climate plans shows that there has been no reflection on how cities should address climate change in the different territories, while it is possible to identify a general trend towards promoting sectorial action on an urban scale (particularly in the field of energy saving and efficiency) (ibid.).

### 3.3 GENERAL CONTEXT OF CLIMATE ACTION IN ITALY

The first explicit step Italy undertook at the national level was the 1994 National Plan for the Containment of CO<sub>2</sub> Emissions, approved immediately after the ratification of the UN Framework Convention on Climate Change. In 1997, Italy signed the Kyoto Protocol. The Italian commitment under the Kyoto Protocol was not agreed with the regions, hence there are no specific legislative arrangements and enforcement procedures to meet the national commitment at the regional level. However, a number of policies relating to GHG reduction (e.g., in transport and energy sectors) have been promoted by the regions (and to some extent also provinces and municipalities). In addition, regions are playing an important role in reducing GHG emissions through their own Regional Energy Plans. Italian regions have been active in the field of energy planning, which is having important effects in terms of mitigation, but to date only few of them have developed specific climate plans.

In 2002 the Italian National Climate Change Strategy was approved, which defined a set of policies and measures to increase the energy efficiency of the economic system and to foster the use of renewable energy sources. The National Plan for the Reduction of Greenhouse Gas Emissions (2003-2012) was developed with the aim of fulfilling the commitment to the Kyoto Protocol. This document includes a wide variety of mitigation actions including measures to reduce emissions in agriculture and industry. In this context, the National Action Plan for Renewable Energy sources (MSE, 2010) was launched under the EU Directive 2009/28/EC. This Plan aims to achieve a 17% share of gross domestic consumption from renewable sources by 2020. Moreover, the Italian Action Plan for Energy Efficiency (MSE, 2011), in compliance with Directive 2006/32/CE, aims to achieve an overall 9% (126.540 GWh/year) of energy savings by 2016 through energy services and other energy efficiency measures. In March 2013, Italy approved the National Plan to reduce GHG emissions planning sectorial actions for the period 2013-2020. The plan aims to prepare a pathway towards a decarbonisation of the economy in compliance with the Europe 2020 policy

and the Energy Roadmap 2050. In this plan, Italy commits itself to achieving the EU's decarbonisation objectives: a 25% GHG reduction by 2020 compared with the 1990 level, 40% by 2030, 60% by 2040, and 80% by 2050. This will be achieved by adopting a set of measures, including the introduction of a carbon tax (to boost resources for the Kyoto Fund), the improvement of energy efficiency, distributed generation, and the development of smart grids for 'smart cities'. Additionally, the plan promotes eco-buildings and the extension until 2020 of the 55% tax credit to sustain investments for a low-carbon CO<sub>2</sub> economy and, finally, the management of forests, which represent both a sink for CO<sub>2</sub> and a source of biomass and biofuels.

The Italian National Adaptation Strategy (NAS) development process began in 2007 with the National Conference on Climate Change organized by the Ministry for the Environment, Land and Sea. It represented a very important event that involved a wide range of stakeholders at national, regional and local levels with the fundamental aim of collecting and organizing the most relevant available information on climate change and its impacts. From the final discussion emerged the urgent need to provide Italy with a National Adaptation Strategy. In 2013, a first draft of the Italian NAS was completed and submitted for public consultation. To date, the Italian NAS has not yet been approved, but a reviewed and complete version of the Italian adaptation strategy, including all the observations received, is available (Elements for the elaboration of a National Adaptation Strategy to Climate Change<sup>9</sup>) and final approval should be obtained by the end of 2015. In the Italian case, the late action of the national government has had a direct impact on the way regions have addressed climate policy. In fact, the national government did not provide clear climate action frameworks for local territories and the stakeholders that operate within them (De Gregorio et al., 2014). As we shall see in the next Sections, this has had an impact on the actions undertaken by the Italian cities.

## 4 LOCAL ACTION ON MITIGATION IN SPAIN AND ITALY

This section examines the state of the database of climate mitigation and mitigation-related plans or programmes as of January 2013 and shows the evolution and engagement of Spanish and Italian cities in the fight against climate change.

### 4.1 COMMITMENTS AND LEADERSHIP: NETWORKS MEMBERSHIP AND APPROVAL OF PLANS

#### 4.1.1 SPAIN

In the context of the national policy described above, many Spanish municipalities are part of joint international or national networks promoting the development of plans and programmes to fight climate change. Particularly, the Covenant of Mayors (CoM) and the national Spanish Network of Cities for Climate (RECC) (see also (Reckien et al., 2014b) for a comparison of Spanish cities with cities in other European countries). The national network RECC was created in 2004 and currently has 291<sup>10</sup> members, including municipalities, regions and regional networks. 1,431 Spanish cities are signatories of CoM (representing 15% of the total) and 1,172 of them have published their Sustainable Energy Action Plans (SEAPs) (81% of the signatories). The results are monitored in only 32 cities (2.7%). The differences in the level of membership in RECC and CoM suggest a higher tendency of Spanish cities to join international networks. Figure 1 illustrates the network membership of our sample of Spanish and Italian cities, up to January 2013.

<sup>9</sup> [http://www.minambiente.it/sites/default/files/archivio/allegati/clima/snacc\\_2014\\_elementi.pdf](http://www.minambiente.it/sites/default/files/archivio/allegati/clima/snacc_2014_elementi.pdf).

<sup>10</sup> Latest update in 2013. URL <http://www.redciudadesclima.es/> (Last accessed June 11, 2015).

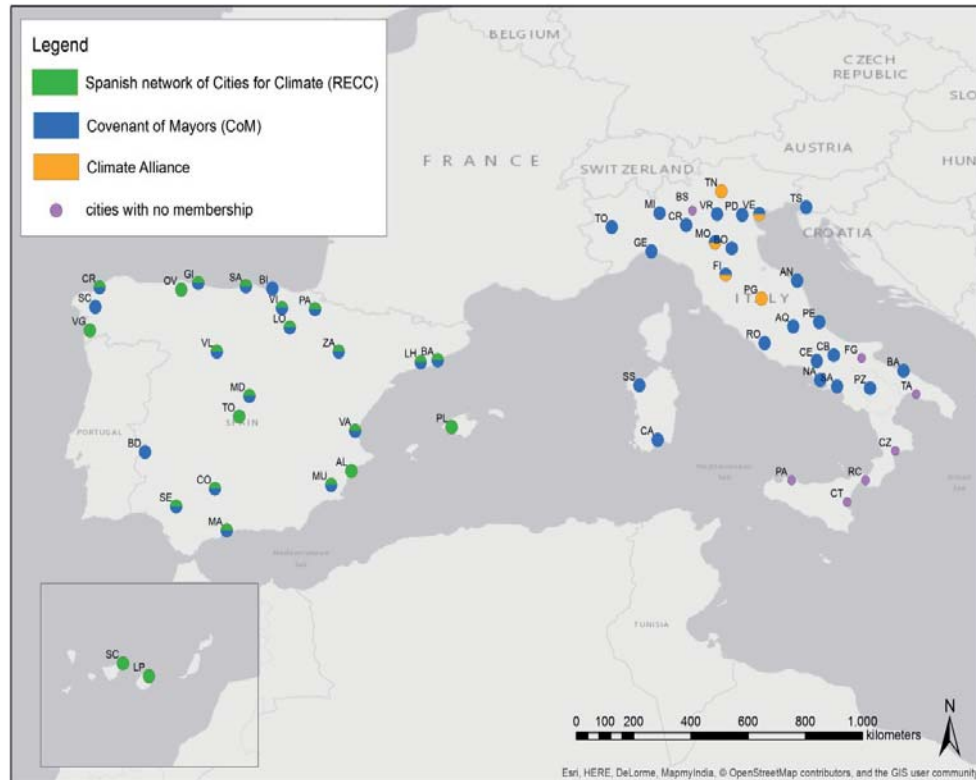


Fig. 1 Climate Network Membership of the Spanish and Italian cities analysed

The 26 Spanish cities in our sample show a tendency to enroll in national and international networks such as RECC or CoM. As argued in De Gregorio et al. (2014), it is interesting to note that participation in RECC has not had a significant influence in the development of plans, whereas participation in CoM has been crucial. These 26 selected UA cities do not demonstrate active approval of the plans until 2008. As of January 2013, only 54% of them had approved their CCM plans, 23% were in the process of developing one, and another 23% had presumably no intention of doing so in the short term (according to personal communications from municipal officials). All the documents considered in this case are CCM (i.e. no CCMR has been identified; see Sect. 2 for definitions).

#### 4.1.2 ITALY

There are two important climate mitigation city networks in Italy. One is the CoM, as Italian cities are by far the largest group of signatories compared with other countries (see Reckien et al., 2014b, for a comparison with cities in other European countries). In Italy, 3,101 cities (38% of the total number of municipalities in Italy) are signatories to the CoM: 2,543 (82%) have already submitted a SEAP, and only 255 (8%) are already monitoring the results (according to the CoM website<sup>11</sup>). The other main network is the Climate Alliance<sup>12</sup>. In Italy, 148 municipalities and associations are currently member of the Climate Alliance. Again, as in Spain, CoM is much more popular. In 2010, the Italian Local Agenda 21 Association, together with the National Association of Italian Municipalities (ANCI) and the Union of Italian Provinces (UPI) developed the Charter of Italian Cities and Territories for Climate, with the aim of becoming a reference document for spatial policies in Italy, putting climate planning into practice through multi-level governance and

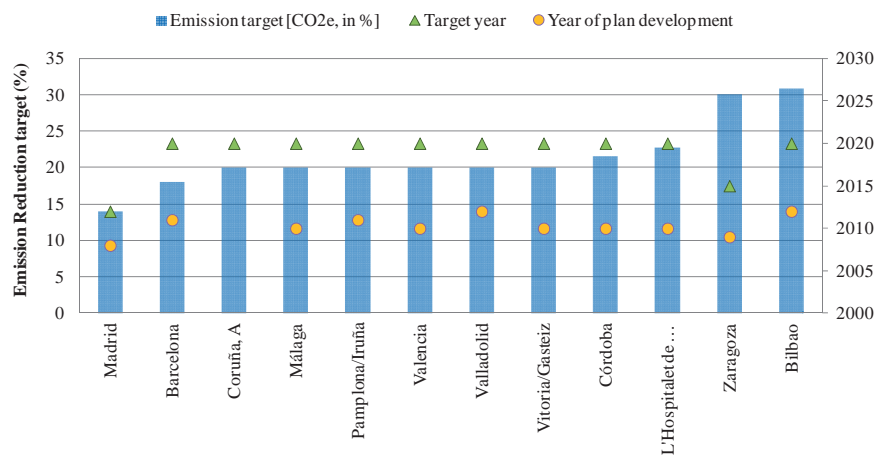
<sup>11</sup> <http://www.covenantofmayors.eu/> (Last accessed June 11, 2015)

<sup>12</sup> <http://www.klimabuendnis.org> (Last accessed June 11, 2015)

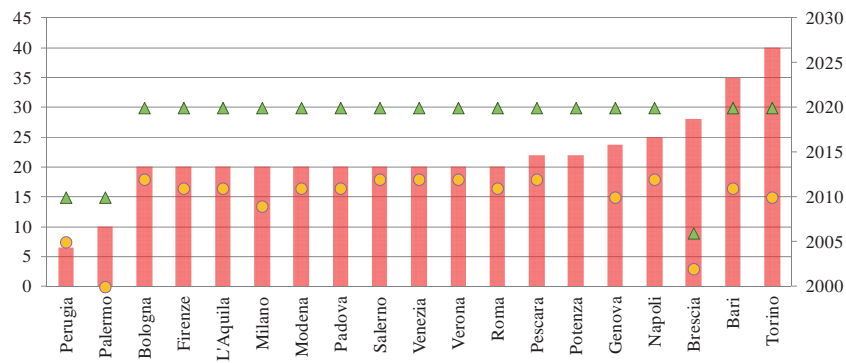
cooperation also on climate issues<sup>13</sup>. In our sample, 19 out of 32 of the Italian UA cities are signatories to the CoM, and only five have joined Climate Alliance (see Figure 1). We observe that CoM is crucial to the development of CCM or CCMR plans in Italy (Olazabal et al., 2014 and Salvia et al, 2014). In January 2013, 25% of the Italian UA cities in our sample had not yet approved mitigation plans (CCM or CCMR). As the authors found, very few plans were being developed, i.e. the great majority of cities that developed a plan had already approved it and published it. Unlike in Spain, the development of some mitigation plans started early in Italy (in 1997). However, the majority of cities started to act after 2005. Indeed the number of approved plans has steadily increased since then, reaching 24 approved CCM and CCMR in January 2013. It is important to note that 18 of these plans are CCM, while the rest are CCMR (e.g. Cagliari, which has developed a plan to promote solar energy) (Olazabal et al., 2014).

#### 4.2 EMISSION TARGETS

Among the indicators collected in the database developed, we gathered information regarding the emission reduction targets included in the CCM plans. All Spanish cities express emission targets as % of CO<sub>2</sub>e equivalent (henceforth, CO<sub>2</sub>e). All Italian cities, in contrast, (except Rome) express emission targets as % of CO<sub>2</sub>. Figure 2 shows the CO<sub>2</sub>e emission reduction emission targets of Italian and Spanish cities. We only show those UA cities that set quantitative targets, i.e. 11 Spanish cities and 19 Italian cities.



(a) Spanish UA cities that have set emission reduction targets in their CCM plans



(b) Italian UA cities that have set emission reduction targets in their CCM or CCMR plans

Fig. 2 Emission reduction targets of the Spanish (a) and Italian (b) cities analysed that have set targets in their CCM or CCMR plans (adapted from Olazabal et al. 2014).

<sup>13</sup> English version available at: <http://www.a21italy.it/medias/746CAD83A40F3AB9.pdf>

In both countries, most cities set reduction targets of 20% until 2020, which is the compulsory target for the CoM agreement. Bilbao and Zaragoza are the most ambitious cities in Spain, with a target of about 30%. In Italy, more cities set reduction targets above 20% as compared with cities in Spain. Naples, Turin, Bari and Brescia set targets above or equal to 25%.

#### 4.3 ASSESSMENT OF EMISSIONS ACCOUNTING (DIAGNOSIS)

Previous to the identification and design of potential mitigation options for the different sectors, every plan has a diagnosis phase where cities assess the baseline emissions from the different sectors (residential, municipal, industrial, transport, etc.) and identify the most important challenging or problematic area. This phase of diagnosis is therefore highly important in singling out the strategic sectors in which mitigation measures should be carried out. Our investigation also focused on the methods used by cities to develop emissions inventories. It should be noted that the type of method depends on the sector being examined and that different approaches can often exist in one single planning document. Thus, we have classified the methods as (a) detailed emissions inventory, (b) estimates from regional and/or national data, and (c) a mix of the previous methods depending on the sector under analysis (e.g. the residential sector using a detailed inventory and the transport sector using estimates).

In Spain, we have found that 14 plans (54%) included emissions inventories (using a, b or c above). This set includes not only approved plans but also some plans under development which have already published emissions diagnosis (and have thus been taken into account in this study). Regarding the types of methods applied to develop the diagnosis, most of the Spanish cities use mix methods depending on the sector under analysis (38% of the total Spanish UA cities) (see Figure 3, Spanish plans are blue shaded and Italian plans are red shaded). Only 4 % use estimates to account for emissions, and 12% use detailed emissions inventories in all sectors.

In Italy, 19 plans (59% of the total Italian UA cities) include emissions inventories. Surprisingly, 5 Italian cities (9%, see Figure 3) do not specify the method used. Regarding the rest, approximately half of them (31% from the total) use a detailed emissions inventory for all the sectors under assessment. Only 3% use estimates from regional or national data and approximately 16 % use a mix of methods.

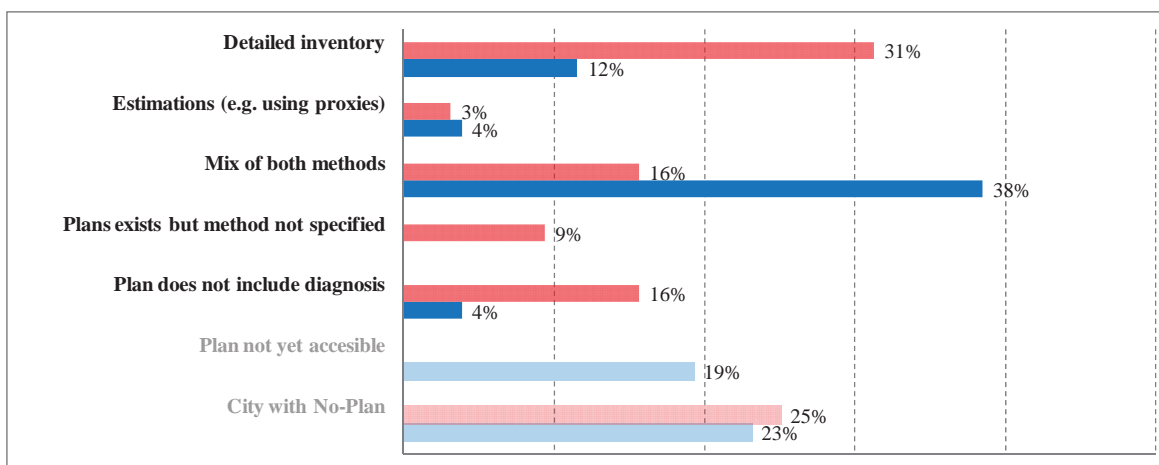


Fig. 3 Methods used to develop base emission inventories in Spanish (blue shaded) and Italian (red shaded) CCM and CCMR plans.

#### 4.4 MITIGATION TOPICS

Table 1 shows the topics most frequently included in the Spanish and Italian mitigation plans. Energy efficiency measures, building interventions (e.g. increase energy performances) and electricity production from renewable sources are the topics prevalently addressed in the Spanish CCM plans, but there is also a greater focus on actions involving the transport sector and waste management. Contrastingly, urban planning, intramunicipal reorganization, agriculture and heating from renewable energies are included less. Similarly, in Italian CCM plans, energy efficiency and renewable implementation are the topics most extensively covered, with heat production from renewable energies (poorly implemented in Spanish UA cities). Both the public and private building sectors are extensively targeted in the Italian cities (boosted by the EPBD EU Directive<sup>14</sup>, aiming to diffuse “nearly zero-energy buildings - NZEB” by 2020). Agriculture and waste management are barely covered topics.

<b>Mitigation topics</b>	<b>% of Spanish plans</b>	<b>% of Italian plans</b>
Energy efficiency	100	91.3
Renewable energies	93.3	95.7
Heating from renewable energies	13.3	91.3
Waste management	73.3	56.5
Urban planning	26.7	73.9
Agriculture	6.7	17.4
Transportation	86.7	87
Intramunicipal reorganization	13.3	69.6
Buildings (e.g. Heating)	100	100
Jobs	0	43.5
Industry	46.7	39.1
Commerce, trade, services	73.3	47.8
Households	93.3	82.6

Tab.1 Topics most included in the Spanish and Italian mitigation plans.

#### 4.5 CLUSTER ANALYSIS OF MITIGATION PLANS DESCRIPTORS

Cluster analysis has been used in this paper to analyse the distribution of mitigation topics in the database of climate plans by Italian and Spanish UA cities. In this application, the ‘objects’ are the cities that have taken mitigation actions, and the ‘descriptors’ are the topics included in the mitigation plans (Table 1).

##### 4.5.1 SPAIN

A matrix [objects x descriptors] was constructed using the database of the Spanish mitigation plans as the starting point. The initial matrix [26 x 15] (see Footnote 1 for acronyms) consisted of 26 Spanish cities and CCM plans, and 15 mitigation topics.

The initial matrix [26 x 15] was reduced to a matrix of [15 x 14] subtracting those cities that lacked all topics (AL, BD, GI, LP, OV, PL, SC, SA, SC, TO and VG). Regarding descriptors, only one topic (job) is not considered by all cities.

<sup>14</sup> Directive2010/31/EU EPBD on the Energy Performance of Buildings



Applying the cluster analysis to this reduced matrix, three clusters are obtained, corresponding to a similarity index value of approximately 0.65, as reported in Figure 4. The obtained clusters group the Spanish cities characterized by the peculiar behaviour of some descriptors:

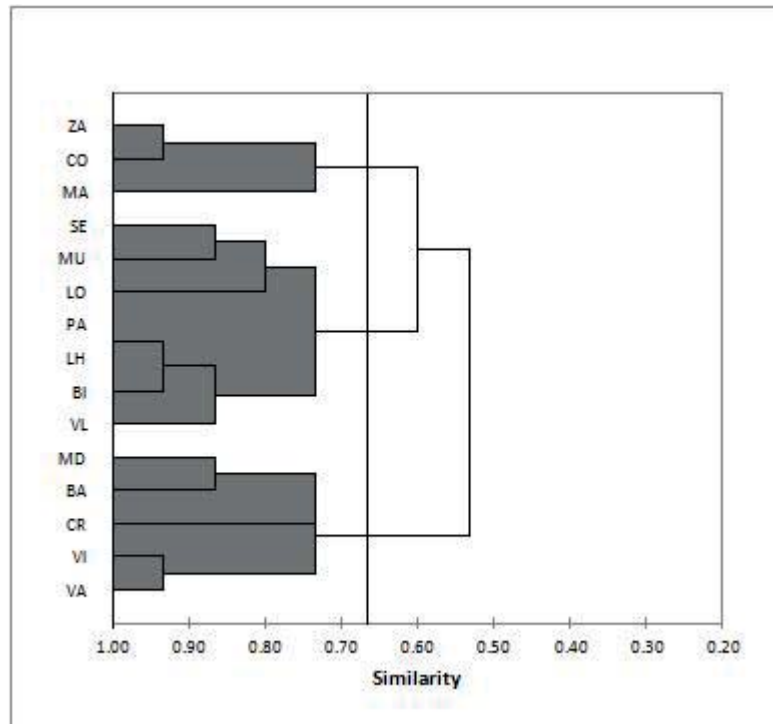


Fig. 4 Dendrogram of cluster analysis for Spanish cities

- Cluster 1 is made up of Zaragoza, Córdoba and Málaga, cities that have included only a few topics in their mitigation plans. They include the GHG emission target, boost energy efficiency, implement waste management strategies, and promote actions to increase building efficiency. These cities have to make extra effort in mitigating climate change in order to keep pace with the most active Spanish cities;
- Cluster 2 (Seville, Murcia, Logroño, Pamplona-Iruña, L'Hospitalet de Llobregat, Bilbao and Valladolid) is characterized by a high number of common topics implemented (energy efficiency, renewable energies, transportation, buildings and households). On the other hand, all cities belonging to this cluster lack urban planning measures, intramunicipal reorganization (such as Green Public Procurement - GPP), and actions in the agriculture sector;
- Cluster 3 includes the cities of Madrid, Barcelona, A Coruña, Vitoria and Valencia which present the most complete mitigation plans implementing seven common topics, including the commerce, trade and service sectors, unlike in the other clusters.

All the Spanish cities include energy efficiency measures and interventions on buildings in their mitigation plans. Consequently these are not characterizing factors for the obtained clusters.

It is worth noting that the most ambitious cities in terms of reduction targets (Zaragoza and Bilbao) are included in the two less ambitious clusters. Figure 5 shows the distribution of clusters across Spain.

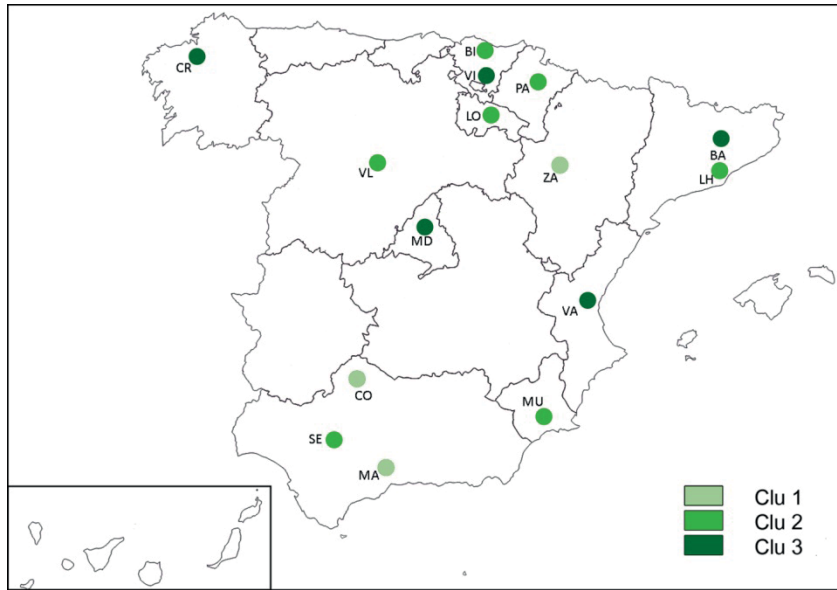


Fig. 5 Spatial representation of cluster aggregations for mitigation efforts in Spanish cities.

#### 4.5.2 ITALY

In the Italian sample of 32 cities 15 topics were considered (Table 1) resulting in an initial matrix of [32 x 15] (see Footnote 2 for acronyms). Taking into account all the topics absent in nine cities (Campobasso, Caserta, Catania, Catanzaro, Cremona, Reggio Calabria, Sassari, Taranto and Trieste) the number of objects was reduced to 23, thus obtaining a matrix of [23 x 15]. The results for the Italian database are shown in Figure 6.

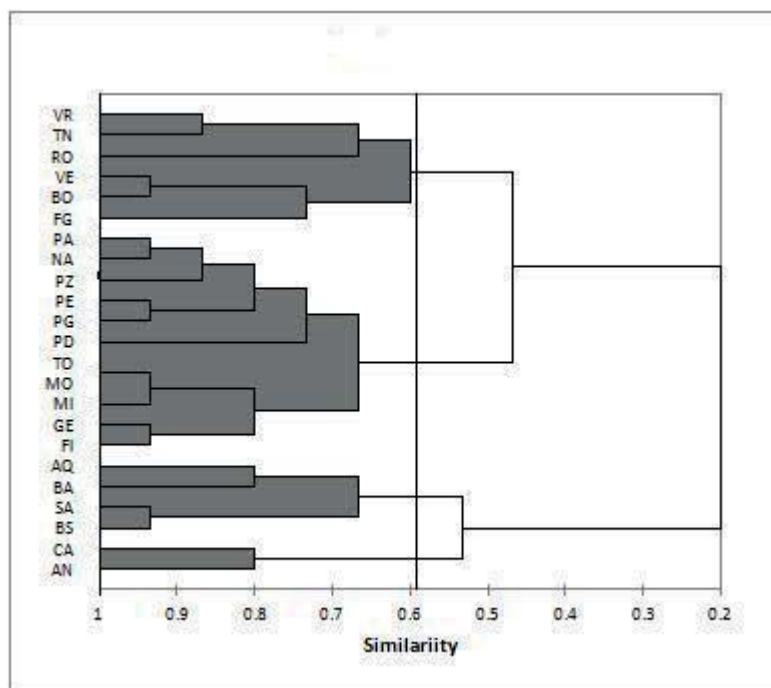


Fig. 6 Dendrogram of the cluster analysis for the Italian cities

This dendrogram identifies the formation of four clusters grouping homogeneous cities in terms of the scope of the mitigation measures (number of sectors addressed) and their focus (which sectors are included).

Clusters 1 and 2 integrate the most active cities, i.e., those undertaking the highest number of mitigation initiatives involving the main economic sectors. The cities in Cluster 1 (Venice, Bologna, Rome, Verona, Trent and Foggia) have mainly promoted measures aiming to increase energy efficiency and renewable energies involving the main economic sectors: commerce, trade, services sectors and households.

All the cities in Cluster 2 (Turin, Modena, Milan, Genoa, Florence, Padua, Naples, Palermo, Potenza, Pescara and Perugia) focused on energy efficiency, renewable energies (both for electricity production and heat production), waste management, urban planning and transportation to reach their mitigation targets.

The medium and low ambitious Clusters 3 and 4 address only a few topics; in particular, the cities in Cluster 3 (L'Aquila, Bari, Salerno and Brescia) have not developed any actions for agriculture, intra-municipal reorganization or jobs. The proposed initiatives include an increase in energy efficiency and the implementation of renewable energies in the commerce, trade and services sectors.

Cluster 4 grouping Cagliari and Ancona refers to the lowest number of topics included in their plans, namely two (transportation and buildings) and three (renewable energies, heating from renewable energies and buildings) respectively.

Figure 7 shows the territorial distribution of the cities. Although 6 out of 9 cities not considered in this analysis (having no topic) are located in the South of Italy, the clusters are rather homogeneously distributed over the Italian national territory.

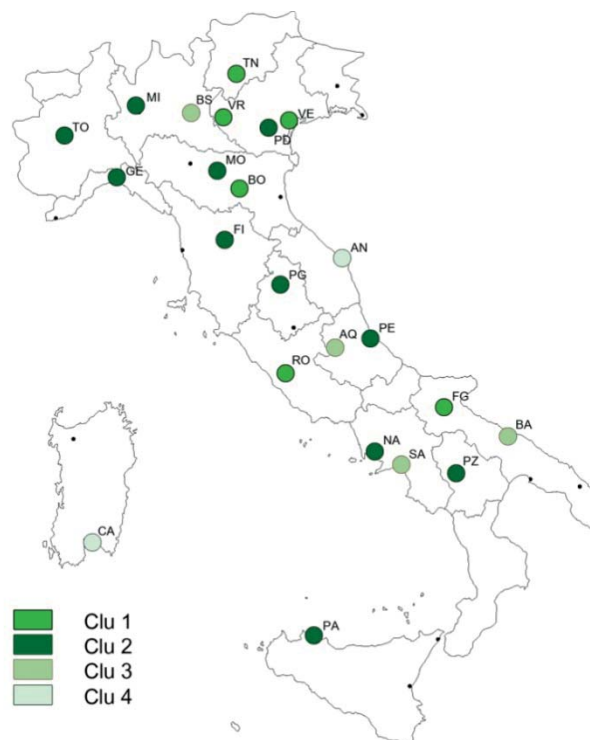


Fig. 7 Spatial representation of cluster aggregations representing mitigation efforts in Italian UA cities

## 4.6 NEW MITIGATION PLANS: ADVANCES SINCE JANUARY 2013

### 4.6.1 SPAIN

The review of the new mitigation plans developed from January 2013 shows that 5 out of 6 Spanish cities that had signed the CoM at that moment (Badajoz, A Coruña, Gijón, Santa Cruz de Tenerife, and Logroño), have already approved their SEAPs. It is to be noted that none of them had previously developed a CCM plan. Vigo signed the CoM in 2010, but, as it does not have a SEAP yet, it no longer appears as “signatory”. Santiago de Compostela signed its participation in the CoM in 2013 (after January), but it has not approved its SEAP. Its plan has been under development since September 2014.

### 4.6.2 ITALY

In Italy, CoM influence continues to be very strong; indeed 10 more cities have joined the network in the last two years. Among these, Ancona, Cagliari, Campobasso, Cremona, Palermo, Sassari, Trent and Trieste have implemented and approved their SEAPs and committed themselves to reducing CO<sub>2</sub> emissions by at least 20% before 2020, whereas Caserta and Catania are currently preparing their plans. In addition, Reggio Calabria has shown an interest in the CoM but has not yet joined.

Outside the CoM initiative it is important to underline the key role played by Municipal Energy-Environmental Plans in the definition of mitigation strategies. This is the case, for instance, of Perugia where detailed CO<sub>2</sub> target reduction for specific actions was specified in the update of its Municipal Energy-Environmental Plan. On the other hand, Catanzaro, Foggia and Taranto, all of them in Southern Italy, continue to be characterised by a strong inertia regarding mitigation issues; in fact no structured initiatives and plans have been promoted even in the last two years.

## 5 LOCAL ACTION ON ADAPTATION IN SPAIN AND ITALY

### 5.1 COMMITMENT AND LEADERSHIP

On the basis of their overall capacity to adapt to the climate change index elaborated by ESPON (2011), all the Spanish and Italian regions have a low or very low ability to adapt to climate change. This means that 84% of the cities in these countries have a vulnerability index of 4 or higher, on a scale from 1 (low) to 5 (high) (ibid.). Despite the negative impacts expected and the low capacity for adaptation, it can be said that neither Spanish nor Italian cities have really focused their attention on adaptation.

In Spain, even though the RECC has developed some actions oriented to guiding cities to undertake adaptation action (RECC, 2011), only 7 cities out of the 26 studied (27%) have included initiatives related to adaptation in their CCM plans. Four of these cities have integrated an adaptation section or measures in their CCMR plans (Bilbao, Madrid, Murcia and Valencia), while the other 3 have created (or are creating) an adaptation plan specifically. Among those plans, there is only one published (Zaragoza, 2010), while the other 2 are in the early stages of development. Barcelona is compiling information, and Vitoria-Gasteiz has completed the first step through a scenario analysis and a sectorial vulnerability assessment. The small number of Spanish cities developing specific adaptation plans reveals that adaptation is not understood as a significant area of action policy by local governments. It is worth noting that the 3 cities that are preparing, or have published, their specific adaptation plans can be considered at the forefront of Spanish cities regarding the implementation of a sustainable urban development approach.

In Italy, 11 cities out of 32 (34%) have an adaptation-related plan. Many of these plans were designed to address specific risks.

<b>Context (motivation) of the plans</b>	<b>% of plans</b>
Climate Change Adaptation	7,69
Energy	7,69
Heatwaves	30,77
Hydrology risks	15,38
Urban greening	38,46

Tab.2 The context (motivation) of the plans related to adaptation in Italian UA cities (% of plans)

Four plans are related to heat waves (Perugia, Potenza, Catania and Milano). Two others focus on hydrogeological risks (Perugia and Catania), and one addresses urban greening (Napoli). In fact, two cities (Perugia and Catania) have a plan for each risk (heat waves and hydrogeological risk). Only one plan mentions adaptation as one of its motives (Padoa, 2011), even though it was enacted along with the mitigation strategy. Five of them have Sustainable Energy Action Plans that also include adaptation measures (Verona, Venice, Sassari, Salerno and Rome).

## 5.2 DIAGNOSING ADAPTATION NEEDS: DO CITIES INCLUDE VULNERABILITY ASSESSMENTS?

In order to identify vulnerable sectors or social groups that require adaptation measures in the short, medium or long term, good practices indicate the need to develop an assessment of vulnerability. This assessment is normally based on current and projected future conditions (e.g. 2020, 2050, 2100...) according to selected scenarios. The assessment of vulnerability not only under current conditions but also in the future is therefore a crucial step in identifying and prioritising adaptation measures and in allocating resources to guarantee sustainability in the medium and long term. Thus, we have identified here which plans from the sample develop and take into account a current and/or future vulnerability assessment for the design of adaptation measures.

In Spain, the review shows that adaptation measures included in the above-mentioned plans have been developed on the basis of little supporting information. Only 2 of these cities (Valencia and Vitoria-Gasteiz) have developed a vulnerability assessment. Valencia has developed a current vulnerability analysis, mainly focusing on health issues, while Vitoria-Gasteiz has further included a future vulnerability assessment by projecting regional temperature and precipitation scenarios onto the local scale and by developing flood and heat wave scenarios for both 2050 and 2100 (Olazabal et al., 2012). Two other cities have also included scenarios in their diagnoses, i.e., Zaragoza (2040 and 2100) and Madrid (2100).

In the case of Italy, not much can be said about the method of diagnosis used for developing these plans, due to the paucity of the contents. Only plans relating to heat waves and hydrological risks have developed (current) vulnerability assessments. For those plans, a reference scenario was used based on the extreme heat wave events of 1998 and 2003 (Perugia and Catania) whereas, in the example of Catania, the extreme rainfall events of 1955, 1999 and 2003 were taken into consideration when assessing hydrological risks. In the case of Perugia historical observations of precipitation from 1860 to 2001 were used. In any case, none of these plans employed medium-long term scenarios to plan for potential risks based on scientific knowledge.

### 5.3 ADAPTATION TOPICS

Table 3 shows the topics most frequently covered in the Spanish and Italian CCA and CCAR plans.

<b>Adaptation topics</b>	<b>% of Spanish plans</b>	<b>% of Italian plans</b>
Health aspects	85.70	38.50
Water management	7.70	57.10
Agriculture	28.60	0.00
Forest management	42.90	38.50
Flood protection	57.10	15.40
Urban planning and development	42.90	30.80

Tab.3 Topics most included in the Spanish and Italian plans

Most of the topics, except water management, are more frequently covered in the Spanish plans as compared with the Italian sample. Health is the topic most frequently addressed. Forest management, urban planning and development are also included in more than 30% of the plans in both countries.

The Spanish plans approach adaptation to climate change more holistically, acting on a number of topics. Health is the most commonly addressed issue (in fact, taking into account that Barcelona has produced no document, it may be said that all cities consider health aspects). Valencia is an exemplary case, in which all the measures to adapt to climate change have to be implemented by health authorities.

Water issues are also very important. Bilbao and Murcia mention storm water network improvement in relation to flood protection, and Vitoria-Gasteiz aims to draw up a flood map. Water management, being an important issue in Spain, is also widely addressed. The measures in Murcia's plan are mostly geared towards maximizing water savings.

Urban planning and development, along with forest management, mainly focused on prevention, sealing and the development of green spaces. Agriculture is the least addressed topic, only mentioned in Vitoria-Gasteiz and Zaragoza.

More than half of the Italian plans focus on a specific risk rather than a holistic approach to adaptation to climate change. The documents are not based on future scenarios. In general, the Italian cities have drawn up ad-hoc programmes, which in some cases are renewed every year to help citizens face extreme temperatures during the summer season.

The topics most often addressed in these plans and strategies are health (in plans relating to heat and hydrological risks), forest management (mostly in plans motivated by emissions reduction) and urban planning and development (regarding codes and certification in plans related to sustainable energy). Water management and flood protection are poorly covered, apparently because these issues fall within the competences of upper levels of government (i.e. regions). The topic of agriculture is not addressed in the Italian context.

### 5.4 NEW ADAPTATION PLANS: ADVANCES SINCE JANUARY 2013 AND MAYORS ADAPT

Recent adaptive action in Spain and Italy relies on the support of a new European initiative arising from the EU adaptation strategy package Mayors Adapt, which follows the successful CoM structure. The Mayor Adapt initiative has been set up to engage cities in taking action to adapt to climate change, by increasing support for local activities through the provision of a platform for engagement and networking. Cities signing up to the initiative commit to contributing to the overall aim of the EU Adaptation Strategy by developing a comprehensive local adaptation strategy or integrating adaptation measures to climate change into existing



plans. The aim is to include the main outputs into the European Climate Adaptation Platform CLIMATE-ADAPT<sup>15</sup>, a partnership between the European Commission and the European Environment Agency (EEA).

In Spain, the cities of Barcelona, Madrid and Valencia have signed this commitment as a first step. Barcelona is currently developing a new plan (the Adaptation to Climate Change and Resilience Plan/Plan de Resiliencia y Adaptación al Cambio Climático). To this end, a report has been produced to address the seven main challenges relating to climate change for the city of Barcelona: health, tourism, water and energy, sanitary infrastructures, governance, coastline (erosion) and civilian protection (regarding improvement of emergency plans). As mentioned above, Madrid has a new Climate Change Plan (Plan de Uso Sostenible de la Energía y Prevención del Cambio Climático - Horizonte 2020/Plan of Sustainable Use of Energy and Climate Change Prevention - Horizon 2020), which represents an improvement on the previous one.

Valencia City Council held the Covenant of Mayors and Adaptation to Climate Change meeting in which they offered other municipalities located in the province of Valencia the possibility to join Mayors Adapt and help them with their local adaptation plans.

Regarding the effects of Mayors Adapt in Italy, Bologna was the first city to join this initiative in 2014, followed by Turin in 2015, whereas Napoli, Palermo and Ancona are in the process of joining it. Bologna has developed the Local Urban Environment Adaptation Plan for a Resilient City, which includes actions on the following main topics: drought and water scarcity, heatwaves in urban areas and extreme weather events. It is also worth mentioning that other cities have developed adaptation plans out of the Mayors Adapt framework. Padua has one of the best Italian climate plans, being carried out within the context of the LAKS-LIFE project, where the adaptation actions are integrated into the SEAP. In January 2014, the Venice City Council approved the Future Climate Venice document, a preliminary document for the development of an adaptation plan.

As happened in the case of the Covenant of Mayors and the development of mitigation plans, cities' commitment to the Mayors Adapt initiative is acting as an important element to enhance the implementation of local adaptation measures on a local scale in both countries.

## 6 DISCUSSION

### 6.1 DISCUSSION ON MITIGATION

Our study reveals substantial differences between the two countries, with Italian cities being on average more active in mitigation as compared with Spain. Considering emission reduction targets, Italian cities are more ambitious than their Spanish counterparts. More cities in Italy (22%) than in Spain (15%) have local CO<sub>2e</sub> emissions reduction targets (above 20%). In contrast, and when this study was carried out, Spain had a national climate framework in place, but fewer cities with ambitious or pro-active climate plans (De Gregorio et al, 2014). 75% of the Italian cities and almost 77% of the Spanish cities analyzed have approved climate change mitigation (CCM) or climate change mitigation-related (CCMR) plans, or have officially committed to develop it.

To understand how the mitigation measures were identified, we also examined the types of methods used when developing emissions assessments. We observed that in Spain there is a greater tendency to include emissions assessments and also an increasing tendency to publish material in different phases of plan development. Despite the fact that developing SEAPs is a compulsory condition for CoM signatories, in Italy there are several plans where measures have been identified without any emissions diagnosis at their basis, or where the methods are not specified. Of the Italian plans that do include them, more than half use detailed inventories for all the sectors studied.

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<sup>15</sup> Climate-ADAPT platform: <http://climate-adapt.eea.europa.eu/>

Compared with Italy, Spain shows a more consolidated culture of using emissions assessment information to gain an understanding of problematic sectors when taking decisions about how, when and why certain activities generate more emissions than others. In the absence of a national network in Italy, this could be a sign of an effective influence of the Spanish Network of Cities for Climate (RECC) in recent years.

Regarding the topics in mitigation plans, both the Italian and Spanish cities largely focus on the local energy system and transportation (in both cases, this seems to be related to the significant actions undertaken by the Regional governments on these two issues), but Italian cities cover a greater number of topics, in general. Cluster analysis made it possible to identify homogenous groups of cities characterized by the inclusion (or exclusion) of topics in the cities' mitigation plans. In Spain, analysis reveals three classes of cities, characterized by a different level of ambition underlying their mitigation measures (number of sectors addressed) and their focus (which sectors are included). Cluster 3 addresses the highest number of issues across the highest number of sectors (from 9 to 12 sectors out of 14). This Cluster is integrated by the three largest cities in Spain (Madrid, Barcelona and Valencia), together with Vitoria-Gasteiz (2012 European Green Capital) and A Coruña, with a new plan, released in December 2013. The inclusion of the 3 most populated cities in the country in this cluster shows that bigger cities are undertaking mitigation climate change from a more inter-sectorial perspective than the medium-sized ones. Also noteworthy is the presence of Vitoria-Gasteiz within this group. It is an example of how medium-sized cities with a relevant political will and a long-standing commitment to tackle climate change can keep pace with the bigger ones by devoting financial resources and developing technical expertise. Nevertheless, Cluster 1 does not include cities with the most ambitious reduction targets. In fact, Zaragoza and Bilbao, the two Spanish cities with the higher reduction targets, are integrated into the clusters that address climate action in a small number of sectors, demonstrating that in the Spanish case ambitious target reduction does not go hand in hand with a holistic understanding of mitigation.

## 6.2 DISCUSSION ON ADAPTATION

In general, there are very few climate change adaptation plans, although large parts of both countries are highly vulnerable (ESPON, 2011). By January 2013, 11 Italian cities (34%) and 7 Spanish cities (26%) had developed Climate Change Adaption (CCA) plans or Climate Change Adaptation Related (CCAR) plans. Italian cities seem to be more active, since the percentage of plans in relation to the total number of cities analysed is higher; at the same time, Spanish plans are more comprehensive, as they deal with more topics.

In addition, the difficulty of translating best adaptation practices from one city to another without important investments has to be taken in account. A relevant reason for this has to do with climate action developed by national and regional governments in both countries, which has focused on mitigation, paying less attention to adaptation (De Gregorio et al., 2014).

There have been some advances in both countries (from January 2013 up to June 2015) regarding climate adaptation plans, despite being among those with the least capacity to adapt to climate change (economic, technology, knowledge, awareness and infrastructure) as shown in ESPON (2011). Given that many of the territory of Spain and Italy are considered to have medium or high potential impact on climate change (especially in Spain) (ibid.), it is necessary to start taking steps in the same way that mitigation measures were implemented during the last decade. Initiatives like Mayors Adapt can transform this inertia (up to now: 4 cities in Italy have joined, as have 3 cities in Spain) and help local governments to start an effective pathway towards a more resilient future of their cities.

Referring to the cluster analysis developed for mitigation plans, we can highlight a relationship between the clusters of mitigation topics and advances in the field of adaptation. In Spain, the most ambitious cities with respect to number of sectors addressed in mitigation plans are also the most ambitious in terms of

adaptation. In fact, in Cluster 3 (addressing a higher number of sectors), Barcelona and Vitoria-Gasteiz are in the process of developing an adaptation plan, and Madrid and Valencia have already implemented adaptation measures in their climate change plans (Madrid and Valencia). Regarding Clusters 1 and 2, only Zaragoza has an adaptation plan, while two cities in Cluster 2 (Bilbao and Murcia) have developed adaptation measures.

In the case of Italy we also identified that the most ambitious cities in terms of mitigation have been in general the most proactive ones in terms of adaptation. Cluster 2, the more ambitious one, contains the highest number of cities that have undertaken adaptation actions (7 out of 11). They are followed by the cities in Cluster 1 (3 out of 6), Cluster 3 (1 out of 4) and finally Cluster 4 (0 out of 2), which is the same classification obtained for mitigation.

We may thus argue that the cities that have paid more attention to mitigation issues are at the same time more sensitive to adaptation.

## 7 CONCLUSIONS

This study shows that in Spain and Italy, climate planning has focused on mitigation actions, particularly in the energy area, with policies aiming to increase energy efficiency and promote cleaner energy sources. It seems to be the result of the combined influence of national and international networking initiatives such as the Spanish Network of Cities for Climate (RECC) in Spain, and the Covenant of Mayors (CoM) in both countries, as well as the mitigation policy developed by the upper tiers of government (provinces, regions and central government).

Regarding climate network membership, the great success of the CoM in Italy and Spain (Italy is the country with the highest number of signatory cities in Europe, followed by Spain) has resulted in a great number of Sustainable Energy Action Plans (SEAPs) that must be considered and treated in all respects as climate mitigation plans. In addition, networking activities at national level, such as the RECC in Spain, have demonstrated their ability to effectively support cities in the development of plans and programmes to fight climate change.

Comparison of the two countries from the point of view of the methods used for the base emissions inventories, topics covered by climate mitigation plans, and the level of ambitiousness of CO<sub>2</sub> emissions targets shows that Italian cities are generally more ambitious (in terms of the topics covered and emissions reduction targets) than their Spanish counterparts. However, they often lack precise and/or complete information on the method used to develop their inventories.

Although the policies and plans evaluated indicate a trend towards an increasing awareness on climate mitigation, the scarcity of local adaptation plans confirms that urban resilience is a very complex issue. The analysis shows that there is a general delay in dealing with climate change adaptation at the urban level in both countries, because adaptation plans and initiatives are more frequently carried out at a higher administrative level (Metropolitan Area, Province, Region), and because adaptive action is being developed later than mitigation at national and regional levels. This has delayed the potential development of economic and legislative frameworks and policy tools able to incentivise cities to undertake adaptation strategies.

Regarding adaptation, a positive trend has been observed in the last couple of years, as important cities like Barcelona, Madrid and Valencia (in Spain) and Bologna (in Italy) have developed adaptation-related plans. In most of these cities, the development of adaptation strategies/plans was boosted by participation in European projects or by the leading role assumed by the Mayors Adapt initiative. Mayors Adapt seems to play an important role in raising awareness concerning adaptation and giving rise to action in both countries. Regarding local mitigation initiatives, cluster analysis shows that there are no clear geographical patterns for cities' responses across northern and southern urban areas or between large and medium-sized cities. This

demonstrates a low incidence of the regional level of government on setting models for implementing mitigation. It also makes it possible to observe that the cities that have shown a more holistic approach to mitigation are those that have developed specific adaptation plans. This might lead to the question of whether this should be understood as a best practice.

On the other hand, our study restates the conclusions of Baker et al. (2012): local governments need funding to support effective planning for climate impacts. They also need technical guidance and to engage in awareness-raising and capacity building processes. This is important in general, but particularly in the case of medium cities and cities with fewer resources (Reckien et al., 2015). Also concurring with Bulkeley and Kern (2006), our analysis shows the necessity to provide cities with more political support and guidance so that they can use traditional forms of authority to work in partnership with other relevant local actors in the field of climate protection.

Dealing with climate change at city level needs to be an integral part of city planning and management. This challenge has to be further addressed by Spanish and Italian cities, but also by the wider institutional frameworks in which they are embedded. In order to achieve this vision, knowledge of local climate action has to be produced and effectively used as a basis for local decision-making and negotiations on an international, national and regional scale. This way, urban needs would be better understood and addressed by the legislative and financial frameworks that cities require for them to collaboratively engage with effective climate action.

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## IMAGE SOURCES

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## POLICIES OF RESILIENCE IN THE NEW INSTITUTIONAL PROCESS

THE CASE-STUDIES OF PALERMO AND SIRACUSA  
IN THE SOUTH OF ITALY

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### ABSTRACT

At the end of 2012, the PON METRO National Scheme was set up in Italy, inspired by the EU Urban Agenda. It also allows towns like Palermo to test and reach targets of urban resilience, focusing on mobility and sustainable energy in order to improve life in the cities together with innovative policies of social inclusion. Other medium-sized cities also tried to face the problem of urban resilience without using national funds. The city of Siracusa, for example, made use of EU direct co-financing schemes. This paper aims to analyse the planning projects and measures adopted in Sicily over the past few years in order to examine government approaches focusing on resilience or those that are somehow linked to it. The comparison shows that, despite the wide range of opportunities (European, National and Regional policies, etc.) a number of differences may be listed in the adoption of schemes for urban planning and for the implementation of transition measures from a linear, rational, sequential, normative and regulative approach to the circular, active, flexible and versatile approach needed to tackle the problems linked to urban resilience. This proposal suggests that new policies are needed. The new policies should focus not only on funds but also on the creation of an innovative laboratory of projects involving all the cities in equal ways and on the building of a platform to exchange data and compare the different practices adopted in relation to urban and local resilience.

### KEYWORDS:

urban resilience, urban adaptation, urban planning, smart city, participation planning

## 1 DEFINITION AND OPPORTUNITIES

Today's debate on eco-friendly development often focuses on the unclear definition of the terms resilience, adaptation and sustainability. These three words are often used in studies and in documents produced by our government institutions or by planning institutions. It is important to underline a number of basic guidelines to improve the efficiency of the policies and practices adopted for the future of the cities. The relationship between the terms resilience and sustainability has been analyzed by Walker & Salt (2006), who state that resilience is the key to sustainability. Sustainability therefore includes a wide range of subjects which, in turn, correspond to useful criteria able to assess policies and practices of intervention that humans should adopt, according at least to the Bruntland Report, regardless of the risk that they may run.

Laying aside the meaning of the word in the psychological sphere, the successful use of the term resilience is due to the efficient communication of its creator who identified the assessment of the strength of the survival phenomena of nature as well as the consequences created by possible analogies between natural ecology and the analysis of social systems. In addition to studies in the field of ecology, resilience theory suggests to analysts of town and country planning that there are many implications, especially regarding the adaptive cycle which provide a clear image of the meaning of the concept also in areas unrelated to the experimental sciences: the four ecosystem functions re-organisation, exploitation, conservation and release (Holling, 1986; 2001, 394) may be seen as an attempt to understand how nature can fight extinction. Also the first definition of resilience reveals a number of features in common with the social sciences (Holling, 1973, 17). Analysis of ecosystems using the resilience model allows us to consider nature not only as a system that constantly seeks equilibrium, but also as a system able to evolve, depending on specific inner conditions and on the contest that surrounds it. There are four crucial aspects of resilience (Walker et al., 2004, 2-3). Among the various aspects, it is necessary to stress that ecosystem management may be included in the urban planning and, therefore, deal with challenges such as the risks and the duty of the administrations to tackle it (Holling, 2001, 404).

The deterministic approach, based on efforts to collect data and the use of a linear, consistent and sequential approach are not able to improve the correct prediction of future events. The idea of uncertainty should be accepted. It is crucial to recognize our ignorance and create a new pattern to conceive nature, which evolves through human actions in a way that cannot be anticipated by our predictive models (Holling, 1973, 21). The relationship between resilience and sustainability becomes more specific if we consider the field of resilience management. In this case, resilience may be considered as one of the aspects of sustainability in terms of value (Starik, & Kanashiro, 2013, 21).

An example of the joint use of the concepts of resilience and adaptation may be clearly detected in the European Commission operational plan (CE, 2011, 14).

Recent studies on the idea of applying resilience to planning (Davoudi, 2012; Porter & Davoudi, 2012; Davoudi et al., 2013) have changed those approaches which used the concept of resilience as a keyword able to reconcile the contradictions between the need to combine resilience approaches based on mutual learning, cooperation, participation and self-sufficiency – most of which have not yet been tested in the field – and the wide range of existing models of analysis and linear actions focusing on prediction, the number of data and their precision, the operative accuracy of the regulations and the implementation of organisational and mainly normative dispositions.

A resilience framework can be built around the crucial idea of preparedness, which is the learning capacity that a system has before, during, and after a critical event. Preparedness may be divided into three linked aspects: persistence (being robust), transformability (being innovative), and adaptability (being flexible). These are not just recommendations: in fact, adopting a resilience approach to tackle future or present shocks is extremely difficult both from the local and multilevel governance points of view. This term should

be used carefully and, above all, it is essential to pay attention to the characteristics and aspects of the social, economic and cultural ecological systems to which the resilience approach will be applied, as experts in ecology do. These difficulties are well known to central governments that are looking for a solution to the problems of climate change as they are asked to strongly cooperate at multi-institutional level. Therefore, they need a transition, that is to say, a deep change in the mutual cooperation between planning, decisional and financing organisms and the local systems in a way that will allow them not to be isolated and left alone (Carmin et al., 2013).

We have several analysis of the urban resilience in physical sense (Colucci, 2012; Galderisi, Ferrara, 2012; Salat, Bourdic, 2012) and now we need more studies and theories on the social and urban resilience policy connections. This brief introduction shows that, despite resilience belonging to the world of natural science, its application in the world of ecological systems has produced a number of creative ideas for planning at all levels. It represents a crucial approach to adopt before, during, and after a critical event occurs. Adaptation, on the other hand, involves a wide scope of situations in which resilience is applied to support the sustainability policies to be adopted and implemented.

## 2 RESILIENCE IN ACTION

By analysing the guidelines of resilience theory, it is possible to identify several action opportunities that municipalities may implement to face the most urgent challenges, from safety risks to social problems such as mobility, energy saving and social exclusion (that will be examined below). As a result, it is possible to list a series of aspects of resilience that should be put into force by local governments: a) learning capacity, b) redundancy, c) diversity, d) self-sufficiency and connectivity. The above-mentioned theories provide useful guidelines for the adoption of actions concerning the learning capacity that a system develops from past and present events as well as the importance of conserving inner diversity in order to improve the ability to withstand external stresses and critical shocks. It is therefore necessary to stress the important role of redundancy and, above all, self-sufficiency and connectivity for local governments.

Overabundance of data, information and infrastructures for facing the problem of risk assessment is often considered overwhelming and a waste of public resources by urban and local policy makers. They often focus primarily on tackling social and economic problems and then on predicting the risk that such emergencies may actually occur. On the contrary, urban systems need to constantly implement redundancy, especially in terms of public safety, i.e., the distribution of drinking water and energy, building alternative highways and railways in the event of structural failure in the main ones, public health, building shelters in the event of earthquake or tsunami, etc.

On several occasions, local policy-makers have applied the resilience approach to food by creating urban gardens to gradually create a balance with highly built-up areas<sup>1</sup>. In order to give greater importance to redundancy in the public sector, policy-makers often use a linear and rational approach, setting-up new laws and regulations, but in so doing, they increase red tape. This kind of sequential approach influences the choices of policy-makers. As a result, the level of resilience is at risk as well as the evolving ability that should characterize a resilient adaptive cycle. In Italy, this is true for the programs adopted by the Civil Protection Agency and implemented by the central Government via the Prime Minister, without the involvement of the Local Authorities.

As far as self-sufficiency and connectivity are concerned, it is necessary to draw a parallel between the family sphere and the ability to communicate. Those who are alone or have difficulties in communicating possess lower resilience than those who are able to create dialogue or accept support and advice, especially

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<sup>1</sup> See the case of the proliferation of urban gardens in Milan. Retrieved October 20, 2015, from:<http://www.agricity.it/pagina-di-esempio/orti-in-zona/> (accessed on May 30th 2015)

when these are provided by agencies and associations close to the subjects and not belonging to a different contest. Self-sufficiency is thus applied not to a single person living in a determined ecological system but to the system itself. For this reason, the inner connectivity of a system is a pre-condition to self-sufficiency and diversity, as stated above. In a large local urban system, decentralization is crucial as it represents an essential aspect of urban planning, aimed at developing self-sufficiency and inner connectivity (Harrison et al., 2014).

It is furthermore necessary to stress that besides the adoption of actions of horizontal cohesion inside the system and between local systems, it is also crucial to create vertical cooperation and subsidiarity between central and local governments.

### 3 THE SITUATION IN THE SICILY REGION

The island of Sicily constitutes an autonomous administrative Region of Italy and has its own special statute. The central government acknowledges the Region's autonomy in relation to the environment and urban and territory planning. In terms of risk assessment, the main regional plan is the Regional Civil Protection Programme. This scheme<sup>2</sup> provides the tools for identifying and assessing risk in the region, to identify the different regional areas and to select and plan preventive measures to mitigate critical events.

According to the national government law, the regional government of Sicily has set an internal organization for risk assessment and for the planning and programming of interventions for prevention and response to disasters. For example in the field of hydro-geological risk, considering homogeneous (n.9) zones of alert, the Multirisk Regional Centrum evaluate the effects on the ground of rainfall by the processing of the data collected by the control units rainfall considering the time series.

The Civil Protection Plan is consistent with other regional plans: the Hydrological System Plan, the Forest Fire Plan, the Regional Landscape Plan, and the Water Sanitation Plan. A number of research hubs cooperate in drawing up the different Civil Protection plans in Italy such as Enea, the Institute of Geophysics, the National Geological Service and others. The plan is implemented through the work of a specific regional office, the "Decentralized Multi-Risk Operative Centre of the Region of Sicily"<sup>3</sup> which collects correct and updated data ready to be used by the Civil Protection. The Regional Civil Protection Plan draws attention to, and studies, the assessment of regional risks and detects risk prevention and mitigation measures. The plan aims to improve land management by the Civil Protection Agency as follows: a) identifying public buildings, especially schools, b) upgrading earthquake security and/or the refurbishment of sensitive and strategic buildings, c) detecting and planning actions to preserve the hydrogeological system. The regional risks assessed by the Plan are: 1 – seismic and tidal wave risk; 2- hydrogeological risk; 3 - volcanic risk; 4 – industrial and environmental risk; 5 – forest fire and interface risk; 6 – health and social risk.

Environmental monitoring is carried out by the Environmental Department of the Regional Office for the Environment and the Territory<sup>4</sup> whose objectives are: a) strategic environmental assessment, b) environmental impact assessment, c) integrated environmental authorisation, d) impact assessment, and e) EU planning for structural funds<sup>5</sup>. The most important aspects of designing the resilience measures to implement in the regional cities include: a) drawing up an "Environmental Status Report", b) outlining the "regional opinion on national plans and programmes", and c) collecting and updating data concerning "environmental and sustainable development indicators for environmental risk assessment measures". In

<sup>2</sup> Decision of the Regional Executive of Sicily no. 2 of January 14th 2011.

<sup>3</sup> Decision of the Regional Executive of Sicily no. 530 of December 19th 2006, under the Directive of the President of the Council of Ministers of February 27th 2004.

<sup>4</sup> As far as "environment norms" are concerned, the legal reference is the Italian Legislative Decree 152/2006 and the subsequent amendments and additions.

<sup>5</sup> Structural Funds – Resilience in Cohesion Strategy. Retrieved October 20, 2015, from: [http://ec.europa.eu/budget/library/biblio/documents/fin\\_fwk1420/MFF\\_COM-2011-500\\_Part\\_II\\_en.pdf](http://ec.europa.eu/budget/library/biblio/documents/fin_fwk1420/MFF_COM-2011-500_Part_II_en.pdf).



December 2014, this Regional Department drew up a Regional Plan for flood risk management. The final plan will be set up in 2015 thanks to the cooperation of Sicilian Institutions and scientific centres. This plan will provide the guidelines for integrated urban planning in relation to rain risk and its direct and indirect impact on the environment. It is the first regional plan to modify the local planning program, starting with the data collected by the risk assessment system. The plan is compliant with European directive n. 6 of 23rd October 2007. This directive promotes the improvement of flood risk assessment and management in order to reduce its negative impact on human life and health, the environment, cultural heritage, economic activity and infrastructures. The Directive splits planning activity into three phases: phase 1 – preliminary assessment of flood risk; phase 2: development of maps of flood risk and danger; phase 3 – preparation and implementation of flood risk management plans (by 22 December 2015). A periodical review and update will be carried out, taking into account the impact of climate change on the occurrence of floods. There will be, a) a review of the preliminary risk assessment at the end of 2018, b), a revision of the flood risk and danger maps in 2019, and c) a restructuring of the risk management plan in 2021. At a later stage, the reviews will be carried out every six years and will take into account the impact of climate change on the occurrence of floods. Legislative Decree n.49 of 2010 assigns the management of flood risk to the Water Authority which, nevertheless, has not yet been established by the Central Government. As a result, the plan must be implemented by the Regions themselves (Legislative Decree 219, 10 December 2010).

The website of the Regional Agency for the Protection of the Environment is responsible for updating the environmental data collected throughout the region.

Besides the Hydrological System Plan and the compulsory disaster risk planning carried out by the Civil Protection Agency, there are no other crucial regional plans to improve the integration of the regional measures on sustainability capable of acting as an interface with the European Union and the Central Government at the upper level, and with Municipalities and the Regional and Local Institutions at the lower level. Despite several attempts over the last 40 years, in 2015 the Region still needs: a) a New Plan for Transport and Integrated Logistics; b) a Regional Waste Plan; c) a Regional Landscape Plan, and d) a Regional Plan for Economic and Social Development – which must be different from the structural fund operative programs as there is a need to set long-term targets and create sustainability schemes going beyond a six-year period.

The urban regional law dates back to 1978 and includes some important changes introduced in 1991. In 2003 was the draw of regional plan with several innovative ways of physical data interpretation for the planning regional choices<sup>6</sup>. During the 2013 the policy-makers tried to drawing up new regulations to renovate and remodel the tools of local urban planning by a regional law of urban planning<sup>7</sup>.

Given the lack of regulation for a regional sustainable development plan, the measures promoted by the National Government to improve access to the European structural funds represent the only analysis and implementation system to detect and plan environmental control and analysis actions in Sicily. The measures included in the national operative programs, divided over the four structural funds available, are scattered over the different regional offices, thus losing in efficiency.

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<sup>6</sup> Regione Siciliana, Dipartimento Urbanistica (2003). Rapporto dal Territorio 2003. Sicilia. Istituto Nazionale di Urbanistica, Roma (Italy). Retrieved October 20, 2015, from [http://www.artasicilia.eu/old\\_site/web/servizio\\_1/scarica.php?id=rapporto\\_inu.pdf](http://www.artasicilia.eu/old_site/web/servizio_1/scarica.php?id=rapporto_inu.pdf)  
Regione Siciliana, Dipartimento Urbanistica (2009). Argomenti di Pianificazione 2009. Contributi per la riforma urbanistica in Sicilia. Palermo (Italy). Retrieved October 20, 2015, from [http://www.artasicilia.eu/old\\_site/web/servizio\\_1/argomenti\\_2009.pdf](http://www.artasicilia.eu/old_site/web/servizio_1/argomenti_2009.pdf)

<sup>7</sup> Pessina, R. (2015) Ddl riforma urbanistica bloccato all'Ars da 2 anni. La sedicesima legislatura e le materie che richiedono un urgente intervento. Ddl n.161 del Mpa, Ddl n.135 del Pd e Ddl n.873 del M5S. *Quotidiano di Sicilia*, August 26, 2015. Retrieved October 20, 2015, from <http://www.qds.it/20298-ddl-riforma-urbanistica-bloccato-all-ars-da-2-anni.htm>



Municipalities find it difficult to implement the different operative plans which directly depend on the choices of the regional departments.

Given the confused regulations and the existence of two different procedures (there are two different laws: national and regional), the individual municipalities must face huge difficulties when designing an efficient expenditure plan, and respecting the schedule set by the European regulations.

Nevertheless, it is essential to complete the regional physical planning within and between the regional departments. Furthermore, it seems first of all that the cities must continue to test the environmental risk adaptation measures which should be regarded as the guidelines for daily urban planning. The latter may be seen as the pillar of regional urban reform.

To conclude, it may be stated that despite the existence of a detailed but outdated and incomplete sustainable planning scheme, the regions still need to come up with a regional resilience plan of adaptation for specific urban management areas: transport, building, and energy saving. Cities must address present/future shocks alone or by seeking the help of the National Government or by experiencing a transition to different approaches to government.

## 4 ATTEMPTS OF SOCIAL RESILIENCE IN THE CITY OF PALERMO

### 4.1 THE URBAN CONTEXT

The City of Palermo, together with other higher level institutions, has long been working to recover its cultural heritage, on the one hand, and to reduce the infrastructural gap on the other, especially in relation to the public transportation system, waste-management and completion of the sewerage system. If these targets are not met, no growth or development is possible. Specifically, the last local governments have made it a priority to recuperate the southeastern coast and, more broadly, the whole coastline of the Gulf of Palermo which, in the past, was a favourite destination of painters, a quiet place to admire and enjoy the beauty of the city, its endless gardens, its crystal-clear water, its beaches and temperate weather. Nowadays, new projects to improve transport and the sewerage system are underway (new tram lines, a new railway, a new elevated subway in the city centre etc.)

These projects were planned and financed many years ago and were being built simultaneously and quickly in order not to lose the public co-financing resources in the event of problems linked to poor knowledge of the subsoil (archaeological/hydrological risk) or due to the technical and financial capacity of the building companies obliged to respect the schedule set out in their contracts.

Because the projects are old, communication between the citizens and the local administrators failed. As a consequence, some forms of social protest emerged, with further risks of delay.

Strategic planning focused on the improvement of the transportation system and, in particular, of road transport. Meanwhile, after Unesco acknowledged the artistic value of Palermo's cultural heritage, the local government is ready to make an effort to protect these assets by creating pedestrian areas and other urban solutions. In general, local policy-makers based their actions on solving these problems and the urban regeneration of abandoned or rundown areas to maintain political consensus and to seek cooperation at national and European level. No action has been taken to tackle the economic and social crisis affecting the city, nor to face the environmental crisis due to the presence of unidentified refuse on the southeastern coast or sea pollution resulting from the poor control of dumping and the incomplete and outdated water treatment system in the whole of the Gulf.

Climate change has already caused serious hydrogeological problems and several parts of the city are at risk of flooding. Among all the measures taken by the local government thanks to the European Structural Funds, the Operational Program for the Metropolitan Cities of Palermo (PON METRO) may be regarded as

the most interesting intervention to detect points in common with the resilience approach. Other tools, such as the municipal social plan, concern future crisis adaptation and preparation measures.

## 4.2 THE SOCIAL PLAN

The City of Palermo is undergoing a period of huge social crisis which has recently worsened due to the high level of unemployment caused by the international financial and economic crisis. The latter further exacerbated a situation that was already critical in the past and that has reached one of the highest levels of criticality in the whole nation<sup>8</sup>. In addition to the increased female and youth unemployment rate, the high number of families at risk of poverty represents the most serious social emergency, together with those citizens that don't have resources and access to decent housing.

Every day, the social department of the government of Palermo has to "provide efficient responses, in order to avoid a systemic risk in the short and long term" (Mayor's Annual Report, 2013-2014, p.55).

The local government should test new actions to construct the basis of resilient planning counting on two leverages, one for the short term, and one for the medium term (the PON Metro) together with one for the long term, namely a comprehensive Social Plan. The plan was launched in 2013 and through a continuous dialogue with the other existent plans (the town planning scheme, the strategic plan and the city covenant) and with the EU Structural Funds planning for 2014-2020 (ERDF and ESF) aims to increase participation by the municipalities thanks to the cooperation of the presidents and counselors in meetings for public and private social partners.

The Plan's main target is to create a Laboratory able to face and solve the problems linked to the Citizenship rights, here regarded as the main tools to improve Palermo's urban life. The social urgency is still further increased in Palermo, due to the employment crisis caused by the international economic and financial situation, which has worsened a pre-existing critical situation and is proving far more severe than in the rest of Italy. In addition to the unforeseeable increase in unemployment among young people and women, the most serious social urgency perceived by the municipal authorities is the growing number of families living below the bread line and the same number of citizens who are completely homeless and have no resources in order to obtain basic accommodation.

For the municipal authorities, it is necessary to experiment with solutions meeting the need to go beyond simple responsiveness to social phenomena, laying the foundations for a resilient program through two medium and short-term levers (PON METRO) and a long-term lever with an authentic Social Plan. The plan was started in 2013 and, by constantly referring to all the other plans – the general town planning scheme, the strategic plan and the city covenant – and by programming the 2014-2020 Community Structural Funds – especially ERDF and ESF – is based on a participatory incremental approach that, starting from public sector meetings, has progressively involved municipalities, where presidents and councilors have taken part in formal meetings open to private and public authorities committed to social issues

The Social Plan building process started from an event were some public workshops held on April 10th-11th 2013 at 'Cantieri alla Zisa' public cultural farm location. The issues of this 'Social Plan for the City' was discussed by using a bottom-up methodology with several urban stakeholders: Ong, delegates of municipal districts, social and development local agencies, social & health services, school observatory, academics, trade union delegates, entrepreneurs and financial advisors. The workshops included various opportunities to meet, ponder and share views about the management of: a) Europe and Mediterranean b) Metropolitan City/Area and Urban Identity, c) Development Strategies, d) Design & Assessment, e) Formal & Informal

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<sup>8</sup> The Economist "A tale of two economies. As the north limps ahead, the south swoons" May 16th 2015. Retrieved October 20, 2015, from <http://www.economist.com/news/finance-and-economics/21651261-north-limps-ahead-south-swoons-tale-two-economies>

societal Networks, f) Social Services & System Actions, g) Participation, h) Ideas, strategies, programs and resources to re-thinking the Metropolitan City of Palermo.

The Social Plan is defining at administrative level (without public costs ) only during 2015. This Plan provide for the creation of a new Social Laboratory with public and private participation and cooperation. The Social Laboratory promote a dynamic action of transversal and multi - sectorial setting to regenerate and motivate the Municipality's administrative and technical several parts toward a new organization open to the citizens at the metropolitan level.

The main goal of the Plan is to create a Workshop to address and solve the issue of citizenship rights, fundamental tools for radically modifying Palermo's social fabric.

#### 4.3 THE PON METRO PLAN IN THE CITY OF PALERMO

The National Operational Program for metropolitan cities<sup>9</sup> is a tool coming under the co-financing policies of the EU Structural Funds, under the competence of the national government. The areas which the national programme apply to are the metropolitan areas, three of which are situated in Sicily: Palermo, Messina and Catania. Most of the co-financing resources are allocated in the South of Italy.

In the City of Palermo, the PON Metro Social Inclusion and Smart Cities policies focus on a specific area called "Southern Coast". This area is characterized by a high presence of organized crime and the existence of the last free areas suited to urban transformation. The local administration has often tried to allocate external investments to these areas in order to support the social actions undertaken for the local population. This initiative also involves other municipalities situated close to the City of Palermo and throughout the Gulf.

The actions planned involve the building of cycling lanes, bike sharing, smart lighting and many technological actions to support social services, including social housing.

The Mayor's Report for the period 2013-2014<sup>10</sup> provides a clear idea of the targets set by the local administration in relation to the two main pillars of cohesion policy (Smart and Inclusion) that must be respected in the framework of multi-level connections between national and regional planning (Urban Agenda). A detailed proposal was launched by the City of Palermo in December 2014. During 2015, the PON Metro will be reviewed and implemented by the European Commission. For this reason, analysing the single projects that applied for financing seems unimportant. On the other hand, it is crucial to examine the strategic approach adopted by local government in order to underline the main aspects of resilience and their chance to be implemented by the local administrators in Sicily. The administration tried to allocate some projects financed by the Minister of Internal Affairs to the area that surrounds the above-mentioned district of Brancaccio, which is affected by a severe economic, social, environmental and cultural crisis (Cavaleri et al., 2008).

The provisions of this plan focus on the south-east of the city, traditionally characterized by agricultural and industrial production as well as by a greater presence of railway infrastructures and the national and local bus terminal. In this area of the city, where almost seventy thousand people live, the city's first tramline should be operative in 2015.

The one hundred million euros plan – thirty of which will be used for social problems – aims to:

- increase sustainable mobility in urban areas, especially the south-east coast

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<sup>9</sup> PON Metro as national policy. Retrieved October 20, 2015, from [http://www.dps.gov.it/it/programmazione\\_1420/PON\\_Metro/index.html](http://www.dps.gov.it/it/programmazione_1420/PON_Metro/index.html) (accessed on May 30th 2015); Pon Metro as pre-implementation phase. Retrieved October 20, 2015, from <https://drive.google.com/file/d/0B9NoeFeOf2sRaURzX0RTQIZDZ0E/view?pli=1>.

<sup>10</sup> 2013-2014 Annual Report by the Mayor of Palermo. Retrieved October 20, 2015, from [http://livesicilia.it/wp-content/uploads/2014/09/Relazione\\_2014.pdf](http://livesicilia.it/wp-content/uploads/2014/09/Relazione_2014.pdf) (accessed on May 30th 2015).

- reduce energy consumption in residential and non-residential public buildings and facilities
- promote digital services in other sectors, through the implementation of smart integrated services (joined- up services).

The plan also includes actions to promote social inclusion and fight poverty as the local administration puts the social crisis at the top of the agenda.

All the PON Metro projects represent an integrated action of e-inclusion whose objective is to promote the inclusion of the weakest and the poorest. This strategy will be implemented through the development of new services and the adoption of new technologies for users and to support the actions of other associations and mediators.

The benefits will be: a higher level of literacy among disadvantaged groups; reduced costs of social services and a more effective use of resources (operators); the reduction of the housing crisis; de-mobilization; a new way to use transport; the chance to use space in a new way; the creation of multifunctional areas close to residential areas.

The e-inclusion strategy of Palermo PON METRO can be carried out by developing new services to the troubling citizens. This strategy wants to exceed the traditional 'standard' service delivery towards a shared building of ad hoc services with (not for) individuals or groups of troubling citizens. This strategy is embedded in a sharing frugal technology that is common to public administration and all citizens (smartphone, etc.) not centered in a new big smart structure. It is important and very simple that local authorities activate open data to a new dimension making social delivery with citizen participation. In the PON METRO program there is a 'Social Lab' and a big centre for science museum with social targets (service delivery to the Brancaccio district).

So that highlights the evidence of several analogies of the PON METRO program with the Social Plan but the first initiative has no connection or crossbreeding with the second one. Probably the reason of this no matching is located in the deep difference of logical framework of the two policies of the Municipality: Social Plan is an 'open' structure of a new form of PPPP (Public Private Partnership People) but PON METRO is a technical proposal of a 'problem solving' model.

## 5 URBAN RESILIENCE IN SIRACUSA

### 5.1 THE EXPERIENCES OF A SICILIAN SMART CITY

Following the IBM Smarter Cities initiative, which has awarded 116 Municipalities all around the world in four years – with Siracusa as the only Italian city – Siracusa has fostered a structured activity programme in the framework of "smart" policy innovation. The main activities include:

- awarding the "Renewable Energy and ICT for Energy Sustainability" tender called by the National Research Council (CNR) in agreement with the National Association of Italian Municipalities (ANCI);
- to be selected by the York Municipality (UK) as a partner in the good practices exchange programme for the URBACT II PILOT PROJECT – GeniUS PLATFORM;
- to award SMAU Rome 2014 with the Smart City Roadshow prize for accomplishing, in collaboration with IBM, the "Siracusa Love City Index" project.

The resiliency projects carried out by the municipal authorities are organized into the following phases.

### 5.2 IBM SMARTER CITIES CHALLENGE

The City of Siracusa on the island of Sicily in Italy was one of the 100 cities selected to receive a Smarter Cities Challenge grant from IBM in 2012 as part of IBM's citizenship efforts to build a Smarter Planet. During

three weeks in June 2012, a team of six IBM experts worked to deliver recommendations on key challenges identified by Siracusa.

Every recommended activity is founded on five principles. Syracuse promote Smart implies, not only foster economic innovation, social inclusion and environmental sustainability, but also:

- Promoting innovation in the protection and enhancement of cultural and environmental heritage;
- Encourage research in renewable energy;
- Make the efficiency of logistic systems and the flow of goods, people and ideas;
- Promote the active sharing of choices to promote the approaches taking on new global challenges;
- Connect and integrate infrastructure and urban services through the development of smart solutions based on ICT.

Following these principles should be automatic for everybody who shares the vision for the future Siracusa. They are values that should be kept and fulfilled by all stakeholders and citizens, in every activity and project that leads to a smarter Siracusa. Collaboration is key – all stakeholders need to be involved and participate in making Siracusa smart. Information-sharing – all actions, plans and decisions must be transparent. This is fundamental for building trust amongst stakeholders who are working towards a common goal. Decisions based on data – both operational and strategic long-term decisions should be based on facts supported by reliable data collected from a variety of sources. The Siracusa brand – all actions and projects must take the building and preservation of the Siracusa brand into account. Influence behaviors – bad habits and lack of civic duty should always be positively influenced through incentives and enforcements.

Enablers make up the first set of pillar recommendations based on these principles. They define key, fundamental projects, which are essential to the success of any further interventions. It is critical that any project in the areas of tourism, environment or urban planning be developed through these enablers. Without this, the chance of success when intervening in any project is dramatically reduced. The pillar recommendations are as follows:

- Enhance collaboration – “The power of many”. This pillar is defined by the projects, actions and tools that can improve collaboration between municipalities, the various stakeholders, and citizens
- Build a Smarter City Centre of Excellence (CoE) – “Manage through data” defined by efforts to improve planning and management methodology for all the projects recommended by the SCC team. It also introduces the means for measuring success and tools that enable better decision making, both from the point of view of a short-term operational horizon and long-term strategic planning.

### 5.3 SMART CITIES LIVING LAB SIRACUSA

The city of Siracusa has been awarded the CNR-ANCI “Smart City Living Lab - Energia da fonti rinnovabili e ICT per la sostenibilità energetica” prize, having won the supply and installation of innovative technologies in the Cultural Heritage field and the management of the city services. The project started out with the aim of enhancing artistic and cultural heritage in the City of Siracusa, by studying and implementing innovative and interactive usage methodologies. The project has also set itself the objective of raising citizens' and tourists' public awareness of environmental issues. Some devices have been installed in the territory to monitor meteorological and environmental parameters, useful for the study of “urban metabolism”.

In addition to a high precision fixed station at the city hall, 6 other fixed stations have been installed in information totems and 10 georeferenced mobile stations, 7 positioned on municipal police cars and 3 on the Traffic Police's mounted officers' assisted bicycles.

#### 5.4 TWINNING PERUGIA-SIRACUSA "TOWARDS A SMART CITY"

Siracusa has joined the Directorate-General for the Regional Community Policy initiative of the Department for Development and Economic Cohesion (Ministry of Economic Development). In the context of the AGIRE POR 2007/2013 project, it promotes the creation of twinnings with the aim of transferring models from tendering administrations to recipient administrations in convergence regions, developing together with the Municipality of Perugia the PER-SIR Twin project 'toward the Smart City'.

The aim of this twinning can be summarised as the transfer, by Perugia to Siracusa, of all models –tried with success– for the implementation of central monitoring and traffic management, both public and private.

The aim of this twinning can be summarised as the transfer, from Perugia to Siracusa, of all successfully tested models for the implementation of the central monitoring and traffic management, both public and private. The fundamental task of the monitoring and traffic management centre is to develop observation and control strategies in order to optimise road network use via traffic fluidification and distribution, and the limitation or reduction of access to critical areas in terms of congestion or environmental conditions.

#### 5.5 ENERGIA INTERREGIONAL OPERATIVE PROGRAMME

Prototypal Action "a", replacing traffic lights with LED lamps and installing traffic light controllers, and webcams.

Prototypal Action "b" replacing street lamps with LED lamps and enabling implementation for the transmission of a high-speed power line carrier to supply services, also aimed at a more effective and efficient management of the Limited Traffic Zone in the historic centre and better management of freight traffic in protected areas.

Prototypal Action "c" Set of photovoltaic shelters covering the parking area located close to the Siracusa Law Courts.

#### 5.6 URBACT GENIUS

Since January 2014 the Municipality of Siracusa has been involved in the European Urbact Genius project, aimed at transferring the good practices of open innovation from the city of York to Siracusa, Tallin and San Sebastian. Open innovation is a method, a governance approach that tears down the barriers of public administration and addresses all citizens in order to plan together how to develop a territory. The project has allowed us to test a new development method and has combined the use of an online platform promoting discussion with all the citizens and the use of participatory methods making it possible to listen to the people and co-plan with them focusing on a specific challenge related to our city. Among the many priorities and needs, it was decided to start from the most critical area of the city: the outskirts, and in particular Mazzarrona, the heart of the Grottasanta district.

### 6 - DISCUSSIONS

The Municipality of Palermo has adopted a solution in order to cope with the social and mobility emergency, meant as a priority for the growth and development of the city, viewed not as bases/conditions for development, but as a risk of loss/extinction of any other future development opportunity. This solution consists in a resilience approach focused on networking information, on trying to enable the municipal authorities to pay attention to the city's human powers, not before, but during the crisis, and is jeopardizing social cohesion and therefore undermining the city's resistance possibilities. Every project effort and the



municipal authorities' ability to acquire financial resources focus on mobility, therefore on the attempt to deal with the traffic problem through structures (major works). The city is stressed by major construction sites in every district, both at the centre and in the outskirts. Such works are expected to be finished and completed without excessively compromising the existing tertiary activities and without seriously damaging the existing building stock, both of which are already being damaged because of design errors or because of enterprises experiencing difficulty in delivering within the terms of their contractual obligations. Indeed, serious problems and protests are arising in the areas where the works are concentrated: these are slowing down because of the crisis that is bringing the whole of the construction industry in Sicily to a stalemate. More major works will have to be designed and put into operation. The effort required for the new infrastructures to be designed, scheduled, financed and built in a very short timescale in order to avoid losing Community co-financing is progressively neglecting the real resilient work which, as already stated, consists in local and supra-local planning.

As Siracusa is a smaller city, on the other hand, it has been possible to progressively train the municipal authorities on a number of diverse issues aimed at understanding the main risks: pollution, loss and devaluation of its world famous cultural heritage and loss of energy-saving power. The various local governments are increasingly aware of the risks related to Siracusa being near the petrochemical field of Priolo-Augusta, which is causing highly dangerous geological phenomena (Aureli et al., 2004); therefore, the municipal authorities have gradually been dealing with problems through the few available resources. Being aware of their significant limits has not prevented the authorities from aiming to network all their internal resources and successfully attempting to ask outside powers for aid, in order to achieve results which wouldn't be achieved autonomously, but simply by openly admitting their difficulties. Such willingness to relate to external outside powers is allowing the municipal authorities to achieve significant results. These include IBM awarding Siracusa Italy's smarter city, thanks to the request for help and support for a guide to a resilient approach to the town's environmental risk issues (air and subsurface pollution due to the nearby petrochemical field), economic risk (the industrial crisis causes unemployment and is not a trigger for agricultural recovery), social risk (social degradation in the outskirts) and cultural risk (the Unesco heritage is in jeopardy because of environmental pollution and management difficulties due to the lack of public resources). In comparison with the current trend, limited but steady success, from the point of innovation in all the sectors at risk, has led to a positive assessment, provided that long-term policies are not discontinued and are regularly followed up.

Urban and territorial planning based on resilience approaches helps decision-makers, stakeholders and citizens – individually, together and as a community - to enact self-learning processes. The tentative approaches put into practice in extreme southern Europe that have been briefly mentioned above, even if they are not explicitly ascribed to resilience, demonstrate that municipal authorities significantly care about social and infrastructural issues, which are of interest in analysing planning styles. Their uniqueness, in comparison with the rest of the country, perhaps lies in the different way shock is perceived, which is the real catalyst to individual and collective resilient approaches. The shock perceived in this European region is a constant economic, environmental, social and cultural concern, objectively ongoing since the end of the Second World War. Therefore, emergencies are easier to deal with only when they arise, whereas being prepared for shock is difficult. Preparation activities – e. g. overabundance, which always appears useless or risky – is in some cases neglected - by common consent - in favour of infrastructural empowerment, the collection of abundant data, and promptness in carrying out planned projects. As a result, reactions to foreseeable future shocks vary or are different for every municipal authority.

The most outstanding aspect is the relationship between decision-makers and uncertainty management, which becomes critical when major public work or complex care systems for the resistance of social cohesion

have to be performed or planned. Better responsiveness seems to emerge when the municipal authorities set achievable objectives, in line with the effectively available capabilities and power and, especially, when the capability of building long cooperation networks exists and is consolidated. If municipal authorities set large-scale and politically stimulating objectives, and when concrete physical transition of the city with a view to reacting to possible concerns and real decline risks depend on such objectives, flexibility decreases. At the same time, these actions stretch and may become disproportional if compared to the levels of internal cohesion and interaction capability aimed at sharing expertise outwards - and not at requiring power, regulations or finances.

The two local contexts show that resilience is detectable even in the extreme south of Europe, although it is not explicitly mentioned. The expectation about the outcomes of such approaches, though, focuses on the next stage, in which both Palermo – the 5th most populous Italian city – and Siracusa – Italy's 34th most populous city - will directly address the most significant environmental risk-related issues. The most urgent action in Palermo is to address coast pollution and the flood and hydrogeological risks aggravated by the massive overbuilding of the entire flat area, while in Siracusa it will be necessary to address desertification and seismic risks and those related to the air and soil caused by the petrochemical processing plants. In compliance with European planning, large public resources were and are still available in order to address and solve at least the issues related to hydrogeological risk, thus there is no shortage of tools that can be deployed, not only for urgent projects for securing entire hill and mountain slopes that have been sliding down over the last ten years and are even putting at risk some strategic connection systems in Sicily. The most suitable solution, instead, should be to plan these activities in preparation to adopt mid and long-term resilience approaches. This requires that planning in large cities like Palermo be no longer like a black box about which only decision-makers are thoroughly informed. In this way, as soon as implementation difficulties arise, citizens can disagree and strive to defend what they consider a priority, even though objective chances to intervene no longer exist. In these cases, even though the willingness to operate without wasting time in order to maintain political consensus is comprehensible, it is impossible to address social, economic and environmental risks without resilience-approach planning, otherwise works and protests would risk coming to a stalemate and political consensus would collapse. Participation and sharing will have to become part of the planning activity of the main actions, especially as far as major works – public mobility, energy, and new urban cores - are concerned, so that issues arising when addressing social, economic and environmental emergencies will produce collective learning. Creating participation opportunities only when the construction sites of major works are opened or when large public resources are deployed for social cohesion emergencies is contrary to resilience. In average cities like Siracusa, it is important for step-by-step policies to be kept constant together with communication and confrontation activities. On the whole, the two cases demonstrate how advisable and opportune it is to adopt resilience approaches: they prove, indeed, to be viable since they do not depend on the amount of funds, but on how carefully such funds are deployed and how flexible the municipal authorities are in determining priorities; within this framework, that can be efficiently referred to as political attention for readiness to risks, municipal authorities aim almost exclusively for an internal confrontation among local powers and a growing external openness – i.e. subsidiarity and cooperation – and, above all, they do not necessarily wait for external aid, or the empowerment of infrastructure provision and knowledge data banks – circumstances that will perhaps never occur together.

## 7 CONCLUSIONS

The Palermo and Syracuse case studies are different in terms of the types of instruments used and human, financial and organizational quality levels, but there are also similarities as both belong to the same regional

context with its economic, social and environmental crisis. The comparison of policies to increase urban resilience in the social dimension of the Palermo and Syracuse municipalities shows that the ability of local governments depends on their degree of internal cohesion and openness to the cooperation with the available forces for active citizenship. The different experiences of interaction and cooperation between local authorities and agencies providing social services from the private sector, assessed as good practice or as failures, are processes of self-learning. These processes, when and if they develop concretely in the urban dimension, constitute a capital of collective knowledge that public authorities must be able to consider as a basis for building new practices and policies of urban resilience in the social dimension. New policies are needed stimulating local authorities capacity in policies of urban resilience based on interaction within public institutions and private non only in visioning or in participation processes but in the co-creation of social innovation practices and especially in the experience's capitalization of these. Local governments can assist social groups or individuals affected by the social and economic crisis, supporting the launch and development of spontaneous processes of self-determination and self-regulation. The role of innovative technologies and integration with policies for sustainable mobility and energy are no guarantee of success for the initiatives of urban resilience in the social dimension promoted by public institutions.

Ultimately, public authorities that manage to mobilize the forces of active citizenship may abandon policies of urban development primarily dependent on a search for huge public financial resources for high-cost, highly technological infrastructures, whereas these initiatives almost always leave citizens in a position of passive waiting, estrangement or opposition.

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## IMAGE SOURCES

Cover image: Gulf of Siracusa and the heart of the Local Communities - elaborated Luigi Minozzi

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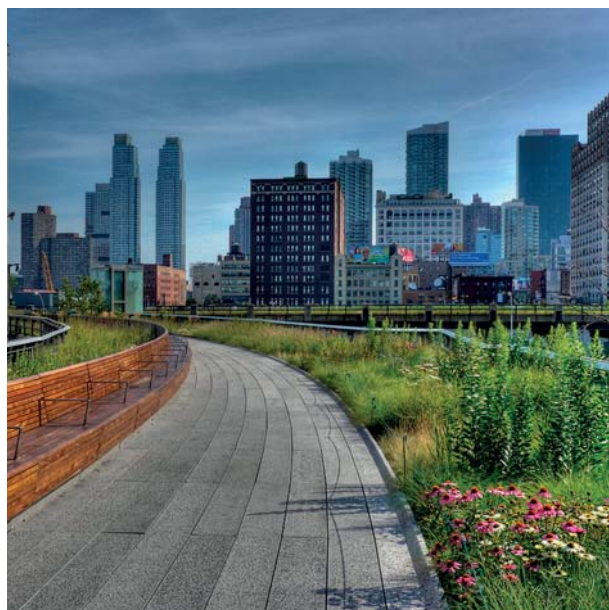
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## EUROPEAN CITIES DEALING WITH CLIMATE ISSUES

### IDEAS AND TOOLS FOR A BETTER FRAMING OF CURRENT PRACTICES

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#### ABSTRACT

Contemporary cities have to deal with numerous challenges, from the growth and aging of urban populations to the scarcity of resources; from environmental degradation to climate change. Climate-related impacts on urban areas are becoming one of the most urgent challenges for urban development: cities are the main contributors to energy consumption and GHG emissions, paying also the highest price for the climate impacts. Thus, climate issues have gained increasing importance in the last decades, both in terms of the metaphors coined by scholars (low-carbon cities, transition cities, smart cities, resilient cities, etc.) and in terms of the initiatives undertaken on different institutional levels. Unfortunately, mitigation and adaptation are generally regarded as two different approaches, neglecting the potential synergies and trade-offs between the related strategies. Hence, based on the growing awareness of the need for mainstreaming mitigation and adaptation policies at city level, this study will provide an overview of the state of the art of the mitigation and adaptation initiatives in Italian metropolitan cities. Then, focusing on the concepts of the “smart” and the “resilient” city – as key concepts for reducing CO<sub>2</sub> emissions and improving the ability of cities to respond to climate impacts – and with reference to a conceptual framework for building up a smart and resilient urban system carried out in previous research works (Papa et al., 2015), the study will examine case studies of Rotterdam and Barcelona, highlighting how this framework may improve our understanding and contribute to better integration of the fragmented on-going strategies and initiatives.

#### KEYWORDS:

climate change, urban adaptation, integrated climate strategy



## 1 CITIES AND CLIMATE CHANGE

Contemporary cities have to deal with numerous challenges, ranging from the growth and aging of urban population to environmental degradation, from the scarcity of resources (from energy to water or land) to the impacts of climate change (Batty et al., 2012). Among these multiple and often interconnected challenges (Galderisi, 2014a), climate change seems to currently represent the main threat to urban development in the near future: cities are indeed the main contributors to energy consumption and GHG emissions paying, at the same time, the highest price for increasing climate impacts. Numerous scholars highlight that CO<sub>2</sub> emissions, mainly due to urban activities, represent about 80% of GHG emissions, which are, in turn, the main cause of the increased climate-related hazards currently threatening urban populations and assets throughout the world (Revi et al., 2014).

Considering that urban areas nowadays host more than half of the world's population and most of its strategic assets and economic activities, the urgent need clearly arises to develop both short term strategies - capable of improving the ability of cities to face already significant climate impacts (adaptation) by reducing urban vulnerability to climate-related hazards - and long term strategies - able to reduce CO<sub>2</sub> emissions (mitigation), by sustaining the transition of cities towards a low carbon development model.

So far, mitigation and adaptation have often been regarded by scholars, and even more so by policy makers, as two different ways "to deal with the same problem" (Biesbroek et al., 2009), neglecting the potential synergies and trade-offs between the related strategies.

In Europe for example – which is considered one of the world leaders in global mitigation policies – ambitious objectives to mitigate climate change have been established by the EU 20-20-20 Strategy since 2007. In 2011, the "2050 Energy Roadmap" set new long-term targets, aiming to achieve a further reduction of GHG emissions by 2050 (the 80-95% compared to 1990 consumptions). On the other hand, adaptation issues have only recently gained some importance: the EU Strategy on adaptation was adopted in 2013 and the Mayors Adapt Initiative, aiming to involve European cities in climate adaptation, was set up in March 2014. A similar fragmentation can be noticed when looking at the numerous and heterogeneous "labels" recently brought into the planners' language and concerned with the future of cities from the point of view of climate related issues (smart cities, resilient cities, transition cities, low-carbon cities, etc.). The different terms and approaches have led to a proliferation of initiatives and tools, often scarcely coordinated among themselves and scarcely integrated into ordinary urban planning processes. The most common labels, i.e., Smart City and Resilient City – whereby numerous initiatives to counterbalance climate change have recently been undertaken – refer, for example, to two different pathways addressing climate issues, being "smart" initiatives and projects mainly focusing on climate change mitigation, by reducing energy consumption and greenhouse gas emissions through a widespread use of ICTs (EIP, 2013), and "resilient" initiatives mainly addressed to adapting cities to climate-related impacts, reducing urban vulnerability (Hordijk, Baud, 2011). Studies and practices relating to the Smart City concept devote large room to the efficient use of energy resources and the reduction of current levels of consumption (Karnouskos et al., 2013, Kramers et al., 2014), emphasizing the potential for ICTs to improve urban energy performance (Mosannenzadeh, Vettorato, 2014). On the other hand, studies and practices relating to the Resilient City concept are mainly addressed to improving cities' abilities to react quickly and effectively to existing and future climate impacts in an equitable and efficient way (The World Bank, 2011).

Obviously, mitigation and adaptation strategies are characterized by different objectives as well as by different temporal and spatial scales of reference (Galderisi, 2014b). The former, aimed at reducing GHG emissions, generally result from international agreements, albeit implemented at national or local levels, and refer to a long-term perspective. Adaptation strategies, aiming to adjusting natural or human systems in response to actual or expected climatic stimuli or their effects (UNISDR, 2009), generally comprise short to

mid-term measures, identified and implemented at local level, and tailored to the specific site and providing local benefits (Bulkeley et al., 2009; Walsh et al., 2011). Nevertheless, over the last decade, numerous scholars and institutions have pointed out the need to carry out an overall response to climate change, able to mainstream mitigation and adaptation into the broader perspective of sustainable urban development (Dang et al., 2003; Biesbroek et al., 2009) by combining long-term policies to reduce GHG emissions, with short-medium term strategies to reduce the impacts of climate-related events (Klein et al., 2005; Jones et al., 2007). The World Bank has recently emphasized that mitigation and adaptation are both essential and complementary for “maximizing the benefits of actions taken and ensuring that any action taken in pursuit of one goal does not undermine progress toward the other” (The World Bank, 2015).

Furthermore, urban planning has been recognized by some scholars as “one of the policy areas with leverage in both mitigation of and adaptation to climate change” (Davoudi, 2009), and the potential offered by urban planning to support an integrated approach, capable of amplifying the potential synergies, avoiding likely conflicts by framing mitigation and adaptation measures into the broader perspective of sustainable development, has been widely remarked (UN, 2012; Kelman et al. 2015).

Thus, over the last few years, awareness that mitigation and adaptation policies at city level should be better integrated and that urban planning might play a crucial role in achieving such a goal is growing rapidly, and it is taking root among scholars and in some pioneering practices. Nevertheless, a robust theoretical framework able to support the development of integrated and multi-objective initiatives is still missing.

Therefore, based on the awareness that an integrated climate strategy is not only desirable but also necessary in an era of limited resources, in what follows we will firstly outline the state of the art of the mitigation and adaptation initiatives so far undertaken in the Italian metropolitan cities; then we shall analyze, with reference to a conceptual framework for building up a smart and resilient urban system carried out in previous research works (Papa et al., 2015), two case studies, i.e., Rotterdam and Barcelona, which are far ahead of the Italian Metropolitan Cities on the path towards a comprehensive climate strategy, in order to highlight how this conceptual framework may allow us to better understand the on-going practices and, above all, to better guide them towards an integrated climate policy, overcoming the current fragmentation of mitigation and adaptation strategies and initiatives.

## 2 MITIGATION AND ADAPTATION PRACTICES IN THE ITALIAN METROPOLITAN CITIES

Among the European Member States, the Covenant of Mayors initiative, set up in 2008, was very successful in terms of the number of signatory cities in Italy. In order to meet the European Union target of a 20% CO<sub>2</sub> reduction by 2020, the initiative was geared to increase energy efficiency and the use of renewable energy sources at local level through the implementation of the Sustainable Energy Action Plans (SEAP). Nevertheless, even though most Italian cities have adopted the SEAP, few have started an effective mitigation process and even fewer are working on monitoring the results achieved. As regards adaptation, it should be outlined that the parallel initiative, the Covenant of Mayors Initiative on Climate Change Adaptation, only began in 2014. The initiative aimed to strengthen cities' resilience to the expected impacts of climate change, by developing a comprehensive local adaptation strategy, or integrating adaptation into relevant existing plans. Although more than half of the 100 signatory cities are represented by Italian Local Authorities, at the moment, very few Italian Cities have started an adaptation process and only one has approved an Adaptation Plan.

Beyond the specific Plans adopted in response to the initiative launched by the European Union, numerous, but fragmented, projects and initiatives to counterbalance climate change have also been undertaken in Italy. We will thus focus here on all the initiatives concerning climate issues recently promoted by the ten

Italian Metropolitan cities established under National Law 56/2014, i.e., Turin, Milan, Venice, Genoa, Bologna, Florence, Bari, Naples and Reggio Calabria (fig. 1) – in which the majority of people, strategic assets and economic activities are located. According to the Italian Constitution, these cities are autonomous entities with their own statutes, powers and functions, and they have crucial responsibilities, such as the strategic development of their territory. Therefore, on the one hand, they urgently require effective strategies to increase their ability to function in the face of climate-related impacts and on the other hand, given their crucial role, they represent the engine for starting and testing new development processes, promoting transition towards low carbon development models by reducing energy consumption and related GHG emissions.

Analysis of on-going practices has been carried out using the documents freely available on the web and has taken into account the approved mitigation and adaptation plans or those still being developed, as well as initiatives and projects promoted under the Smart City and Resilient City “labels”.

Despite the lack of universally shared definitions of these increasingly widespread urban labels, most of the Italian Metropolitan cities have recently launched research projects and initiatives under the Smart City flag, ranging from the promotion of renewable energy sources (e.g. for transport and urban mobility) to the reduction of energy consumptions by improving energy efficiency at different scales (from building to city level). On the other hand, very few Italian Metropolitan cities have undertaken specific initiatives under the Resilient City flag, through participation in campaigns promoted by large international organizations (UNISDR, Rockefeller Foundation, etc.).

The time window 2008-2015 has been chosen as a reference for our analysis; the starting point has been set in 2008 as this was the year that the “Covenant of Mayors” was launched. It is also worth recalling that numerous mitigation initiatives have been undertaken since 2009, following the establishment of the Strategic Energy Technology Plan (SET Plan) by the European Commission. The SET Plan, whose main goal was the reduction of CO<sub>2</sub> emissions, identified Smart Cities as one of the seven investment priorities for the transition towards a low carbon future. Adaptation issues gained relevance from 2012 - after the launch of the second phase of the “Making Cities Resilient” campaign, begun by the UNISDR in 2010 – becoming more and more widespread after the adoption of the EU Adaptation Strategy in 2013.

However, it is important to recall that the Italian National Strategy for Adaptation to Climate Change (SNACC) – which identifies urban settlements as one of the strategic areas to promote adaptation actions - was only set out in July 2014.

The graph in fig. 2 provides an overview of the mitigation and adaptation initiatives for dealing with climate change adopted by the Italian metropolitan cities. According to the collected data, 9 out of 10 metropolitan cities are committed to reducing CO<sub>2</sub> emissions through mitigation plans and/or mitigation initiatives promoted as part of the Smart City projects at city level. On the other hand, only 4 out of 10 cities (Bologna, Venice, Rome and Milan) have started the process of outlining an adaptation plan or have joined an international initiative to enhance urban resilience.

It is worth noting that the most active cities in promoting mitigation and/or adaptation initiatives are involved in European research projects allowing participants to access funds. From the “GELSO” (ISPRA, 2014) Italian database of best practices for local sustainability, Bologna carried out some mitigation and adaptation initiatives through funds received by the Research and Technological Development Framework Programme, the Central Europe Programme and the Intelligent Energy Europe Project, to a total of 22 million euro. Also, some Southern cities (Naples and Bari) financed part of the mitigation initiative thanks to the Research and Competitiveness 2007-2013 National Operational Programme (PON) or the “POR FESR AXIS VII”.



Fig. 1 The Italian metropolitan cities

Summing up, this analysis highlights a significant imbalance between mitigation and adaptation initiatives, pointing out that to date, most of the efforts have been addressed to developing mitigation strategies. All the cities considered have approved, or are going to approve, the SEAP, and most of them are involved in research projects focusing on energy efficiency, smart grid development, or promotion of the use of renewable energy sources, with the sole exception of the city of Reggio Calabria.

On the other hand, adaptation is at a very early stage. Although cities are considered pivotal to both mitigation and adaptation issues, only two cities are currently developing an Adaptation Plan, and only one of them (Venice) has joined the UNISDR “Making Cities Resilient” campaign as a “Role Model” city, since the city had already promoted good practices and innovation in disaster resilience, and two of them (Rome and Milan) have recently joined the “100 Resilient Cities” initiative promoted by the Rockefeller Foundation with a view to building up a roadmap for improving resilience in the face of the numerous challenges that cities have to deal with (physical, social, economic, etc.), including extreme events due to climate change.

It is worth noting that all the cities dealing with adaptation issues are located in the North of Italy. The southern cities have neither plans nor adaptation initiatives geared to increasing urban resilience.

Moreover, according to the overview provided, it is evident that none of the cities analyzed have undertaken a move towards developing an integrated strategy to counterbalance climate change, overcoming the traditional approach to mitigation and adaptation goals.

A more in-depth analysis of the plans and initiatives undertaken by the Italian metropolitan cities provides the opportunity for some further consideration. Despite the lack of a comprehensive urban climate strategy in the cities analyzed, some preliminary signals of an increasing awareness that a cross-sectoral approach to climate change is becoming more urgent are emerging. For example, in the case of Venice, the SEAP (2012) clearly outlines the need for an adaptation strategy capable of integrating the mitigation policy already embarked upon. Also in the case of Bologna, the SEAP (2012) outlines that a climate change strategy at city level needs to be developed taking into consideration both energy efficiency and adaptation issues. Even more explicitly, the Action Plan for Sustainable Energy and Climate approved by the city of Milan in 2014 remarks that mitigation and adaptation strategies share the same policy levers, requiring shared tools in order to implement them (e.g. urban planning, building regulations, etc.).

## MITIGATION AND ADAPTATION TO CLIMATE CHANGE IN ITALIAN METROPOLITAN CITIES

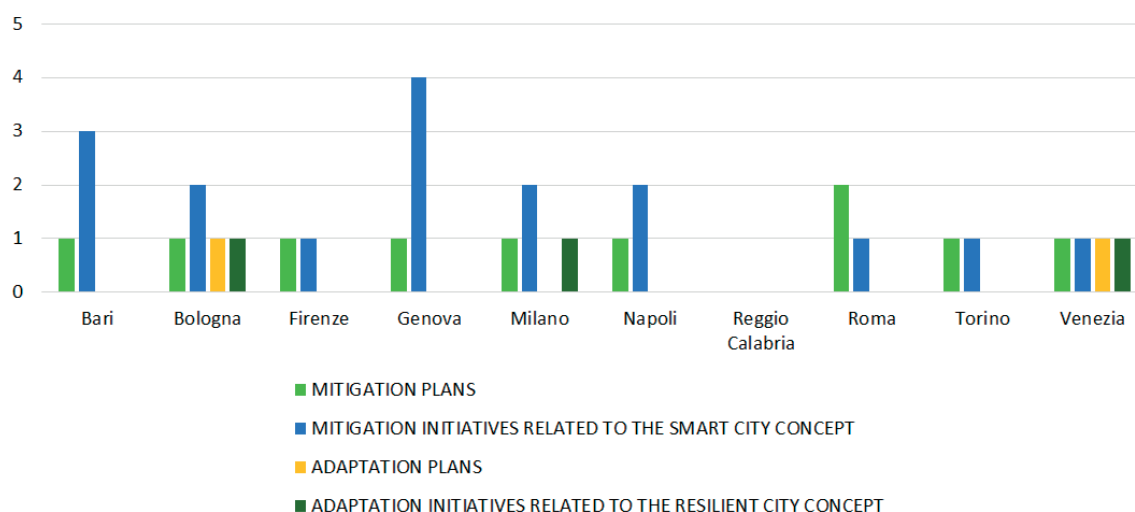


Fig. 2 Recap of mitigation and adaptation measures in the ten Italian metropolitan cities

Thus, available documents underline that - although effective tools for developing integrated strategies and measures to counterbalance climate change are still missing - some preliminary steps towards cross-sectoral approaches to climate change have been undertaken, although they have so far mainly been restricted to mere will statements. To reverse current trends and save the more and more limited economic and financial resources, more effective steps along this path are required, such as a closer cooperation between the various city departments, which generally act independently, as well as the "adaptation" of the ordinary urban planning processes (Mocchia, 2010) and their tools to better frame the fragmented climate strategies.

### 3 A CONCEPTUAL TOOL FOR ANALYZING AND DRIVING SMART AND RESILIENT INITIATIVES IN THE FACE OF CLIMATE CHANGE

As stated above, despite the growing awareness that an integrated strategy to counterbalance climate change is increasingly necessary, a robust theoretical framework capable of guiding the development of an integrated and multi-objective climate strategy is still missing.

On the one hand, mitigation and adaptation strategies have been developed separately and at different times at European level, resulting in fragmentation of the relative tools at city level and a significant delay in the start of adaptation plans. On the other hand, the two concepts of Smart City and Resilient City - which have increasingly drawn the attention of decision-makers and scholars involved in climate studies over the last few years, as witnessed by the numerous mitigation and adaptation initiatives promoted under these labels - have generally been developed and conceptualized separately.

Nevertheless, some authors have recently emphasized the increasing overlap between these concepts: despite smart initiatives having so far essentially focused on energy sector, indeed, the most recent approaches to smart cities clearly show the need to drive these initiatives to better cope with global pressures (climate change, poverty, natural hazards, etc.) as a key to improve the quality of life of the citizens (Greco, Bencardino, 2015). Moreover, the goal of enhancing urban resilience in the face of the most urgent challenges affecting urban development is becoming more frequent among the Smart Cities' objectives and, as remarked by Kunzmann (2014), smart initiatives are often designed to allow cities to "become more livable and resilient and, hence, able to respond quicker to new challenges". From this perspective, some international organizations and networks are promoting integrated strategies to build up

smarter and more resilient cities, as a key step to effectively counterbalancing the challenge of climate change, as well as pursuing better integration between mitigation and adaptation strategies (Klein et al., 2005). The American Planning Association (APA), for example, has created a Smart Cities and Sustainability Task Force, whose mission is to exploit advances in technology and innovation to build up smarter, more resilient and sustainable cities; the Asian Cities Climate Change Resilience Network (ACCCRN), funded by the Rockefeller Foundation, is striving to develop smarter and more resilient cities in India.

Nevertheless, as mentioned above, an effective theoretical framework to drive urban strategies towards building up smart and resilient urban system in the face of climate change is still lacking: current literature provides some conceptual frameworks aimed at better framing smart initiatives (Chourabi et al., 2012; Neirrotti, 2014) or enhancing urban resilience in the face of different pressures (Tyler and Moench, 2012; Galderisi and Ferrara, 2012; Desouza and Flanery, 2013), neglecting the potential synergies between these concepts. To fill this gap, a conceptual framework capable of framing the characteristics of a smart and resilient urban system throughout the different temporal phases that characterize cities' responses to climate change, and with the aim of guiding planners and decision-makers in developing a comprehensive climate strategy, has been outlined in a recent research work (Papa et al., 2015).

In referring to this research for a detailed description of the steps leading to the definition of the conceptual framework and of the meanings, roles and interconnections of the various characteristics, it is important to recall here that the structure of the model (fig. 3) is that of a cyclical process developing over the different time spans (short, medium and long term) that characterize the response of a complex urban system in the face of climate change (Salat and Bourdic, 2012). The cyclical process is grounded in continual learning (Cutter, 2008; Davoudi, 2012) and is characterized by the "dynamic interplay of persistence, adaptability and transformability" (Folke et al., 2010), allowing urban systems to extend their focus beyond resistance to shock, through the inclusion of adaptive responses, as well as long-term transformation in response to future or unforeseen threats (Galderisi, 2014a).

In more detail, learning capacity, persistence, adaptability and transformability are classified as the key properties of a smart and resilient urban system, the main goals to which strategies and measures have to be geared in order to improve cities' responses in the face of climate change. The cyclical structure of the process is also characterized by three different stages (strategy definition, implementation and management), connected by a feedback loop: such a structure emphasizes that a smart and resilient urban system does not represent a "fixed state" (Davoudi, 2012), but is the result of a dynamic and continuous development process.

Learning capacity, which is at the core of the process, allows the system to start, revise or change the strategies to achieve the key characteristics of a smart and resilient city. Based on ICTs and according to the uncertainties of climate scenarios, learning capacity can support the development of climate strategies (Linkov et al., 2006) that can be continuously updated in the light of variable conditions and information.

Despite the dynamic interplay of the selected characteristics through both time and space, it is worth noting that each of them gains prominence along a different time span. In the short term, strategies are generally adopted with a view to improving cities' ability to withstand the expected (or the most likely) climate-related impacts, by increasing the persistence of a system. In the medium term, strategies aim to enhance a city's capacity to cope with unexpected impacts by improving a system's adaptability. In the long term, strategies to improve a city's transformability should drive urban transition towards new an original development models, capable of reducing the energy footprint of the city and, in so doing, prevent future climate-related impacts. All the selected characteristics have been placed in a hierarchy within a given model, and related to one or more of the key characteristics identified on the basis of their meaning and relevance.





Fig. 3 Framing roles and linkages among the characteristics of a Smart and Resilient Urban System in the face of climate change

#### 4 ARE EUROPEAN CITIES ON THE WAY TO AN INTEGRATED CLIMATE STRATEGY? TWO CASE STUDIES

Based on this framework, we can examine two case studies of cities striving to promote smart and resilient initiatives as a key step in the progress towards an integrated climate strategy. We focus on the smart and resilient initiatives undertaken by two European cities – Rotterdam in the north, and Barcelona in the south of Europe – in order to better understand which of the primary and secondary selected characteristics are taken into consideration in the on-going practices.

The choice of the two cities, both of them outside Italy, was dictated by the significant imbalance between mitigation and adaptation initiatives that characterizes Italian cities. As can clearly be seen from the state of the art in the Italian Metropolitan cities as portrayed above, except for a few cases still, however, at a very early stage, mitigation and adaptation plans are developed as sectoral tools, and effective linkage among smart and resilient initiatives is still lacking. Current strategies are strongly focused on mitigation issues, with limited attention to urban adaptation, even though some of the analyzed documents emphasize the need to promote cross-sectoral and multi-objective strategies capable of reducing GHG emissions by improving, in the meantime, urban safety in the face of climate impact.

On the other hand, the city of Rotterdam, which has a long history of water management, adopted a smart strategy specifically addressed to improving urban resilience after two major flood events during the twentieth century. Such a strategy earned the city an award in 2014 - The New Economy Smart Cities Award – for its efforts in tackling climate issues and promoting its image as the most sustainable port in the world. Similarly, the city of Barcelona, after a number of infrastructures failures in 2007, including a power outage that left over 300,000 users without electricity for 3 days, developed strategies to improve the resilience of urban services through smart urban design (Chelleri et al., 2013). The two selected case studies significantly differ in demographic size, broader economic weight, environmental features, and expected climate-related impacts. Nevertheless, they have some similarities: they share the idea that resilience may represent one of the key vectors for moving towards the smart city, and both of them have promoted a Public-Private

Partnership to implement, promote and manage an integrated climate strategy (The Rotterdam Climate Initiative and the Barcelona Resilience Group).

Our study of the strategies and measures adopted by the two cities is based on the documents and reports available on dedicated web platforms (Rotterdam Climate Initiative and Barcelona Smart City). The available documents were used to carry out a screening of the main strategies and related measures undertaken on the national and local level and the crucial factors determining current policies. Then, taking the conceptual framework briefly presented above as a reference, the current strategies and measures were analyzed in order to assess if and how they contribute to improve the different characteristics of a smart and resilient urban system and, in so doing, to promote an integrated approach to climate issues.

#### 4.1 THE ROTTERDAM CLIMATE STRATEGIES

In the last decade, Rotterdam has undertaken a sustainable development policy aiming to integrate smart and resilient initiatives in the face of climate change. The city has always dealt with water issues, since 1953 when a significant flood killed almost 2000 people. Thus, to better understand current policy, three main factors have to be considered: the morphological features of Rotterdam itself, the size and role of the city, and the importance of establishing a public-private partnership for dealing with climate change. Rotterdam is a river town with 80% of the urbanized area below sea level: this particular morphology has always forced Rotterdam to find strategies to cope with flood issues (Lu, Stead, 2013). As regards the second factor, it is worth noting that Rotterdam city – the second city in the Netherlands, covering an area of 319,35 km<sup>2</sup> and counting about 610,386 inhabitants – is part of the “Randstad” metropolitan area which covers an area of about 542 ha, with about 1,003,088 inhabitants, and its port area plays a crucial role on both national and European level. Concerning the third factor, it must be underlined that a Public-Private Partnership – the Rotterdam Climate Initiative (RCI) – has been running since 2006. It comprises the Municipality of Rotterdam, the Rijnmond Environmental Protection Agency (DCMR), the Port Authority and the Deltalinqs (Group of Industrial and Logistic societies in the Port of Rotterdam) to promote and implement smart initiatives in order to increase urban and regional capacity to cope with climate change impacts in view of the 2050 scenario forecasts.

Smart and Resilient initiatives are part of a well-established and interconnected framework of mitigation and adaptation strategies carried out on different (national and local) geographical scales and mostly developed between 2007 and 2010. In detail, on the national level, the National Adaptation Strategy (NAS) and the Delta Programme represent the main points of reference for Water Plan 2 and the Rotterdam Climate Change Adaptation Strategy (RCCAS), both of which are carried out at the local level. Furthermore, at national level, great attention has also been devoted to the question of mitigation, as witnessed by the Energy Agreement for Sustainable Growth and the Climate Agenda (2013), whereas at local level, the most interesting initiative is the Rotterdam Energy Approach and Planning (REAP), carried out in 2009 and supported by the Rotterdam Climate Initiative in order to develop a methodology for the effective integration of CO<sub>2</sub> emissions and energy issues in urban planning processes.

The NAS – *Make Space for Climate* (2007) – referring to the 2050 scenario forecasts and based on an analysis of past events, provides a comprehensive picture of the expected vulnerabilities and risks in the Netherlands and promotes an adaptation policy mainly focusing on the impact of climate on the social and economic sectors. The Delta Programme (2014) is a strategic plan aiming to improve the safety of the Netherlands from flooding, by ensuring water safety and a sustainable and resistant freshwater supply by 2050. Started in 2010, the Programme is currently in its fifth edition. The measures promoted by the Delta Programme mainly focus on disaster prevention and articulated on five axes: three of them refer to thematic

measures (Water Safety, Freshwater Supply, Spatial Adaptation), and the others to specific geographical areas (the Rhine-Meuse and the IJsselmeer Region).

As regards local adaptation strategies, Water Plan 2 (2007) focuses on water management over the 2007-2030 time span and frames the projects that have to be primarily undertaken in the next years, grouping them into four main sectors (protection, clean water, attractive city, sewers). The RCCAS (2008) aims to transform water from being a threatening factor into an opportunity for city development, and to make Rotterdam a climate-proof city by 2025. The strategy comprises five axes of intervention (Hydraulic Safety of the Delta of Rotterdam; Accessibility of the Port for Freights and Passengers; Adaptive Buildings; Urban Water System; Climate City improving Urban Environment and Quality of Life) and is based on three pillars: knowledge, marketing communication, and actions.

Shifting to the mitigation strategies and focusing on the local level, it is worth mentioning the Rotterdam Energy Approach and Planning (REAP) methodology (2009) aiming to support a 50% reduction in CO<sub>2</sub> emissions in the Rotterdam region (city and port) by 2025, compared with the 1990 emissions (Tillie et al, 2009). Based on these briefly described strategies, current measures have been analyzed in depth in order to assess how they contribute to improving the key properties of a smart and resilient city and their related characteristics as sketched in the conceptual model presented above (Fig. 3) and, in so doing, to promote an integrated approach to climate-related issues.

*Learning capacity* – All the strategies carried out on national and local level assign a key role to learning capacity and, above all, to the improvement and dissemination of the available knowledge. In the Delta Programme, for example, in-depth knowledge of the water safety infrastructures, as well as of their level of maintenance, is a key tool for increasing ability to prevent future flooding events. Furthermore, the RCCAS is based on the Dutch national research programme, 'Knowledge for Climate', which provides an in-depth knowledge base relating to climate effects, such as rising sea levels, the increase in cloudbursts, periods of drought and higher temperatures. Building up effective monitoring systems to continuously update the available knowledge is also considered a crucial factor in guaranteeing the review of climate strategies and actions. Besides knowledge and monitoring, much attention is given over to networking ability as a key to sharing and exchanging knowledge and best practices. To this end, the Delta Programme Knowledge Network has been established within the Delta Programme itself: it is worth recalling that Rotterdam is also part of the 'Connecting Delta Cities', which is, in turn, part of the wider C40 cities network.

*Persistence* – It must be underlined that both the RCCAS and Water Plan 2 are tasked with combining grey measures (structural measures) and green infrastructures to improve urban ability to cope with floods. In more detail, numerous measures aim to maintain and improve the robustness of the existing network of storm surge barriers and dikes, canals and lakes, sewers and pumping stations that have always protected the city from the water. Moreover, a network of green infrastructures has been put in place to improve the city's ability to deal with floods and heat waves, by creating benefits for the natural environment and new recreational areas for citizens.

*Adaptability* – The Rotterdam climate strategies include numerous measures to improve the flexibility and diversity of the urban system: adaptive buildings (e.g. Floating Pavilions) and adaptive public spaces (e.g. water plazas, the redesigning of the river Meuse, Tidal Park), green facades and green roofs.

*Transformability* - The Rotterdam climate strategies also include long-term measures to reduce energy consumption and CO<sub>2</sub> emissions, by innovating the design of the urban settlements at both structural and neighborhood levels.



Fig. 4 The Rotterdam's Solar-Powered Floating Pavilion: a "flag" project for a climate-proof urban Development.

Furthermore, the Rotterdam Climate strategies promote a new pathway to favor citizen collaboration and participation: citizens are involved in the design and maintenance of small green areas designed to improve rainwater absorption in the case of heavy rainfall, with the ultimate aim of enhancing air quality and providing other ecological benefits.

However, it is worth emphasizing that measures addressed to improving both adaptability and transformability have so far been mainly conceived as "flag" projects to be tested and then extended on a larger scale. For example, thanks to their innovative building materials, as well as innovative systems to improve internal comfort, the Floating Pavilions have been designed as pilot buildings capable of reducing CO<sub>2</sub> emissions.

#### 4.2 BARCELONA SMART AND RESILIENT STRATEGIES

The city of Barcelona covers an area of about 102 Km<sup>2</sup> and counts 1.6 million inhabitants, while its metropolitan area covers an area of about 803 Km<sup>2</sup> and has 4.5 million inhabitants. The city is characterized by a great entrepreneurial spirit, significantly focused on innovation. Also thanks to this feature, the city embraced a Smart Strategy for social, economic and urban development in 2011. The Strategy is based on cross-sectoral measures to promote sustainable urban development by improving the green economy, high-speed connections between the city and its Metropolitan Area, and by pursuing an energy self-sufficient and zero-emission city policy, where nature holds a prominent role. This Strategy includes numerous projects that, by working together and integrating technology and innovation, address different issues and, above all, a more efficient management of the city's services and resources.

In 2009, in the wake of a number of incidents that occurred in 2007 and that stressed the need to increase urban resilience to guarantee the security and continuity of its services in an emergency, the Barcelona City Council launched a Resilience Strategy, guided by the Barcelona Resilience Board for Infrastructure and Services Supply (TISU) and the Barcelona Resilience Group (BRG), a public-private association established in

2008, which includes different stakeholders (Universities, large scale and local companies, local Authorities, etc.). Specifically, the BRG is in charge of coordinating different sectors of local government, private operators, infrastructure owners, and other administrations. This Strategy aimed to drive cross-sectoral projects for reducing urban vulnerability and guaranteeing the operational continuity of the city's services in the event of hazardous events. As a result of the Resilience Strategy, due to its efforts to reduce the vulnerability of critical infrastructure and to ensure the continuity of urban services, the United Nations recognized Barcelona as "a role model for urban resilience" in April 2013.

The smart and resilient strategies in Barcelona are supported by a robust framework of mitigation and adaptation strategies at national level issued in 2006-2007 (such as the Spanish Strategy of Climate Change and Clean Energy; the Strategy for Energy Saving and Efficiency in Spain; the National Plan for Adaptation to Climate Change).

At local level, the institutional web platform - the Barcelona Smart City - comprises 122 projects, classified into 24 programs relating to 10 smart city areas (e.g. public and social services, environment, mobility, etc.). All these projects are based on innovative solutions for better management of public services and resources so as to improve quality of life. Resilience is one of these programs, and is related to the Environment Smart City Area. The Resilience Program provides measures for preventing and mitigating climate-related impacts, in order to guarantee a safer city and better quality of life. Moreover, some projects - such as Urban Platform (2013) and HAZUR (2012) - are specifically intended to enhance urban resilience by using ICTs for improving connections within the metropolitan area and allowing wider sharing of the available knowledge. Specifically, the Urban Platform represents an open and transversal platform, in which information can be collected, elaborated and shared, in order to guarantee better management of the various resources (water, public services, CO<sub>2</sub> emissions, etc.), and improve the response capacity of the city in case of emergency. HAZUR is a software platform that provides public authorities with a service tool able to evaluate and increase the continuity of urban services.

Like in the Rotterdam case study, current measures have been analyzed in depth in order to assess how they contribute to improving the key properties of a smart and resilient city and their relative characteristics as sketched in the conceptual model presented above (Fig. 3) and, in so doing, to promote an integrated approach to climate-related issues.

*Learning capacity* – The measures addressed to create networks for collecting, disseminating and sharing information and knowledge represent the core of the Barcelona Smart City Strategy. Moreover, a number of projects strongly promote the involvement of citizens, one of which is the GO (Open Government) project within the Urban Platform project, which provides services based on public information. Real time monitoring of water levels and energy consumption through sensor networks is also considered a crucial activity in all the measures in order to save energy and reduce GHG emissions. The care dedicated to building up a constantly updated and widely shared knowledge base is also important in increasing the awareness of citizens and decision-makers in the face of natural and climate-related hazards and for improving ability to anticipate future events.

*Persistence* – Although there are no measures to specifically strengthen resistance or the robustness of the urban system, most of the measures included in the Resilience Programme, the Urban Platform and the HAZUR project may, through improved connectivity, allow the urban system to better withstand external pressures.





Fig. 5 The Smart City Campus in Barcelona: a project that combines urban regeneration and technology innovation.

*Adaptability* – Most of the on-going projects aim to address the redundancy of the material and immaterial infrastructure networks and, in so doing, to guarantee the continuity of urban services in the event of emergency. Furthermore, some initiatives included in the Barcelona Smart City Strategy, such as the BUIITS (Urban Space with Territorial and Social Involvement), which promotes the temporary use of abandoned areas through public-private-partnerships, may contribute to enhance the flexibility of the urban system.

*Transformability* – The Barcelona Smart City Strategy envisages, in a long-term perspective, an innovative path for city development, based on citizen collaboration and participation and addressed to promoting sustainable mobility, the smart use of public space for improving biodiversity, and social cohesion, in order to achieve an energy self-sufficient habitat, characterized by smart and sustainable resource management. The BIT (Barcelona Institute of Technology) and The Smart City Campus projects are two examples of this innovative vision: they promote the renovation of old factories into zero-emissions smart buildings through a public-private partnership (Cisco and Schneider Electric as industrial partners and BIT as a research partner).

#### 4.3 DISCUSSION

The analysis of the strategies and projects carried out in the two case studies allows us to better understand which of the key properties of a Smart and Resilient Urban System are mainly considered in the on-going practices and to reshape the conceptual framework presented in the previous paragraph (Fig. 4) accordingly (Cillo, 2014). First of all, it is worth noting that whereas in the Rotterdam case study – also due to its peculiar relationship with the water issue – the smart initiatives so far undertaken have been mainly geared to enhancing urban resilience in the face of climate change, in the Barcelona case study, Resilience is only one of the sub-programmes, albeit important, of a wide set of smart initiatives geared to improving the quality of life and to better management of urban services and resources also, but not primarily, concerning climate issues. Moreover, it is worth noting that in both case studies, a Public-Private Partnership has been established that can drive and coordinate the numerous strategies, initiatives and projects.

Then, focusing on the relationships between current initiatives and the selected key characteristics required to build up a smart and resilient city, both the examined case studies confirm the key role of learning capacity (Fig. 6).



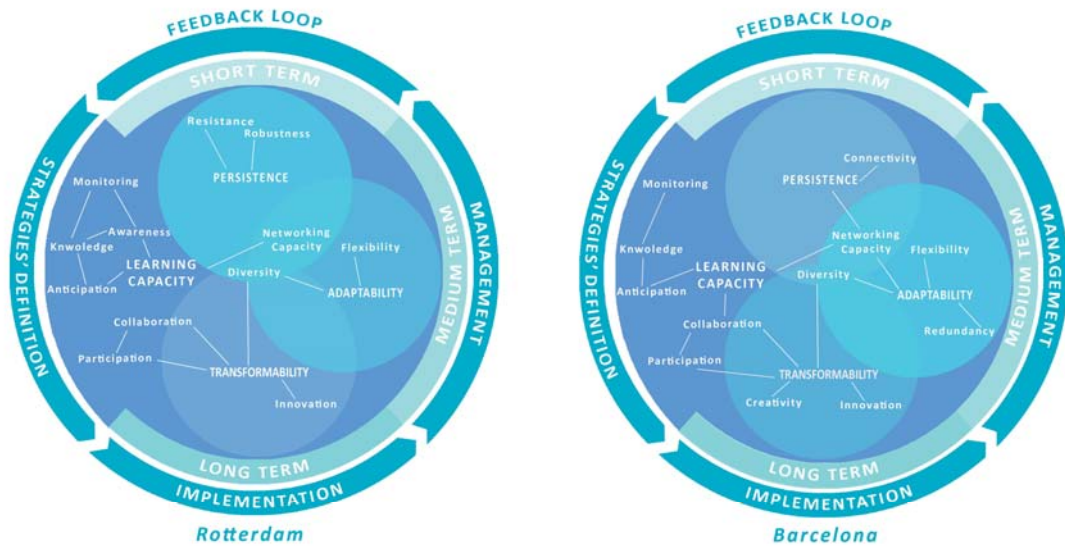


Fig. 6 The Conceptual Framework applied in the Rotterdam and Barcelona case studies

Both of them assign a key role to building up an effective and constantly updated knowledge base, also through the widespread use of ICTs that allows the strengthening of real-time monitoring capacity and, consequently, the improvement of the ability to anticipate future climate impacts and citizen awareness of energy and climate issues. In both cases, local and global networking ability plays a crucial role in disseminating and sharing knowledge and best practices, while particular attention has been devoted in the Barcelona case study to strengthening citizens participation in public life, by promoting widespread use of ICTs to enhance collaboration between citizens and public administrations.

Persistence is a crucial property in the Rotterdam case studies, where strategies and measures are primarily addressed to increasing the ability of the urban system to withstand the impacts of climate-related events by improving the robustness of the existing grey infrastructures and combining them with green infrastructures. In the Barcelona case study, despite the fact that persistence seems to play a secondary role, many of the smart initiatives so far undertaken are geared to improving connectivity, efficiency and networking capacity, in order to allow the city to guarantee the operational continuity of urban services should hazardous events occur. Adaptability also plays an important role, even though in the Barcelona case study, some of the smart initiatives are geared to increasing the redundancy of physical and telecommunication infrastructure networks, whereas Rotterdam has promoted numerous projects aiming to increase flexibility and diversity in the urban environment by introducing adaptive buildings and adaptive public spaces as well as reinforcing the green infrastructure networks that play a twofold role, contributing to adapt the city to climatic impacts (allowing better management of both floods and high temperatures in urban areas) and to mitigate climate phenomena (e.g. allowing carbon storage and sequestration).

Lastly, both cases address transformability by means of experimental projects that envisage innovative paths for city development, promoting nature-based measures to counterbalance climate impacts as well as transition towards a zero-emission urban environment. Nevertheless, up to now, these projects are limited to individual buildings or to specific neighborhoods, requiring extension and integration into the wider processes of urban development.

## 5 CONCLUSION

Summing up, this contribution provides some hints to better frame current practices to counterbalance climate issues undertaken by the Italian and European cities.

In greater detail, based on the awareness that an overall response to climate change requires mainstream mitigation and adaptation within the broader perspective of sustainable urban development, by combining long-term policies aiming to reduce GHG emissions with short to mid-term strategies aiming to reduce the impacts of climate-related events, the research initially outlined the state of the art in the Italian metropolitan cities. This outline clearly highlights that, despite the fact that the need to develop cross-sectorial approaches to climate change is sometimes recognized, most of the cities analyzed have developed mitigation strategies based in sectorial plans (e.g., SEAP or Municipal Energy Plan) or “smart” projects, whereas only four cities are developing an adaptation plan or have recently developed a local strategy to enhance urban resilience.

Then, based on a theoretical framework able to show the characteristics of smart and resilient cities (fig. 3), the Rotterdam and Barcelona case studies were analyzed in order to better understand the strengths and weaknesses of current smart and/or resilience initiatives aiming to counterbalance climate change. Analysis of the two case studies clearly shows that current initiatives and projects, undertaken under the flags of the “Smart” or the “Resilient” city, seem to significantly contribute to promoting cross-sectorial and multi-objective strategies to deal with climate change, paving the way for an integrated approach to climate issues. In the case studies examined, numerous measures, and above all, those related to the improvement of green infrastructures, play a twofold role, contributing to both mitigation and adaptation issues.

Moreover, the selected case studies emphasize that smart and resilience initiatives are largely tailored to their specific contexts. In the case of Rotterdam, the peculiarity of the city – where 90% of the urbanized area is below sea level – has led to considering urban resilience in the face of climate change as the key goal of most of the smart city projects. On the other hand, in the case of Barcelona, smart city projects pursue a wide range of objectives related to the improvement of the quality of life as well as to a better management of urban services and resources, also including increased urban resilience in the face of climate change.

In addition, both case studies attribute a key role in improving urban response to climate change to learning capacity, and numerous initiatives have been undertaken to enhance the related characteristics, also through widespread use of ICTs. On the other hand, initiatives to enhance transformability are still at an early stage, requiring a move on from current urban development models and the transition from current energy-consuming development models towards low-carbon ones, in order to reduce GHG emissions and, consequently, climate-related impacts on urban areas.

Nevertheless, to pursue transformability, a more crucial role should be assigned to urban planning, which may well represent a key tool in reconciling different objectives as well as different temporal and spatial perspectives and the various stakeholders and, above all, in better framing current sectorial policies, initiatives, projects and tools.

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## IMAGE SOURCES

Cover Image: "NYC Highline", Retrieved October 10, 2015 from: [https://www.flickr.com/photos/wasabi\\_bob/5967508362](https://www.flickr.com/photos/wasabi_bob/5967508362)

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Fig. 1, 2, 3, 6: figures are from authors.

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## SMARTNESS AND URBAN RESILIENCE

A MODEL OF ENERGY SAVING

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### ABSTRACT

Climate change, energy issues and urban population growth are among the main themes on which the scientific debate focuses today. Over the last decades, the literature has proposed different approaches to face these challenges. This paper focuses on two widely debated approaches: the smart and the resilient city paradigms, that continue to draw the attention of scholars and institutional bodies worldwide.

The need to find strategies to reduce energy consumption and mitigate climate change impacts has been a prerequisite for the Smart Energy Master project for territorial governance of energy. One of the results is the Urban Saving Energy Model that "looks" at the several characteristics of a city in an integrated manner. This paper presents the results of a scientific and technical procedure that, starting from a thorough investigation of the physical and environmental characteristics of the city of Naples, has identified which variables have the greatest effect on energy consumption.

The results have shown that the possibility of identifying an "ideal" sustainable urban form, able to maximize energy efficiency, still remains theoretical, opening up the possibility that there are different consumption patterns due to the different physical, environmental and building characteristics of urban areas.

### KEYWORDS:

energy consumption, urban built environment, building density, smart and resilient city



## 1 INTRODUCTION

Since the first IPCC assessment report in 1990, research and national governments have been addressing their knowledge and actions both to limiting the sources of GHG emissions and to adapting to the effects of climate change effects (Schipper 2006; Marsh et al., 2009; Gilardi, 2010). According to the latest assessment report, overall anthropogenic GHG emissions have increased, especially during the period from 1970 to 2010, growing on average by 1 GtCO<sub>2</sub>eq per year and by a total of about 75% (IPCC, 2014). The increase in GHGs, mainly due to a still high dependence on fossil fuels, could determine an increase of 4.8°C in the mean global surface temperature in 2100, referring to the baseline scenarios and compared with pre-industrial levels. The effects of global warming, such as heat stress, flooding, tropical diseases and crop failures, are already affecting millions of people, resulting in more than 150.000 deaths a year (WHO, 2005). The Earth's average temperature has increased by 0.7°C compared to the pre-industrial period, and needs to be contained below 2°C, in order to avoid catastrophic consequences, reducing GHG concentrations to at least 80% by 2050.

A key element in achieving these goals is the reduction of energy consumption, as the energy sector is responsible for about two-thirds of global GHG emissions, "an amount that is increasing at a faster rate than for any other sector" (WWF, 2011). In particular, the energy demand is strictly tied to urban and economic development (Jones, 1989; Burney, 1995; Imai, 1997; Lenzen et al., 2006). In fact, the population shift from rural to urban areas typically occurs as people seek to improve their quality of life, also conditioned by the possibility of using all the services based on electricity (Liddle & Lung, 2013). Then, within urban areas, factors such as the increase in residential household demand can lead to a growth in transport, production of building materials and activities that, in turn, bring about a rise in energy consumption (Zhou et al., 2011). In other words, demographic growth leads to urbanization that, in turn increases energy consumption (Zaman et al., 2012; Shahbaz et. al. 2015).

World urban areas occupy 4% of the Earth's land area, growing on average twice as fast as their population, and 65% of all land surface will have become urbanized by 2030 (Creutzig et al., 2014). If cities are responsible for a rate of energy consumption ranging from 67% to 76% of total consumption, accounting for more than 70% of global CO<sub>2</sub> emissions, "global city energy use is projected to grow by 1.9% per year (compared to an overall global growth rate of 1.6% per year), to 12.374 Mtoe in 2030" (IEA, 2008).

For instance, in Europe per capita energy consumption will increase from 3.5 Mtoe (2006) to 3.6 Mtoe by 2030 and total urban energy consumption will increase by 0.5 % per year by 2030, ranging from 1259 Mtoe (2006) to 1427 Mtoe by 2030. This last rate is more than double that of the entire European Union.

From the state of the art described above, it is clear that urbanization, both in developed and developing countries, is reshaping the Earth's economy, land use, energy systems and climate. This consideration can represent an opportunity for policy makers to accomodate the relationship between urban built environment and energy in a more efficient way, especially because 2030 is now approaching.

We aim to contribute to the debate on energy consumption in urban areas by providing a comprehension model that, based on the systemic approach, seeks to identify which physical and environmental elements most influence energy consumption.

The paper is divided into four sections: section 2 describes the smart and resilient city approaches that can help urban planners and policy makers deal with energy and climate change challenges; section 3 illustrates the research methodology so as to identify the main physical, environmental and building elements that can be considered as determinants of urban energy consumption; section 4 describes the results of the research; the last section discusses these findings by providing some food for thought about the scientific debate on energy consumption in urban areas.

## 2 THE SMART AND RESILIENT CITY APPROACHES

Up to the 19<sup>th</sup> century, environmental issues affecting urban areas, mainly related to air and water pollution, were considered solely from the perspective of human health. In the 20<sup>th</sup> century, the four-fold rise in world population and the fast increase of economic and productive activities, mostly due to technological changes, meant that these issues had to be considered from a broader perspective, taking into account the different elements of a given territory (infrastructure, buildings, social and economic aspects, etc.). This change in approach occurred also as a result of the spread of systems theory (Von Bertalanffy, 1950) and the paradigm of complexity (Ruelle, 1992). These represent the theoretical foundations that also led to the definition of the concept of sustainability that still plays a prominent role in development policies.

The complexity of urban phenomena, combined with that of environmental issues, has led to the development of different approaches to meeting these challenges that need to be addressed primarily at the urban level. Rather than trying to review the plethora of city paradigms (green city, digital city, low-carbon city, etc.), that have developed over time to tackle the different challenges that cities are called to face, this section concentrates on the smart and resilient city approaches that continue to draw the attention of scholars and institutional bodies worldwide.

The smart city concept has been developing since the end of the last century, when the new technologies and the fast spread of computable devices drove urban scholars to imagine cities as places where technology could replace collective interaction, travel needs, overcoming spatial distances (Atkinson, 1998; Graham, 2004; Mitchell, 2004) and “pasting the reality of what was possible at that time” (Angelidou, 2015). To date the smart city has become a label, rather than a paradigm or approach to be adopted, heavily overused, and a trend to adhere to, thanks to the substantial financial resources allocated too.

The opportunity to take advantage of the significant funding aimed at favouring a large and widespread use of Information and Communication Technologies (ICT) has led to the development of many different definitions and approaches, because each stakeholder involved in urban transformation proposes its own vision, often not connected with the others (Fistola, 2013; Moraci, 2013; Mosannenzadeh and Vettorato, 2014). In a way similar to what happened in the past regarding the concept of sustainable development, the notion of smart city too seems to be defined essentially as a kind of large “container” that is sufficiently generic to contain just about anything and obtain a wide consensus; in this regard it is worthy quoting Hollands: “Which city, by definition, does not want to be smart, creative and cultural?”. Hollands, in a 2008 article with a simple but thought-provoking title (*Will the real smart city please stand up?*), disapproves the weakness of the definitional framework as one of the most problematic and risky elements.

However, although a clear and shared definition of the smart city is still lacking, it is possible to identify two main characteristics, which studies and research agree on. The first one is the use of ICT in order to make cities more efficient, attractive and competitive, by understanding and analysing what happens in real time and predicting urban functions (Batty, 2012; Berst, 2013). The second is sustainability and, consequently, a better quality of life, as energy consumption can be reduced through ICT. Solutions such as smart meters, smart grids or smart mobility, just to name a few, may allow a more efficient management of infrastructure and networks and can help increase consumer awareness about the possibilities of energy saving. It is worth noting that ICT should be put to green use, able to combine energy and environmental sustainability with the potential use of technology, in order to avoid a scenario where the more ICTs are used, the more energy is consumed (ITU, 2014; Viitanen and Kingston 2014).

Like smart city, also the term resilient city “may collapse into the meaningless that results from having too many meanings” (Vale, 2015). Even though the notion of resilience has been gaining increasing influence within various disciplinary fields since the fifties, only during these last years has the resilient city concept been developed, mainly in relation to urban adaptation to climate change.

In fact, according to Evans (2011) "the attraction of resilience [...] is fairly obvious", as cities increasingly need to withstand, absorb or transform a broad range of shocks, threats and stresses. And adaptation to all the ongoing changes takes place while a city continues to operate, retaining the same function and identity (Colding, 2007; Leichenko, 2011; Malalgosa, 2013).

Even though the resilient city is a complex and multidisciplinary concept, it is linked to that of sustainability. According to Folke et al. (2002), Chelleri (2012) and Colucci (2012), the target of sustainability can be achieved by enhancing urban resilience, especially "optimizing available resources, making a rational use of them, and contributing to increasing the amount of available resources" (Galderisi and Ferrara, 2012).

Cities, in fact, are key players in energy and climate challenges, as they are responsible for the most energy consumption, and at the same time they are vulnerable to the effects of climate change, such as urban heat islands, water supply scarcity and so on. Therefore, urban systems are compelled to define short-term and long-term strategies related to these issues. The former aim to prevent climate change related events (heat waves, etc.) and the latter aim to decrease energy consumption and GHG emissions, promoting a low-carbon urban future. In other words, if a city wants to be smart, it has to be resilient too, in order to make cities places where a wide network of infrastructure and sensors allows a more efficient use of resources and can increase user awareness regarding their energy habits. On this subject, it should be remembered that ICT is not sufficient to transform and improve the urban system, as "the critical factor in any successful community has to be its people and how they interact" (Nam and Pardo, 2011). In order to reduce energy consumption, users need to be informed and aware of their role, being involved in an energy performance improvement strategy that includes them from the very first phases defining critical points and needs.

In summary, the improvement of urban resilience should take place together with the enhancement of urban smartness, as these can be considered two sides of the same coin: the application of smart technology provides innovative opportunities to pave the way towards a low-carbon city. This, in turn, enables cities to face the imminent energy crisis and therefore become more resilient.

### 3 THE URBAN SAVING ENERGY MODEL

Awareness of the importance of fielding strategies to reduce energy consumption and to mitigate climate change impacts, especially in urban areas, was a prerequisite for the Smart Energy Master project for the energetic governance of the territory, by the DICEA (University of Naples).

Among the project results, there is the Urban Saving Energy Model that represents the starting point for the development of a support tool for local policy makers who will be able both to identify the highest energy consumption elements and energy-critical areas and to define energy saving strategies and actions.

The UrbanSEM, in fact, is a comprehension model designed to identify which of the main urban components (physical, socio-economic, mobility) relationships can be identified as determinants of energy consumption.

This paper provides the results of a scientific and technical procedure that identified which physical and environmental variables mostly affect energy consumption from among all these components of urban systems aiming to save energy.

#### 3.1 DATA AND DEVELOPMENT OF THE INTERPRETATIVE MODEL

This work aims to develop of an interpretative model that, at neighbourhood level, and based on a systemic approach, makes it possible to identify the urban and environmental elements that have the greatest impact on energetic consumption. This approach refers to the general system's theory that seems to have great significance on the theme of energy.

If the city is indeed a place of complexity, because the system of interactions and activities that takes place within it is complex, the implementation of a systemic approach and the paradigm of complexity seem to be

the most efficient way to find out the impacts of its elements and its interactions (activities) on energy consumption and to measure the actions according to its characteristics (Papa et al., 2014a).

Choosing this type of approach represents a first look at of innovative research, since only a few studies in this field have used a systemic approach, favouring experiments related to the use and energetic performance of buildings, energy productions and transportation systems, rather than the urban system itself. Under this approach, the interpretative model is based on the development of different urban features, especially the "physical-environmental", in order to determine the relationships that can be considered determinant factors in energy consumption.

This research was divided into 5 operational phases geared to developing an interpretative model (Figure 1).

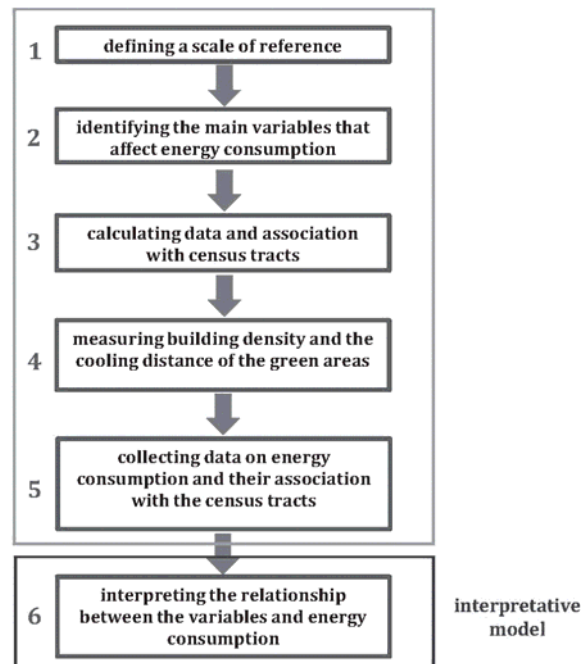


Fig. 1 The phases for the development of the interpretative model

#### Phase 1. *Defining a scale of reference*

Selecting which neighbourhood to take as a territorial scale of reference, requires the knowledge that a thorough reasoning at this level of space may facilitate analysis of the complex relations between urban systems and energy consumption.

Taking the neighbourhood scale as the base unit actually makes it possible to establish the relationships between activities, physical characteristics and energetic consumption that could not be identified if we considered one single building, and at the same time makes it possible to identify the portions of territory characterized by different levels of energy consumption within the larger urban scale.

The area where the model was implemented and tested includes the neighbourhoods of Chiaia, Vomero and Arenella, located in the city centre of Naples, and their different geological and functional characteristics, make this a meaningful experiment for the development of an easily replicable model in diverse urban surroundings.

Phase 2. *Identifying the main variables that affect energy consumption*

The few authors that have addressed the issue of energy on an urban scale have all agreed in their identification of the variables that have a significant impact on energy consumption (Steemers, 2003; Lin et al., 2010; Feng and Zhang, 2012; Soltani et al., 2012; Howard et al., 2012; Ko and Radke, 2013; Papa et al., 2014b). Based on these studies and a thorough knowledge of this area, a set of variables has been established in three categories: physical, environmental, and building.

The physical variables mainly describe the geometry of the urban fabric, while the environmental variables refer to the climatic and morphological characteristics and those for building illustrate the physical characteristics of a building.

PHYSICAL VARIABLES	ENVIRONEMNTAL VARIABLES	BUILDING VARIABLES
Mean building density	Green Plot Ratio <sup>1</sup> (GnPR)	Mean building age
Mean building height	Cooling distance green area <sup>2</sup> (R <sub>i</sub> )	Mean surface
Mean aspect ratio	Index Green Ratio <sup>3</sup> (IGnR)	Old masonry buildings
Coverage ratio medio	Slope	Newer concrete buildings
Compactness factor		

Tab.1 Variable's set

Phase 3. *Obtaining data to calculate physical, environmental and building variables and their association with the census tracts for the three neighbourhoods.*

The data to calculate the physical, environmental and building variables were obtained using statistical sources (data from the ISTAT 2011 census) and cartographic data, and the creation of GIS maps based on the three neighbourhoods analysed (plans and orthophotos).

These data were then geo-referenced, or associated with census tracts in order to carry out a series of thematic maps using the variables and significant processed data. All the data obtained were also systematized into two matrices, one for the census tracts, that represent the territorial unit of reference, and the other for buildings.

The choice of census tracts as a territorial unit of reference was made for two main reasons: it consists of the minimum unit of integration of census data, which allows a comparison of the relative data from different areas other than the territorial unit of reference itself.

Phase 4. *Defining a method for measuring building density and the cooling distance of the green areas.*

Almost all the variables were classified using significant intervals so as to allow the joint of the census tracts.

The measurement operations also took into account several studies carried out at building level.

For the variables concerning building density and cooling distance of the green areas, it was necessary to develop a specific measurement methodology capable of relating these variables to energy consumption.

This fourth phase basically aims to show the building density and cooling distance of the green areas on the basis of the external surface temperature of the buildings and the air temperature, in order to measure the

<sup>1</sup> The Green Plot Ratio is calculated as the ratio between the total green surface within the census tract and its total surface.

<sup>2</sup> The green areas' *radius of influence* is the maximum distance of cooling beyond which the presence of a green area has no more effects.

<sup>3</sup> The Green Ratio Index (IGnR) is the ratio between the total green surface within the census tract, including the *radius of influence*, and its total surface.

incidence that these variables have on temperature changes in the urban fabric, and to determine the relevant landmarks for the development of the interpretative model.

According to various authors (Newman and Kenworthy, 1989; Givoni, 1998; Ratti et al., 2005; Salat and Nowacki, 2006; Ewing and Rong, 2008; Doherty, 2009) the building density and the cooling distance of green area variables have a major impact on urban energy consumption.

In addition, the choice to relate them to temperature is also linked to the fact that some researchers have shown that urban morphology and density in particular, influences the urban heat island phenomenon (Oke, 1997; Baker and Ratti 1999; Rizwan et al. 2008) that produces a warmer microclimate within urban areas, and therefore results in an increase in energy consumption especially during the summer months.

A simulation software ENVI-met4, was used to stimulate micro-climatic behaviour and the geometrical and environmental characteristics of the three neighbourhoods. The results of these simulations have made it possible to obtain 'reference values' for both variables, which thus, also measure the incidence of the cooling effect of the green areas in urban areas.

*Phase 5. Obtaining data on energy consumption and their association with the census tracts for the three neighbourhoods*

The data on energy consumption were obtained through the online SIATEL system from the Revenue Agency (Financial law of 2005) and refer to the individual consumers for both, the use of electricity and natural gas; the data also reflect annual turnover (€) and the kWh and cubic metres consumed.

The geolocation of consumption, or in other words, association of the data to the census tracts, comes from the creation of two different geo-databases, for electricity and gas, containing the relationship between consumption and the census sections to which they belong.

*Phase 6. Interpretation of the relationship between the physical, environmental and building variables and energy consumption.*

In order to be able to determine how the urban and environmental characteristics impact on energy consumption, the three neighbourhoods studied were divided into different types of areas, with physical, environmental and homogenous building characteristics for each. Each of these categories has been represented on a thematic map, where comparison with those related to both electric and gas consumption has made it possible to identify the relationship that may depend on energy consumption.

## 3.2 METHODOLOGY

The aim of this interpretative model is to identify of the physical, environmental and building characteristics that have greatest impact on the consumption of electricity and gas, using a type of 'systematic' logic at neighbourhood level. The approach used in this research "looks", contextually and simultaneously, at the elements and the relevant relationships in the area of study, emphasizing the physical, environmental and building characteristics that are used to join an urban area. Different classes of census tracts have been identified on the basis of the significant intervals of the variables used.

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<sup>4</sup> Regarding building density, the worst weather conditions during summer and winter have been simulated in order to study the effects of this variable, on energy consumption (cooling) and gas consumption (heating) respectively. The simulations for green areas have been carried out on the hottest day of the last ten years.



Based on the significant intervals of the values assigned to all the variables, different classes of census tracts were identified with homogeneous internal physical, environmental and building characteristics but different from each other.

To be able to “enforce” all sixteen variables to identify the spatial structure that defines the area under examination, a correlation was made between each of the urban variables and energy and gas consumption, by means of statistical analysis. The exception is building age and the building density variable, for which the Analysis of Variation (ANOVA) was made as ordinal variables. The Bravais Pearson statistical index was applied for all other alternatives. However, neither the values of the indexes of correlation obtained, nor the ANOVA results, showed significant relationship between any of the variables, including energy consumption, electricity or gas (Tab. 2).

VARIABLES	AVERAGE ELECTRICITY CONSUMPTION	AVERAGE GAS CONSUMPTION
Mean building density	-0,031	-0,037
Mean building height	-0,026	-0,010
Compactness factor	-0,056	-0,058
Mean coverage ratio	-0,026	-0,021
Mean aspect ratio	-0,068	-0,045
GnPr	0,119	0,101
IGnR	0,077	0,093
Mean surface	-0,041	-0,024
Old masonry buildings	-0,024	-0,026
Newer concrete buildings	-0,045	-0,012

Tab. 2 Indexes of correlation between urban variables and energy consumptions

BUILDING AGE		SUM OF SQUARE	MEAN OF SQUARE	SIG.
Average energy	Among groups	49239044,783	12309761,196	0,371
	Within groups	4439828932,299	11502147,493	
	Total	4489067977,083		
Average gas	Among groups	7005,370	1751,343	0,993
	Within groups	9975628,630	28021,429	
	Total	9982634,000		

Tab. 3 ANOVA results for building age

BUILDING DENSITY (SUMMER)		SUM OF SQUARE	SUM OF SQUARE	SIG.
Average energy	Among groups	461550713,846	115387678,462	0,593
	Within groups	67950732120,751	164928961,458	
	Total	68412282834,597		
Average gas	Among groups	217982,371	54495,593	0,096
	Within groups	10467628,141	27402,168	
	Total	10685610,512		

Tab. 4 ANOVA results for building densities as a function of surface summer temperature

**BUILDING DENSITY (WINTER)**

		SUM OF SQUARE	SUM OF SQUARE	SIG.
Average energy	Among groups	200585872,917	100292936,458	0,545
	Within groups	68208960084,303	165154867,032	
	Total	68409545957,220		
Average gas	Among groups	97598,285	48799,142	0,172
	Within groups	10570026,368	27597,980	
	Total	10667624,653	100292936,458	

Tab. 5 ANOVA results for building densities as a function of surface winter temperature

In a literature review on this topic, four variables stand out because they can summarize the entire information content: building density, the green areas' radius of influence, building height and age. Building density can especially be considered an indicator of the synthesis of the morphological characteristics of the city, since it refers to factors such as volume and compactness.

The Green Index Ratio (IGnR), which describes the cooling distance of green areas and takes into account the portion of territory affected by the presence of a green area (radius of influence), has been chosen rather than the Green Plot Ratio (GnPR) because the latter has a less relevant information content in terms of energy consumption since it is calculated just as the percentage of green areas respect the total area. The software ENVIMET has been used to calculate the radius of influence of a green area, because it is able to simulate the effects of vegetation evapotranspiration on adjacent urban areas.

The building age also provides information related to the materials used, and therefore the variables related to old masonry buildings and newer concrete buildings. Lastly, the building height, represents one of the most relevant variables in literature.

A classification of the census tracts was carried out for each of these variables, based on the values that the variables adopt (Figures 2,3,4,5 and 6).

Then, in a GIS environment, different stepwise queries were used in order to classify the census tracts based on the sixteen characteristics considered.

In other words, some geo-processing operations relating to spatial analysis were carried out, such as 'overlay', i.e. the overlap of the different variables through the following stages of recalibration of the ranges of the variables, so as to bring out the features of the area of study that best represent the differences between the three neighbourhoods (Figure 7).

Furthermore, in order to ease the interpretation of the results, the 56 sections of open spaces were removed (parks and squares).

The relationships between the four substantial variables were used to define the classes of areas, in particular by referring to both the range of variation within each class and its average value compared with the average value of the entire urban system (Tables 6,7,8).

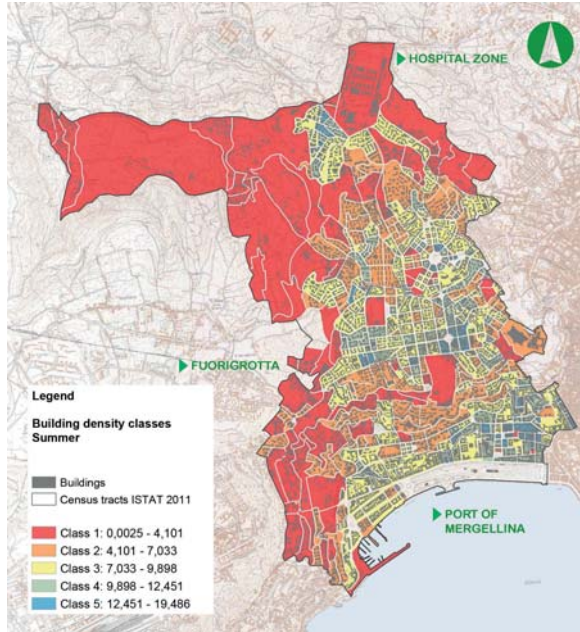


Fig. 2 Building density ranges summer

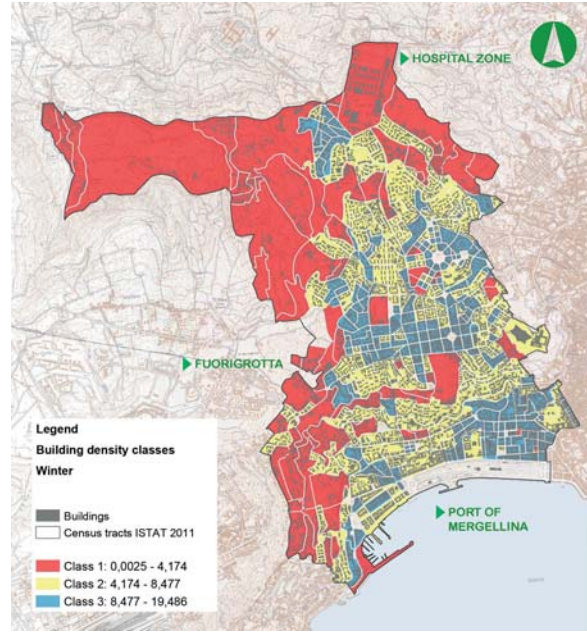


Fig. 3 Building density ranges winter

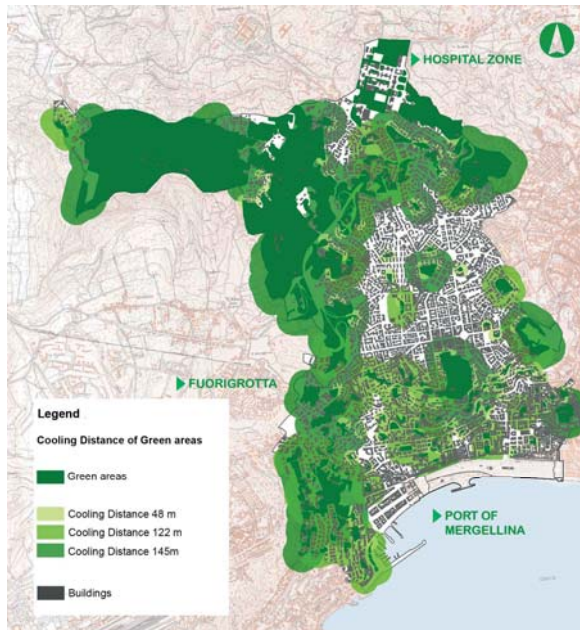


Fig. 4 Cooling distance of green areas

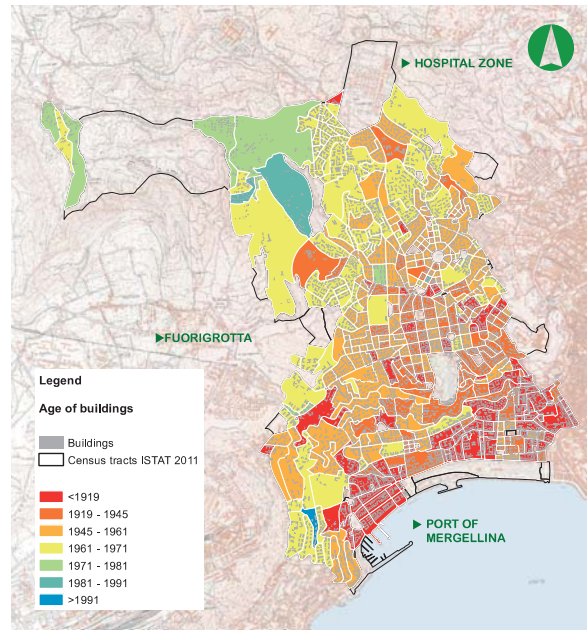


Fig. 5 Age of buildings

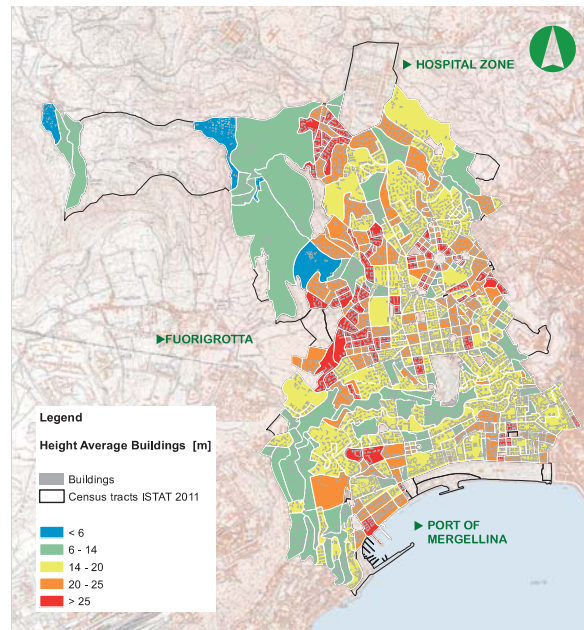


Fig. 6 Height average buildings

The three classes of census tracts identified are:

- Census tracts characterized by low building density, building age 1961-1971, and buildings at least 4 floors in height, with lower residential density values than the average for the overall system of reference. Most of the buildings in this class of census tracts developed unevenly with no clear planning pattern, connected by rather narrow “interweaving” roads, thus providing limited available space free from buildings.

This can be defined as the “*No planned areas*” class.

- Census tracts characterized by low building density, the significant presence of green areas, and tall buildings of around three floors in hilly locations. In other words, the Class 2 census tracts are located mainly in the areas of Chiaia and Arenella, particularly those located in Posillipo in the first case and Camaldoli in the second case.

This can be defined as the “*High Green Index Areas*” class.

- Census tracts characterized by high building density, buildings of at least six floors, and compact and predominately historical buildings. The census tracts of this type seem to represent a planned and compact urban fabric, built according to one single plan. It is based on a “foundation area” in neighbourhoods that have been drawn and designed, providing a woven chessboard framework as is the case of “Piazza Vanvitelli” and “Medaglie d’Oro”. It is no coincidence that most of the census tracts in Vomero and the different parts of Chiaia such as Viale Gramsci belong to this class.

This can be defined as the “*Organized Medium To High Density Areas*” class.

### 3.3 RESULTS

The intersection of physical, environmental and building variables made it possible to establish three classes of areas within the areas of study.

Both the gas and electricity consumption have been compared for each of these types of areas, in order to identify the characteristics that impact on energy consumption.



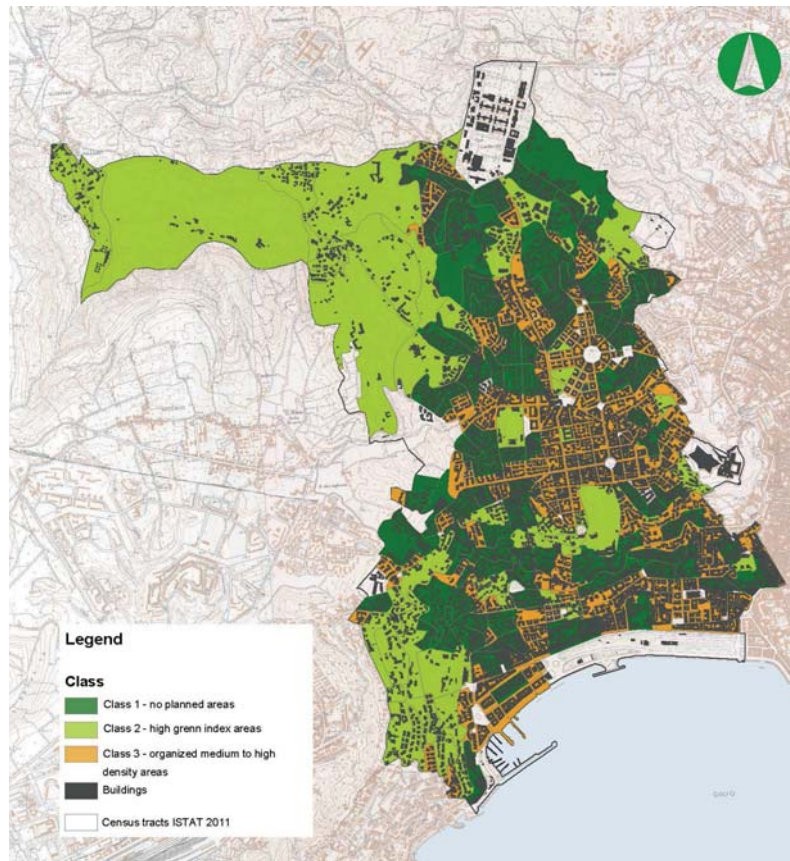


Fig. 7 Classes of census tracts identified within the three neighbourhoods of study

	VALUE RANGE	AVERAGE VALUE
Building Density	2,2 mc < d < 19,5 mc	7,81 mc
IGnR	-	0,50
Height Average Buildings	11,5 m < h < 31,4 m	18,84 m
Building Age	most '61 - '71	-

Tab. 6 Average values for the first class. No planned areas

	VALUE RANGE	AVERAGE VALUE
Building Density	0,44 mc < d < 7,15 mc	2,76 mc
IGnR	-	0,84
Height Average Buildings	5,46 m < h < 21,4 m	10,87 m
Building Age	most after '61	-

Tab. 7 Average values for the second class. High Green Index Areas

	VALUE RANGE	AVERAGE VALUE
Building Density	2,2 mc < d < 19,5 mc	8,92 mc
IGnR	-	0,16
Height Average Buildings	9,8 m < h < 32,6 m	19,6 m
Building Age	most before '45	-

Tab. 8 Average values for the third class. Organized Medium To High Density Areas

Because of the systemic approach on which this research is based, a comprehensive interpretation of the different variables taken into consideration was carried out, i.e. urban and energy variables, to provide the first indications of the physical elements that have more impact on energy consumption. Basically, within each of these areas, the census tracts with the highest level of energy consumption were identified and these were recognized as the most widespread urban features, able to provide useful information to identify urban intervention and reduce energy consumption.

### THE "NO PLANNED AREAS" CLASS AND ENERGY CONSUMPTION

The census tracts within this class have a high level of energy consumption (> 3822kWh / year) at about 11%, mostly in Chiaia, a neighbourhood characterized by a gentle slope (<150 m above sea level).

This information may be a useful initial indicator, as of the other sections with the same characteristics, it presents a lower consumption, located in steeper areas, for example, the census tracts around Cardarelli hospital.

Also taking into consideration building density and the average height of the buildings, the census tracts are characterized by a medium building density (0.0025 to 9.9 m<sup>3</sup> / m<sup>2</sup>) and medium-to-tall buildings (at least 12 m).

As for the green areas, there seems to be a detrimental element in terms of consumption, and the level of electricity consumption is high, being strongly affected by the cooling effect of the green areas.

Changing the focus to the census tracts characterized by higher gas consumption, the first indication is that only two out of ten (20%) energy-intensive sections, in terms of electric consumption, present higher gas consumption.

Moreover, it appears that the few sections that present higher gas consumption, roughly 5%, are characterized by medium building density (4 - 9 m<sup>3</sup> / m<sup>2</sup>) and buildings at least 18 m tall. Also in this case the presence of green areas distinguishes the energy-intensive sections in terms of gas.

Unlike the findings concerning electricity consumption, increased gas consumption does not seem to have been influenced by slope variations.

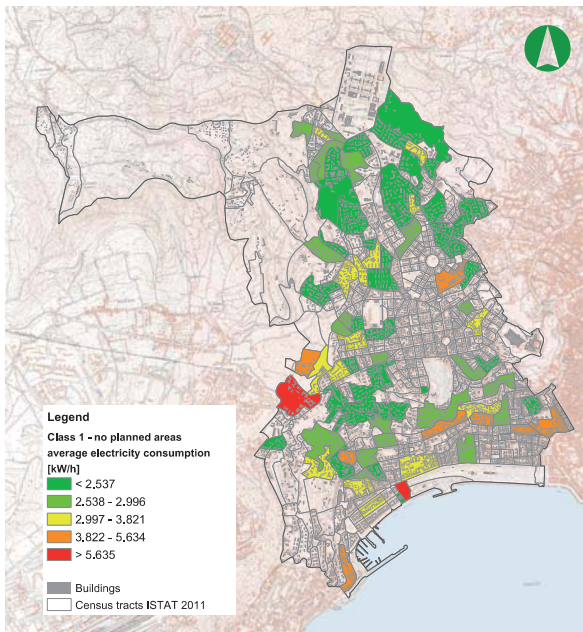


Fig. 8 Average electricity consumption class 1

#### Class 1 - No Planned Areas

#### AVERAGE ELECTRICITY CONSUMPTION

% highest consumption	
census tracts	11%

Tab. 9 Average electricity consumption class 1

#### COMMON CHARACTERISTICS OF MOST OF THE HIGHEST ELECTRICITY CONSUMPTION CENSUS TRACTS

Building density	Medium 0,0025 – 9,9 mc/mq
Height average buildings	Medium to tall, at least 12 m
Green areas	yes
Elevation	low 0 - 150 m.a.s.l.

Tab. 10 Common characteristics class 1



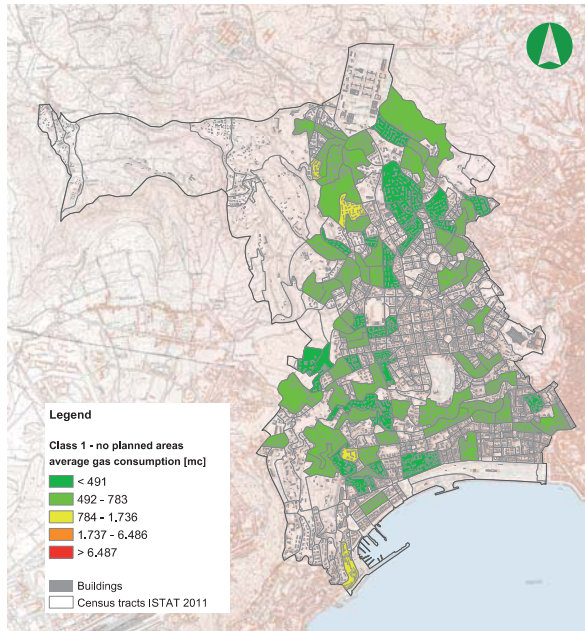


Fig. 9 Average gas consumption class 1

Class 1 - *No Planned Areas*

**AVERAGE GAS CONSUMPTION**

% highest consumption	
census tracts	5%

Tab. 11 Average gas consumption class 1

**COMMON CHARACTERISTICS OF MOST OF THE HIGHEST GAS CONSUMPTION CENSUS TRACTS**

Building density	Medium 4 – 9,9 mc/mq
Height average buildings	Tall, at least 18m
Green areas	yes
Elevation	-

Tab. 12 Common characteristics class 1

THE “HIGH GREEN INDEX AREAS” CLASS AND ENERGY CONSUMPTION

In terms of electricity consumption this class is characterized by a greater number of energy-intensive census tracts (27%), compared to the other two classes.

This condition can be explained by the low values of building density (0.002 to 7 m<sup>3</sup> / m<sup>2</sup>) and the strong presence of green areas. These elements distinguish this class, in particular the features that showed increased consumption in energy-intensive census tracts belonging to class 1.

The census tracts with high electrical consumption within this class (Class 2) also seem to be mainly characterized by the low average height of the building (maximum 12 m).

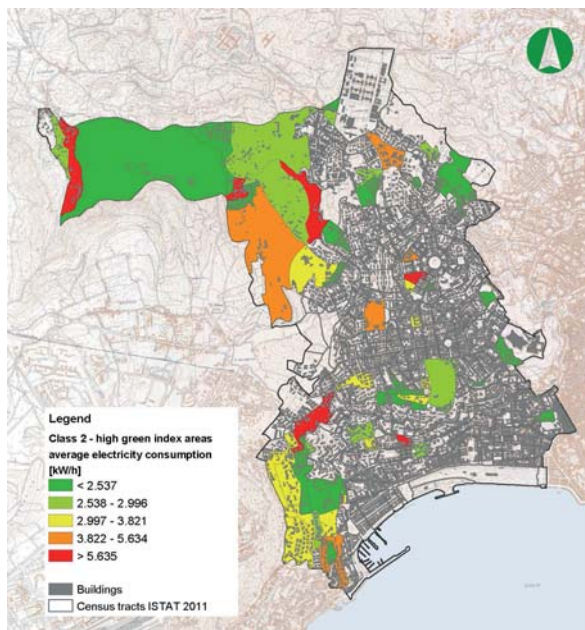


Fig. 10 Average electricity consumption class 2

Class 2 - *High Green Index Areas*

**AVERAGE ELECTRICITY CONSUMPTION**

% highest consumption census tracts	27%
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Tab. 13 Average electricity consumption class 2

**COMMON CHARACTERISTICS OF MOST OF THE HIGHEST ELECTRICITY CONSUMPTION CENSUS TRACTS**

Building density	Medium 0,0025 – 7 mc/mq
Height average buildings	Low at most 12 m
Green areas	yes
Elevation	-

Tab. 14 Common characteristics class 2

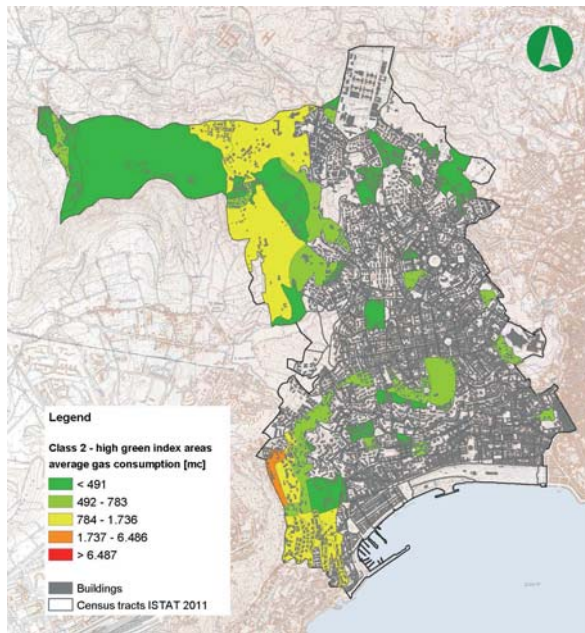


Fig. 11 Average gas consumption class 2

**Class 2 - High Green Index Areas**

**AVERAGE GAS CONSUMPTION**

% highest consumption census tracts	8%
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Tab. 15 Average gas consumption class 2

**COMMON CHARACTERISTICS OF MOST OF THE HIGHEST GAS CONSUMPTION CENSUS TRACTS**

Building density	Medium 4 – 9,9 mc/mq
Height average buildings	Low at most 12 m
Green areas	yes
Elevation	-

Tab. 16 Common characteristics class 2

Some census tracts marked by high electricity consumption, also present higher average gas consumption values (16%).

The interesting aspect is that the presence of high consumption both electricity and gas is found in those sections located in the hilly areas of Posillipo and Camaldoli, areas in which, as mentioned before, the strong presence of green areas is associated with low building values.

This result seems to support previous studies showing that urban areas with low density values are characterized by higher energy consumption (Andrews 2008; Ewing & Rong 2008).

Unlike the energy consumption findings for Class 1, the climometric index for Class 2 does not seem to be significant.

**THE “ORGANIZED MEDIUM TO HIGH DENSITY AREAS” CLASS AND ENERGY CONSUMPTION**

The several census tracts of this class with high electricity consumption (24%) are characterized, in most parts, by high building density values (> 10 m<sup>3</sup> / m<sup>2</sup>) and also by tall buildings of at least 18m.

The majority of these energy-intensive sections also seem to be characterized by the absence of green areas or appear to be located beyond the maximum distance of cooling of the green areas.

This element confirms the different studies that support the importance of green spaces in a positive reduction of energy consumption (Akbari *et al.* 2001; Hong Ye *et al.* 2013).

Moving now to the census tracts characterized by higher gas consumption, the first findings show that 16 out of 24 (66%) energy-intensive sections also have high gas consumption, compared with electricity consumption. Moreover, it appears that the census tracts with higher gas consumption (13%) are largely characterized by medium to high building density values (> 7mc / sqm) and have tall buildings at least 18m. These are the census tracts most affected by the areas of influence of some of the green areas existing in this class located within the Chiaia area, especially those areas with a low slope (0-150 m above sea level).

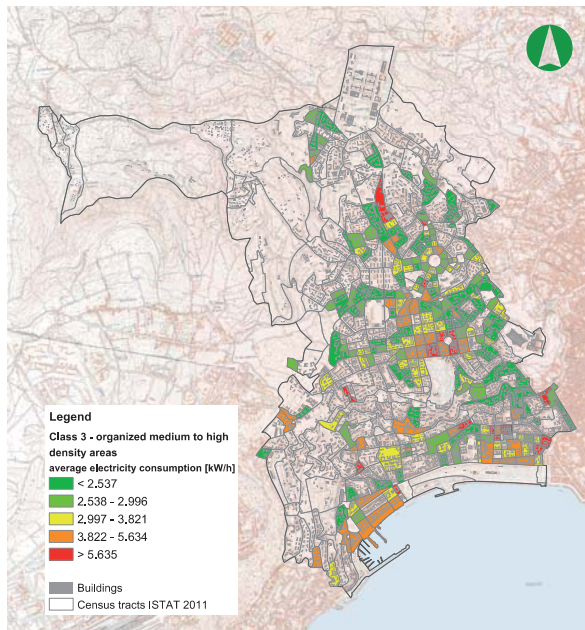


Fig. 12 Average electricity consumption class 3

Class 3 - *Organized Medium To High Density Areas*

**AVERAGE ELECTRICITY CONSUMPTION**

% highest consumption census tracts	24%
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Tab. 17 Average electricity consumption class 3

**COMMON CHARACTERISTICS OF MOST OF THE HIGHEST ELECTRICITY CONSUMPTION CENSUS TRACTS**

Building density	high > 10 mc/mq
Height average buildings	High, at least 18 m
Green areas	no
Elevation	-

Tab. 18 Common characteristics class 3

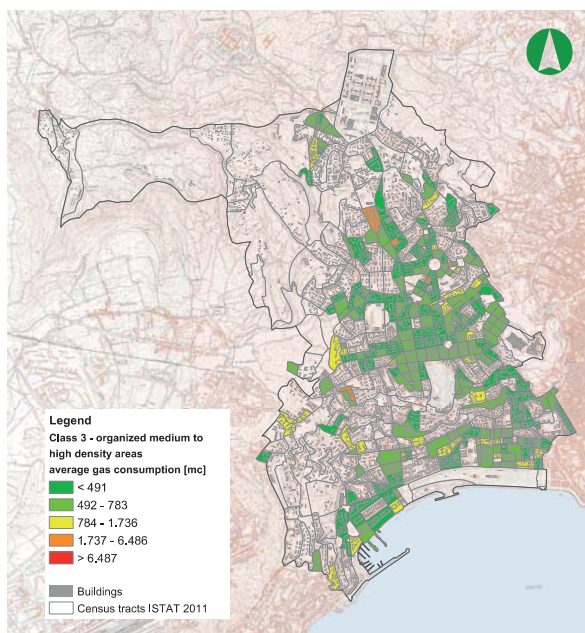


Fig. 13 Average gas consumption class 3

Class 3 - *Organized Medium To High Density Areas*

**AVERAGE GAS CONSUMPTION**

% highest consumption census tracts	13%
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Tab. 19 Average gas consumption class 3

**COMMON CHARACTERISTICS OF MOST OF THE HIGHEST GAS CONSUMPTION CENSUS TRACTS**

Building density	Medium to high > 7 mc/mq
Height average buildings	Tall, at least 18 m
Green areas	yes
Elevation	low 0 - 150 m.a.s.l.

Tab. 20 Common characteristics class 3

## 4 DISCUSSION

The interpretative model is the “translation key application” of the systemic approach, adopted to identify which of the physical, environmental and building variables can be deemed responsible for possible electricity and gas consumption.

These characteristics were defined for each of the three classes of areas in which the three neighbourhoods of study were divided, thanks to the variables common to most of the census tracts defined as energy-intensive. Class 1 is characterized by buildings built after the 60s, buildings at least 4 floors tall, and medium building density values. These features seem to distinguish both the energy-intensive sections from an



electric energy point of view and gas, with less than the height of the buildings more extensively elevated in accordance to the second type of consumption.

The presence of green areas can represent an additional element to attribute to the increased consumption of energy-intensive census tracts in terms of electricity and gas.

Class 2 is strongly characterized by a physical and environmental variable: low building density and the considerable presence of green areas. These features, together with three-storey buildings built in mostly hilly locations after 1960, can be identified as the elements that affect the consumption in energy-intensive sections both in terms of electricity and gas.

Class 3 is characterized by buildings of at least six floor, mostly compact and built before 1945 ('historic buildings'). These features are common to energy-intensive census tracts in terms of both electricity and gas. They differ with regard to those green areas which seem to be a 'worsening' element, but only in terms of gas consumption.

The following charts show the characteristics of energy-intensive census tracts described above:

### ELECTRICITY CONSUMPTION

	<b>CLASS 1 NO PLANNED AREAS</b>	<b>CLASS 2 HIGH GREEN INDEX AREAS</b>	<b>CLASS 3 ORGANIZED MEDIUM TO HIGH DENSITY AREAS</b>
% highest consumption census tracts	11%	27%	24%
<b>CHARACTERISTICS OF THE ENERGY-INTENSIVE CENSUS TRACTS</b>			
Building density	Medium	Low	High
Average height buildings	Medium to tall	Low	Tall
Green areas	Yes	Yes	No
Elevation	Low	-	-

Tab. 21 energy-intensive tracts' characteristics in relation to energy consumption

### GAS CONSUMPTION

	<b>CLASS 1 NO PLANNED AREAS</b>	<b>CLASS 2 HIGH GREEN INDEX AREAS</b>	<b>CLASS 3 ORGANIZED MEDIUM TO HIGH DENSITY AREAS</b>
% highest consumption census tracts	5%	8%	13%
<b>CHARACTERISTICS OF THE ENERGY-INTENSIVE CENSUS TRACTS</b>			
Building density	Medium	Low	Medium to high
Average height buildings	Tall	Low	Tall
Green areas	Yes	Yes	Yes
Elevation	-	-	Low

Tab. 22 Energy-intensive tracts' characteristics in relation to gas consumption

A qualitative comparison between the physical, environmental and building characteristics that seem to affect the consumption of electricity and gas, prompts the following considerations:

- Low values of building density and low building height of are associated with higher values of electricity and gas consumption. The reasons for such consumption levels are offset in several studies, according to which the parts of the urban territory with few built-up areas show a higher level of energy consumption and have residences of considerable size (terraced houses) that

require greater quantities of energy for various purposes (heating, cooling, etc.) and, being located randomly throughout the territory, have more external dispersed surfaces which require a greater amount of energy. Furthermore, the strong presence of green spaces on one hand highlights a negative influence in terms of gas consumption, because of the need for a greater use of heating during the winter, but on the other, it does not seem to be reflected in those studies that support the positive effect of green spaces on the reduction of the temperature and subsequently the reduction of energy consumption during the summer.

- The medium building density values and high buildings are associated with higher consumption of electricity and gas. Such levels of energy consumption are due to the fact that they belong to densely constructed portions of urban areas with numerous business activities and consumers, as well as the increased need for artificial lighting, and air conditioning in the summer season. Moreover, the high consumption of gas is most likely due to the greater shadow effect created by the proximity of the buildings. Inside the portions of urban areas possessing these building density and building height characteristics, the influence of green spaces on energy consumption is not easy to determine.

The foregoing considerations seem to suggest that the highest consumption of electricity and gas within some census tracts of the three areas of study are not totally influenced by the sixteen variables considered. Firstly, in order to help clarify some of the issues that for have long captured the attention of researchers, it is possible to say that building density by itself is not enough to analyse energy phenomena. Although building density cannot be overlooked when studying the relationship between energy consumption and urban systems, energy issues at neighbourhood level and thus on an urban scale, cannot be addressed by reducing everything in terms of building density.

The oversimplification that characterizes research related to energy consumption on an urban scale, especially that relating to the form and dimension of cities, studying the parameters that work independently of each other, has been evaluated in this research work, but an attempt has been made to improve it through an interpretation of the different variables examined in order to identify which physical, environmental or building features have greater impact on the consumptions of energy and gas.

High levels of building density or low density with the presence or the absence of green areas, high buildings or low buildings have different impacts on energy consumption and therefore the possibility of identifying an “ideal” sustainable urban form able to maximize the energy efficiency is still theoretical (Doherty et al., 2009). These results suggest a serious analysis of the validity of this ambitious goal of identifying a unique pattern that correlates urban form and energy consumption, opening up the possibility of reformulating this goal based on the assumption that there is not only one, but several consumption patterns due to the different physical, environmental and building characteristics of different urban areas.

In conclusion, the decision to adopt an integrated holistic approach rather than a sectorial one and to consider the dimensions of the neighbourhood rather than the building, made it possible to explore the relationship between city and energy, taking into account the many features of the physical level. This type of approach has confirmed the complexity of the relationships between these characteristics and energy consumption and therefore, the inadequacy of using a sectorial approach. In addition, along with the physical and social characteristics, if one adds the financial and social characteristic, the relationship between urban space and energy consumption would become even more complex and multi-dimensional, and the definition of a unique solution of interpreting the relationship between cities and energy becomes extremely difficult as already pointed out by Doherty et al. in 2009.

Furthermore, the use of a holistic approach also represents a fundamental requisite in the development of more smart and resilient cities to better face the local challenges dictated by climate change.

Deepening the knowledge of the complex relationship between the characteristics of the urban space and energy consumption makes it possible to define on which “site-specific” elements to intervene, in order to make a more rational and efficient use of available resources and so to enhance the urban resilience.

In other words, this work represents the step in the more and more widespread and broad debate on which features allow to create a resilient and smart city (EEA 2008; Jabareen 2013).

The complex and multi-dimensional nature of both the energy phenomena and urban systems, provide many interesting ideas for the future development of this research work.

Firstly, one of the possible subjects of study is to expand the application of the interpretative model to an urban area, including different variables, for example those describing functional specialization, such as climate and the transportation behaviour of the consumers.

A further point of interest might be to deepen the impact of the green areas on the consumption of electricity and gas, as the results obtained in this research work do not appear to be sufficiently clear.



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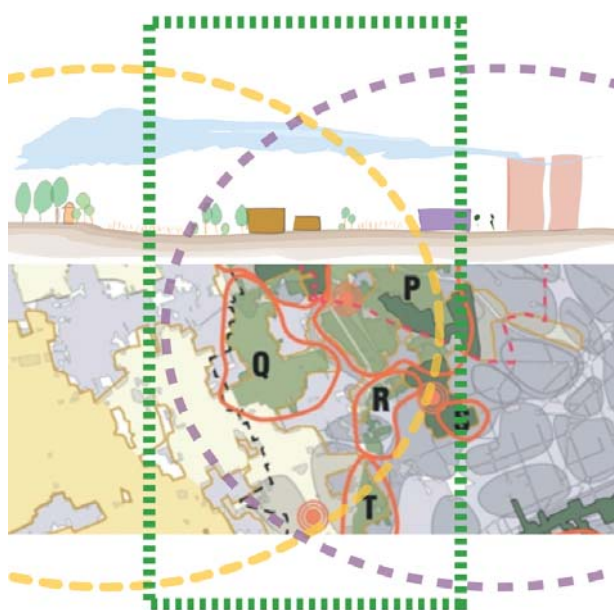
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## THE POTENTIAL OF PERIURBAN AREAS FOR THE RESILIENCE OF METROPOLITAN REGION

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### ABSTRACT

The paper aims to present as an organic structure the outcomes from various pieces of research and consulting activities developed over the last few years (2011-2015). Shared topics are: urban-rural partnerships, food planning, metropolitan polices and the territorial resilience of periurban areas.

In the first part (the core of the paper) the paper underlines critical questions and establishes needs so as to move towards a new approach to development processes in periurban areas. The paper uses some key concepts to present the main outcomes: 1. Understanding complexity (multi-scales in space) and dynamics (multi-scales in time); 2. Identifying all the resources and opportunities; 3. Crosscutting and multi-issues.

In the second part (in the final part) the paper proposes the "Ecotone" metaphor to support innovation in the approach to periurban areas. It is a "zone of transition between adjacent ecological systems, having a set of characteristics uniquely defined by space and time scales and by the strength of the interactions between adjacent ecological systems" (Hansen et al, 1992). In these terms, periurban areas may be assumed to be ecotonal zones of transition between urban and rural or natural systems. Using the concept of "ecotonal buffer of transition" to approach the periurban systems it is possible to connect main needs and critical questions underlined to a homogeneous framework and to emphasize on the strategic role that the periurban systems play for the future development of metropolitan regions oriented to a improvement of resilience of socio-ecosystems. In the final part the paper focuses on the governance of urban rural partnerships and research perspectives.

### KEYWORDS:

periurban, urban-rural partnership, resilience, ecotone

## 1 INTRODUCTION

### 1.1 THE REASONS FOR, AND AIMS OF, THE PAPER

The paper aims to present in an organic structure the outcomes from various research and consulting activities developed over the last four years (2011-2015). Shared topics are: urban-rural partnerships, food planning, metropolitan polices and the territorial resilience of periurban areas.

The two main activities are:

- CIVES (citizen towards sustainability), a participatory process towards the definition of shared visions for a large portion of the Milan municipal area between Naviglio Grande and Naviglio Pavese. The project has involved associations, stakeholders, institutions and local communities with a view to developing shared strategies and projects for urban and rural environmental quality improvement and the integration and strengthening of rural and urban alliance;
- Urban Rural Partnerships in Metropolitan Areas (URMA - <http://www.urma-project.eu/>) is an INTEERG IV C program (2012 –2014). The Pilot Case developed by the Lombardy Region focuses on the periurban areas in the western portion of the Milan metropolitan area.

The project has involved researchers and consultants specialized in various fields. As a matter of fact, this provided the opportunity to study the issues and topics on a crosscutting (but homogeneous) basis, merging different points of views and activating fertile links and connections between different literature disciplines, knowledge systems and approaches.

### 1.2 THE CONTEXT

The “context” could be considered the “Pilot area” identified for the URMA project by the Lombardy Region. The “reference context” scale is compared with metropolitan and local scales. The Pilot context is localized in the Metropolitan area of Milan in the Lombardy Region (Figure 1).

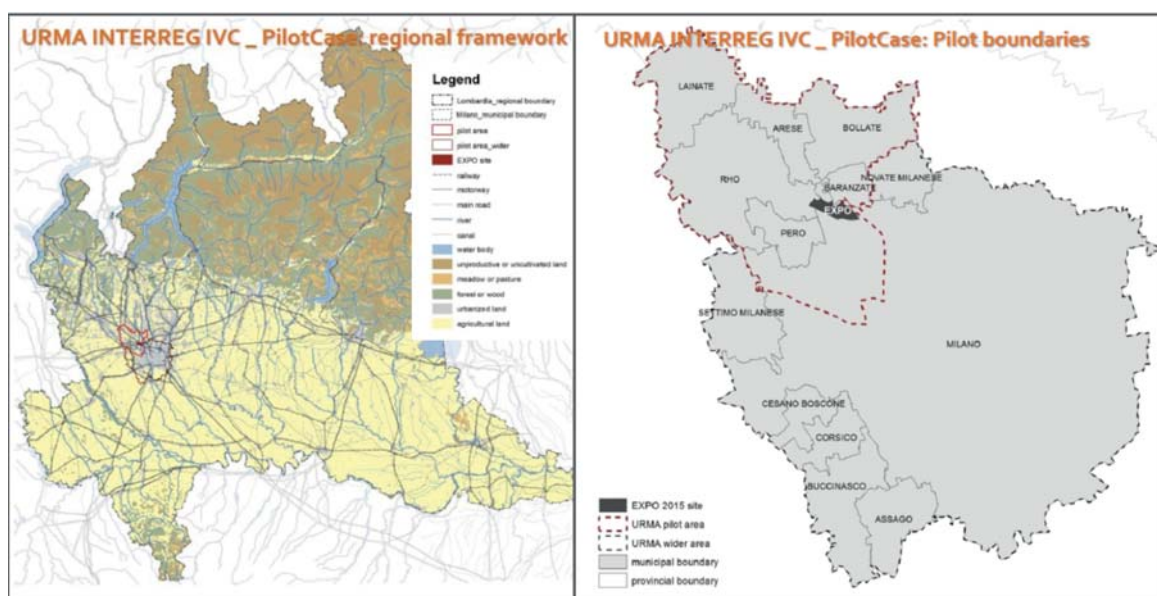


Fig. 1 Localization of the “Lombardy Pilot Case” for the URMA project: the localization in the Lombardy Regional context and in the metropolitan area of Milan. The Pilot includes two different boundaries: the Pilot boundaries and the wider context used to characterize the periurban system.



The context chosen is very stimulating in terms of transformation and trends (the EXPO site and a large range of connected projects, such as Waterway, the rural heritage presentation project etc., are within the context), critical pressures and critical problems for the ecosystem and environmental components, as well as the complex dynamics involving social and economic components.

### 1.3 EMERGING QUESTIONS AND KEY CONCEPTS

A shared set of “critical questions” and “needs” have emerged thanks to a variety of research projects, consulting activities and workshops (particular mention should be made of the role of REsilienceLAB, a network of professionals and researchers devoted to the study of Resilience, promoting workshops on the different applications of the “resilience” approach to territorial complex systems). In the paper, the needs and critical questions are associated to some key concepts.

#### *Key concept 1. Understanding complexity (multiscales in space) and dynamics (multiscales in time)*

Based on research concerning the Pilot context, it is clear that pressure on single open/rural surfaces is a significant problem, but the main critical problem is related to the fragmentation process taking place in periurban open areas. The fragmentation (due to both urbanization and infrastructure) implies a) a contraction of agricultural production surfaces (the non-cultivation of fragmented contexts). The process implies a trend of under management of the non-cultivated surfaces in decline (both in terms of recognition of their value in terms of agricultural interest and the perception of communities). In general, the surveys have confirmed the positive correlation between the continuity of the rural system (low level of fragmentation) and the presence of “good practices” (such as local networking, associations, local food buying groups, local parks): conversely, surface/sub-systems with a high level of fragmentation (due to infrastructure, urban sprawl, industrial/other isolated settlements...) are not involved or are the target of initiatives of “valorization” (not related to the development of settlements).

The areas characterized by a high level of fragmentation show a specific fragility/vulnerability due to a low level of identity and low value in terms of agricultural production.

From the technical point of view, it is necessary to develop surveys and assessment processes able to identify the fragilities that characterize these portions of the periurban areas. The methods have to approach the “periurban” not as isolated surfaces but in terms of “transition transects” from the rural/natural to the urban system in order to overlay different information from the database able to represent the complexity of environmental, social, economic and governance dynamics, and the flows that link the rural/periurban/urban systems and dynamics (in terms of scenarios or transformation factors).

#### *Key concept 2. Identifying all the resources and opportunities*

The complexity and richness of the Milan metropolitan area were evident during the CIVES and URMA projects: it is a complex and multi-faceted scenario from the point of view of the functions and services performed by the periurban areas and the policies and projects activated for the improvement of periurban areas promoted by institutions, but also by a large range of associations. The large consensus that supports local food distribution and consumption is also evident. The panorama also shows situations of periurban surfaces “neglected” due to isolation (in the midst of infrastructure nodes, including settlement development areas, deriving from industrial or other uses). Rural buildings and (unused) rural cultural heritage may be included in the “neglected” or degraded category.

#### *Key concept 3. Crosscutting and multi-issues*

The main difficulties/barriers to the implementation of integrated projects relate to the rigidity of the institutional framework in terms of competencies (different scales and bodies have responsibilities and competencies for water, rural, natural, soil, urban plans and management) and in terms of a lack of crosscutting governance instruments. The existing governance framework is not able to support/implement

the crosscutting proposal and projects proposed by individual associations or private enterprises. In particular, if these proposals imply multi-issue actions and solutions (involving, at the same time, agriculture innovation, water management, ecosystem improvement and urban neighborhoods renovation, etc.).

*Key concept 4. The periurban system as strategic buffer for a new metropolitan development [functions and services]*

The “periurban” transition belt plays a relevant and strategic role in the future vision and development of metropolitan polices: these areas can receive/embrace several functions essential to the adaptation and survival of the urban area (ecosystems services, green infrastructures, etc.). These functions may mitigate critical issues; services and functions useful for promoting urban economic innovation (innovation hub, co-working initiatives, studio and research start-up, etc.) could be localised here, offering services useful for the urban population (green and community open spaces/public realm, social enterprises, circular economies, etc.) as well as for the agricultural system (innovation and research centres, training and services for agricultural management and innovation, etc.).

## 2 UNDERSTAND COMPLEXITY: BUILDING KNOWLEDGE

The main assumptions relating to the knowledge phase and survey activities are: a) the characterization of the context has to (spatially) integrate different spatial scales and b) dynamic (temporal) survey systems: mapping the phenomena, identifying c) practices and community initiatives as knowledge sources.

### 2.1 PERIURBAN IDENTIFICATION

*Key concept 1. Understanding complexity (multiscales in space) and dynamics (multiscales in time)*

The knowledge step was based on the overlapping of the main territorial data on a wide scale (landscape and environmental features, infrastructure and mobility system, urban patterns, water system, and agricultural landscape and production).

The first process was the identification of a periurban cluster based on the following phases:

- identifying open space fragments (all the non-built up areas based on the DUSAF, the regional land use database);
- identifying periurban fragments: the open/green surfaces included in the Urban textures were excluded): in this phase it was possible to recognise all the fragments of periurban open areas;
- identifying clusters: based on the DUSAF, aerial photos and the relationships with the wider context, it was possible to identify a number of clusters. Single fragments were aggregated into clusters which have physical continuity or share specific characteristics (e.g.: all the open areas identified in the previous step are included in a nature safeguard institution...);
- “cluster” surveys: for each cluster, a number of surveys were carried out to underline the main phenomena and data (land uses/landscape & ecological quality level, transformation trends, good practices & networking/governance).

The “clusters” were redefined on the basis of the surveys, and the “sub-systems” within the periurban area were identified (based on readings/analyses of the characteristics of the cluster: land use, functions, and context relationships).

In defining the periurban “sub-systems”, the areas surrounding the site of the EXPO development surfaces (and the connected development surfaces, i.e., the red circle in the map in figure 2 and figure 3) and the fragments connected to rural systems external to the Pilot boundaries were excluded.

To determine the characteristics of periurban “sub-systems”, different sets of territorial information were overlapped and compared in order to underline:

- existing characterisation of the single “periurban sub-system” (ecological complexity and value, fragmentation/continuity, agriculture production ...);
- existing characteristics of the context surrounding the periurban sub-system (urban patterns and functions, urban communities, the mobility and infrastructure system ...);
- the trends and future transformations defined by the planning system (at regional, metropolitan and municipal level). Territorial plans define four main kinds of guidelines: safeguarding and conserving the environment/landscape, agricultural landscape and production safeguards, infrastructures and mobility improvement/projects, urban development) ;
- community initiatives regarding the active protection of the local landscape (local green parks promoted and managed by local associations), urban-rural partnerships mostly connected with local agricultural production and the local food chain, specific local actions and initiatives connected with the use or valorisation of the cultural heritage (local associations or social enterprises).

In order to understand and recognize the whole range of resources, it is important to integrate the surveys on the periurban system with rural/natural patterns and urban patterns (both have to be involved in the design of strategic projects based on urban-rural partnerships) and include the dynamic trends of transformation and local community actions and initiatives acting on the rural-periurban-urban transition transects.

## 2.2 MAPPING AND COMPARING INITIATIVES AND PRACTICES

### *Key concept 2. Identify all the resources and opportunities*

Projects, initiatives, and programs that promote urban-rural partnerships already exist. These projects are perhaps isolated and have a very different range of characteristics and specificities. Therefore, there is a need to improve the exchange of information between levels of regional and local planning, in order to ensure the right support and the transfer of good practices to other areas.

Different practices and initiatives were developed in the context of the URMA project as this was one of the key activities envisaged. One of the aims of the URMA project was in fact to share good practices and identify success factors.

The pilots and good practices of the European project have demonstrated that there is co-responsibility and regional solidarity among the actors involved (citizens' groups, NGOs, local and regional administrations, students). In particular, the good practices developed by the Netherlands partner (the Twente Region) were used as examples for the Lombardy Region Pilot, i.e., the Twente Green Knowledge Portal and the Fresh Route/Distribution and Experience Centre (Twente).

The identification of bottom-up initiatives (local level) and the good practices comparison (figure 4) are significant and crucial aspects in the knowledge phases (both in URMA and CIVES).

The initiatives of the local communities promoted by associations (or local institutions) are fundamental for different reasons:

- to understand the dynamics (specific bottom-up safeguard initiatives are related to specific places), it is important to understand the dynamics and the reasons of mobilization. This may make it possible to identify some possible success factors...);
- to identify all the resources (in terms of social and economical resources) and involve all the stakeholders in the design process of urban rural partnerships projects/strategies.

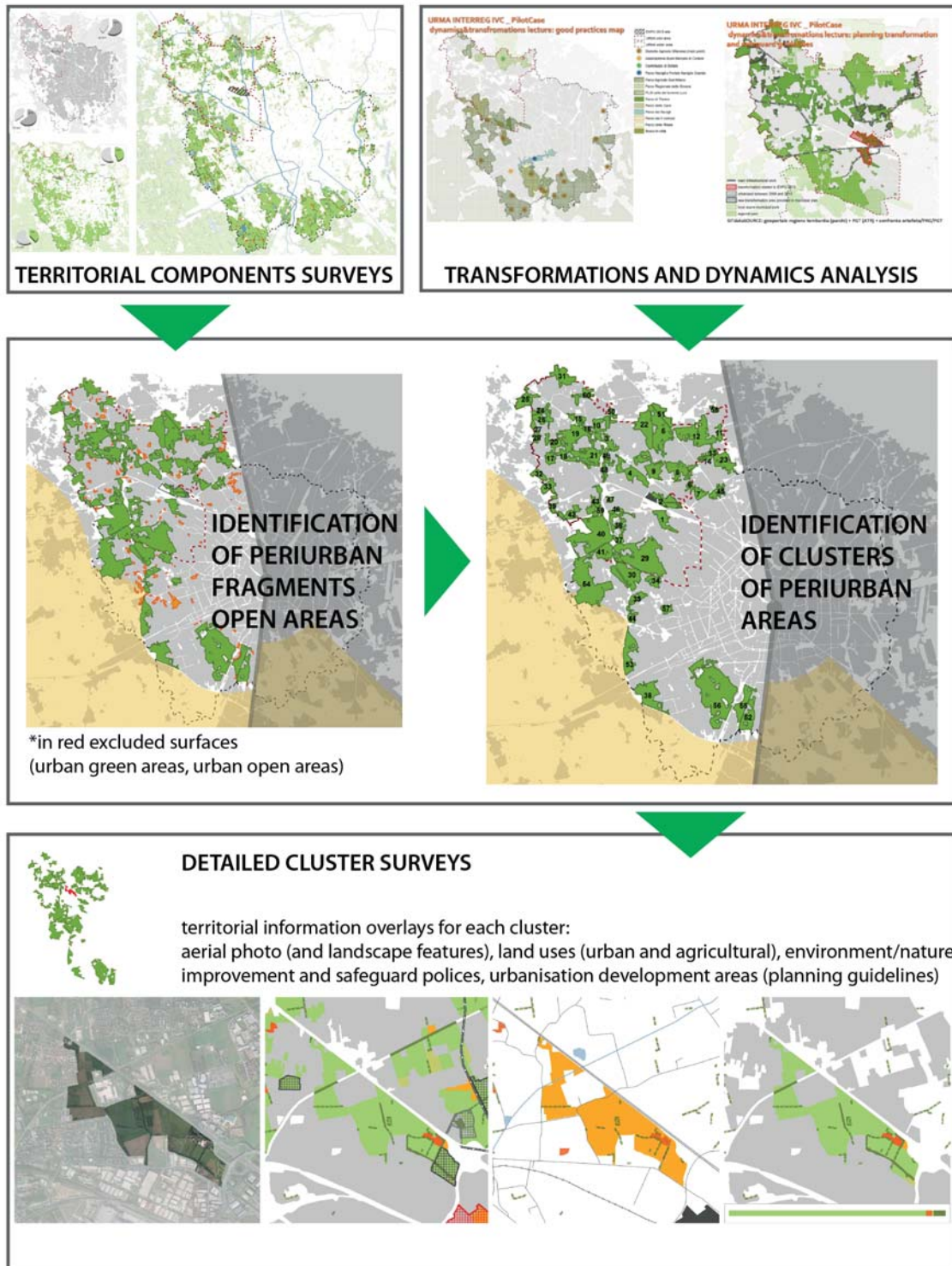


Fig. 2 The process of identification and characterization of Periurban subsystems in the Lombardy Region Pilot of the URMA projects.



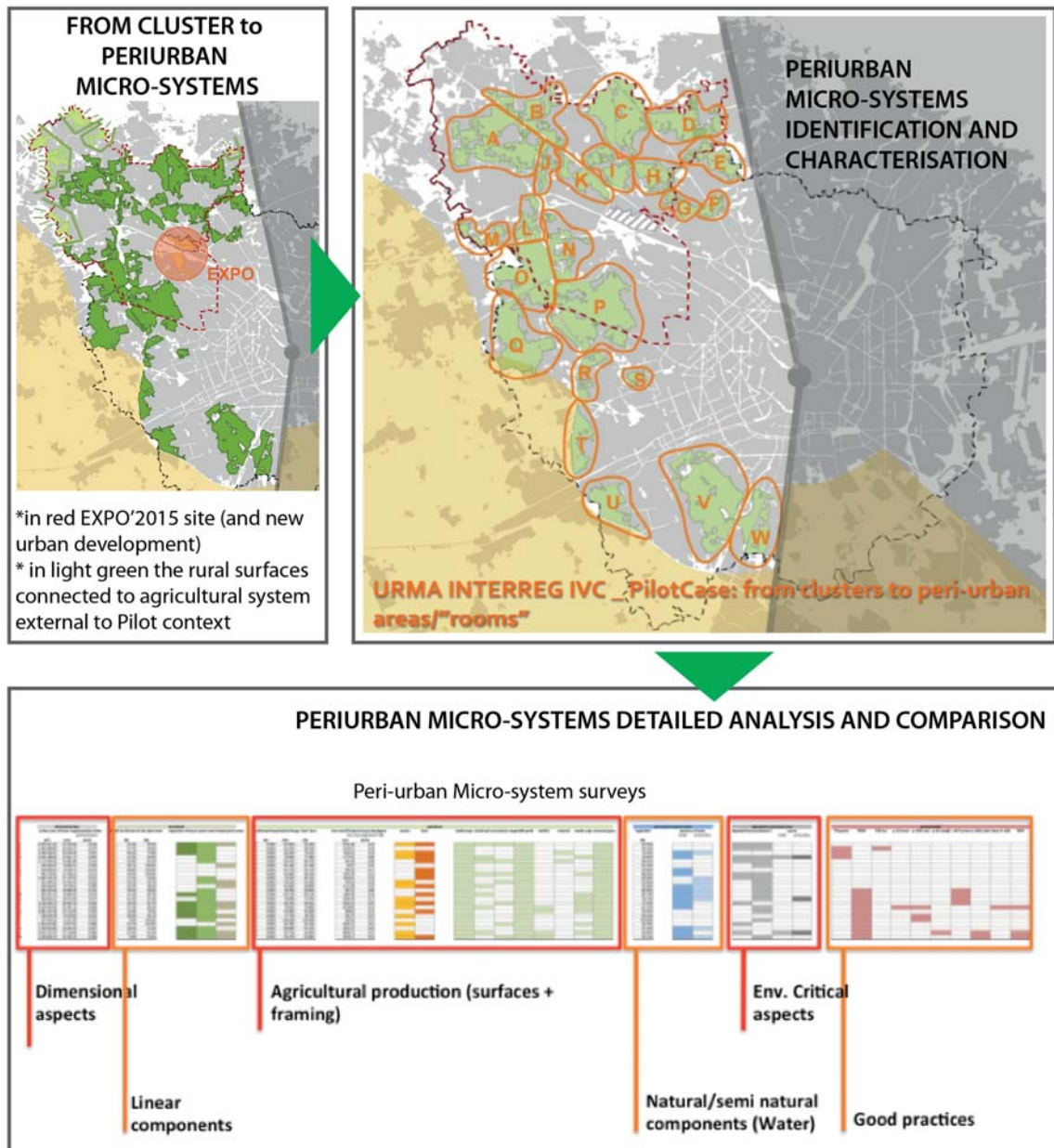


Fig. 3 The process of identification and characterization of Periurban subsystems in the Lombardy Region Pilot of the URMA projects.

During the research and consulting works, different kinds of local initiatives and local proposals/projects were developed.

The URMA Pilot focused on initiatives, research, coordination policies, strategic planning and administration engagement with specific characteristics:

- initiatives/practices that have activated a synergic and positive system of responses involving a complex governance process (multi-stakeholders, such as communities, academics, administration, private individuals, associations, etc.);
- multi-purpose initiatives: the aims of the initiatives have to include and integrate goals related to different elements in "resilience" for complex systems (such as environmental, social, governance networks, etc.);



- initiatives that have activated or proposed innovative solutions in relation to the connection between food, energy, and water (in the Milan case study in particular, “food” is identified as a “core/activator topic”, due to the role of EXPO’ 2015 as a “catalyst event”);

The aim was to identify a large range of “resilience” initiatives (e.g., small and local actions, metropolitan policies and/or applied research) in order to understand the complexity and richness of the Milan metropolitan panorama.

In the Milan metropolitan context there is a consolidated tradition of widespread locally-based actions relating to environmental/climatic topics. They focus particularly on food and environmental preservation/improvement issues.

Important local actors have promoted structured projects and programs fostering the diffusion of initiatives for local sustainability, resilience and adaptation (projects promoted not only by “institutional” actors, but also involving independent actors such as the CARIPO Foundation and Universities and associations/NGOs of metropolitan importance).

It is possible to identify (figure 5) a rich panorama in terms of different typologies of initiatives and projects. The panorama could be characterized by:

- isolated but diffuse bottom-up initiatives relating to individual community gardens. These initiatives have different “histories”, and the initiatives involve different ranges of community sectors. They integrate different issues (sometime more closely related to social inclusion, environmental issues and the quality of urban landscape, adaptation, etc.);
- place-based initiatives where associations work to preserve and improve open spaces (urban, green, rural...). The “Parco delle Risaie”, one of the good practices of the URMA project, is an example of an initiative where farmers and citizens have set up an association to preserve and develop a strategic vision for a rural landscape within the urban patterns of the Milan Metropolitan area.

Some initiatives are place-based, but have developed a network of connections with other initiatives that act on a larger scale or in other contexts. The good practices of the Buonmercato are an example of such an initiative.

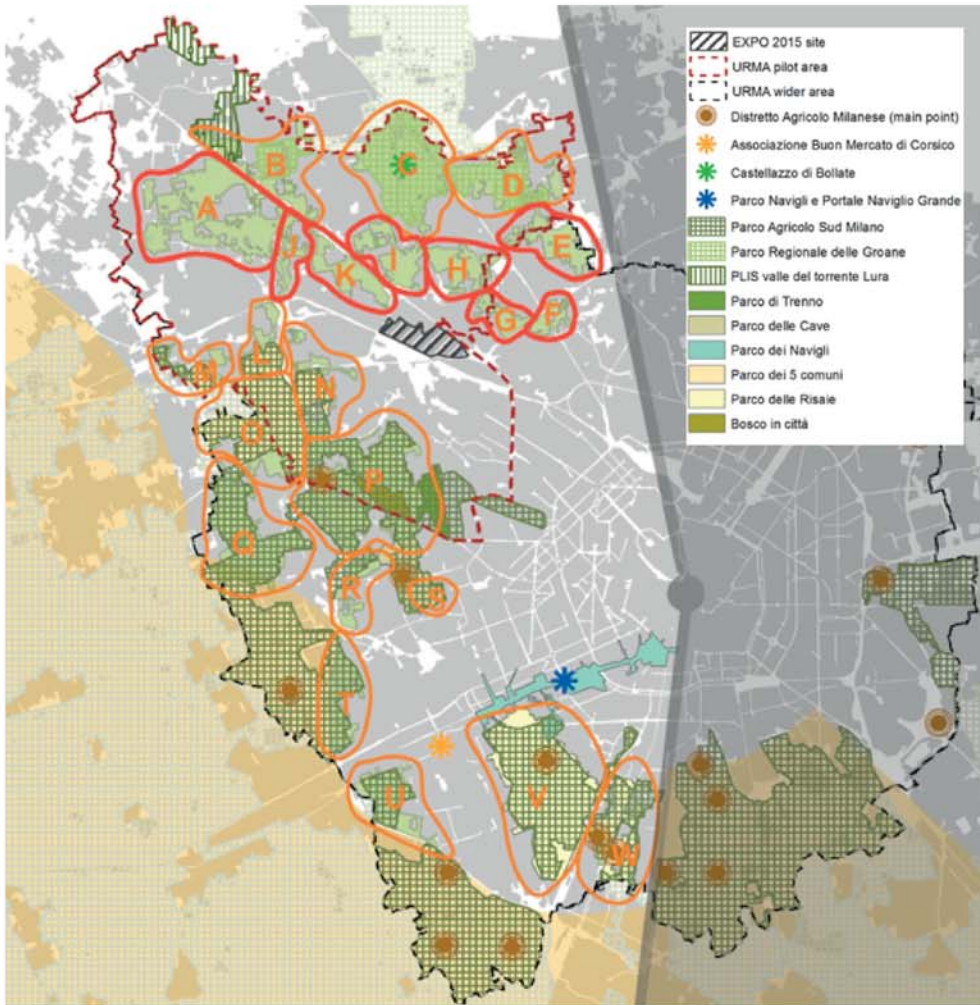
Over the last few years, much research work and many European projects have been set up focusing on food policies, rural-urban landscape and urban/rural partnerships.

With the recent institution of the Milan metropolitan area and the EXPO, the institutions have launched a different program to foster networking between the initiatives. One example is the food policy pact and the Milan food policy.

Good practices and initiatives germinate similar initiatives and it is important to underline the diffusion of integrated initiatives in the Milan metropolitan context.

The knowledge behind the URMA Pilot included the comparison and overlapping of local initiatives in the mapping process (the mapping process implies physical localization but also networking). It is essential to compare good practices (and also “not good” or “problematic” cases) from comparable territorial contexts.

PERIURBAN "MICROSYSTEMS" AND GOOD PRACTICES/DYNAMICS OVERLAY AND COMPARISON



GOOD PRACTICES AND PROJECTS COMPARISON MATRIX

definition of the case	implementation	managements	green infrastructures		assessment	blue/water infrastructures		assessment	food chain + agricultural multifunctionality		assessment
	realized/proposed	level and management proposals	vegetation improvement (ornamental/trees forest/vegetation belts)	green network + biodiversity	positive/negative + high/medium/low effect on the topics	improvement of water cycles	water courses improvement	positive/negative + high/medium/low effect on the topics	food system strategies	multifunctionality in agriculture areas	positive/negative + high/medium/low effect on the topics
Parco della mata	bottom up	realized		INDIRECT	positive/high effect						positive/high effect
Consorzio DAM (distretto agricolo Milanese)	institutional supported	start	DIRECT			DIRECT			DIRECT	DIRECT	positive/high effect
DESR - Distretto di economia agricola rurale del parco agricolo Sud Milano	bottom up	realized				DIRECT			DIRECT	DIRECT	positive/high effect
Buon Mercato	Bottom up/MS								DIRECT		
Associazione Cascine Milano	Non institutional		INDIRECT						DIRECT	INDIRECT	
Portale Naviglio Grande	bottom up	proposed		DIRECT	positive/high effect		DIRECT	positive/high effect		DIRECT	positive/medium effect
parco lineare naviglio grande	bottom up	proposed	DIRECT	DIRECT	positive/high effect	DIRECT	DIRECT	DIRECT (regarding water courses/high effect high impact on the topics)	DIRECT	DIRECT	positive/high effect
Progetto parco 5 comuni	Top-down / institutional		DIRECT						DIRECT		
Parco di Trenno	Top-down / institutional	realized	DIRECT	DIRECT	positive/high effect		INDIRECT	negative (tourism used as migration channels and not productive effect)		DIRECT	positive/high effect
PARCO DELLE CAVE	Top-down / institutional	realized	DIRECT	DIRECT	positive/high effect	DIRECT	DIRECT			DIRECT	positive/high effect
BOSCONCITTÀ	Top-down / institutional	realized	DIRECT	DIRECT	positive/high effect	DIRECT	DIRECT			DIRECT	positive/high effect
PARCO GROANE	Top-down / institutional	realized	INDIRECT	DIRECT	positive/high effect				INDIRECT	INDIRECT	positive/low effect/Agriculture is not efficient in the type of INTERC
progetto EXPO (general master plan)	Top-down / institutional		INDIRECT								
Vie d'acqua	Top-down / institutional		DIRECT				INDIRECT				
Caravana di Milano Project	Top-down / institutional		DIRECT				DIRECT				

Fig. 4 Comparison of the overlap and integration of the characteristics of the periurban areas and good practices/initiatives (map and comparison matrix).



Fig. 5 The graphical framework of the Milan metropolitan area “Panorama” showing resilience practices (focusing/moving on/from food polices).

### 2.3 GOVERNANCE AND PROCESS

#### *Key concept 3. Crosscutting and multi-issues*

In order to understand the dynamics of urban rural partnerships, the URMA Pilot carried out an analysis of drivers and barriers from a governance point of view.

The governance framework that was developed regarded the existing guidelines/competencies framework and an analysis of competencies and rules relating to potential functions and services (see paragraph Functions and services).

The analysis focused on the Lombardy regional context, but the same problems (concerning barriers to the activation and implementation of crosscutting policies) were evidenced also in the other European regions involved in the URMA project. Specifically speaking, most relevant barriers are related to the overlap and non-coordinated framework of competencies (administration/bodies/planning system etc.) connected with urban development policies, nature and ecosystems policies, and agricultural development policies. At European and regional level, there are no crosscutting policies focusing on urban rural partnerships, in terms of developing integrated projects involving urban and rural systems. For example: some critical neighborhoods in Milan (social housing, social inclusion problems, the ageing Italian component of the population...) are related to periurban open areas and to the rural system; policies able to integrate and find innovative solutions involving the urban and social components (urban housing, communities and social

services) and periurban and rural ones (local food chain, green infrastructure and related maintenance...) encounter serious barriers in the current governance and institutional framework (due to the planning system, land use laws, etc.).

#### *LivLAB and games*

Expert workshops and seminars were organized in connection with the URMA project; the URMA work team was also involved and integrated in a Crosscutting "workshops/workgroup" involving institutional (regional) representatives and experts on urban and rural areas (in the Strategic Environmental Assessment of Regional Economical Development Program and the Regional Agricultural Program - POR/PSR)

An instrument used in all the research and consulting activities, that turned out to be very effective, is the organization of interactive workshops using the LIVlab and/or games techniques. In particular, the periurban games were organized during the final steps of the URMA project in order to share the results from the Pilot and identify shared guidelines that could be given back to the regional decision-making process.

The Periurban games event involved experts from academic, professional, and regional institutions as well as the economic sectors from different disciplines and backgrounds. During the Periurban games, some statements and proactive questions were discussed in a "role-play" (the reference used was the Urban Games developed by Stockholm County Council and was also used during the METREX congress). The outcomes were used to complete the final guidelines of the URMA Pilot for the Lombardy Region.

### 3 FUNCTIONS AND SERVICES

#### *Key concept 4. The periurban system (Ecotone) as strategic buffer for new metropolitan development*

#### 3.1 ECOSYSTEM SERVICES

Acting in accordance with the literature on ecosystem services (According to TEEB) an initial identification of potential ecosystem services offered by periurban areas in the URMA Pilot area was proposed.

Using the defined categories of ecosystem services, two different kinds of ecosystem services were identified: a first group of services offered by the periurban areas in their current condition and a second group of "potential" services that could be performed with the implementation of projects improving the capacity and quality of the ecosystem services. The first group includes functions already performed. These ecosystem services are not recognized in value terms (not necessarily economic or monetary) in the decision-making at the root of decision-making process for territorial planning. Explicit recognition of the values and advantages deriving from the ecosystem services performed could be the first step in ensuring their enhancement over time.

In the second group, the ecosystem services that periurban areas could potentially offer by implementing interventions or practices to improve the ecosystem quality of components (physical and natural) were identified. The services identified refer to the categories of classification established (MES, TEEB).

The category of "cultural" ecosystem services was not considered in relation to ecosystem classification. The main categories of "performed" and "potential" Ecosystem Services are shown in the table 1.

The ecosystem services listed in the category of "cultural" ecosystem services include: recreation, health, tourism, aesthetic, spiritual, etc. In the URMA Pilot context (and in general in periurban areas in Lombardy) these "services" are performed by the agricultural component (not by "ecosystems" or natural components) or landscape, or else by the historical and architectural heritage. For this reason, the "cultural" services were not considered in this first application of ecosystem services to the URMA Pilot.



ES cat.	Performed services	Improved or potential ES	
Provisioning services	Fresh water		
	Food		
	Raw material (wood)		
Regulating services	Drainage and water management	Improvement of drainage and water management	
	Microclimate regulation (urban hit island)	Improvement of Microclimate regulation (urban hit island): vegetation, green periurban and urban infrastructures	
	Air pollution mitigation	Improvement of Air pollution mitigation Noise pollution mitigation	
	CO2 cycle (incorporation and storage of CO2)	Improvement of the CO2 cycle	
	Pollination	Improvement of pollination and seed dispersion /diffusion	
	Biodiversity and (semi)natural habitats		Improvement of urban and periurban biodiversity and (semi-) natural habitats
			Agricultural biodiversity
			Extreme event mitigation (flood, storm, hit island)
			Waste Water treatment (wetland)
			Soil fertility preservation Soil erosion reduction
Supporting services		Habitat per species	
		Diversity (genetic diversity)	

Tab.1 The main categories of "performed" and "potential" Ecosystem Services offered by periurban areas in the URMA Pilot context.

In relation to "urban-rural" relationships, it is important to also underline the "negative aspects" or problems that rural and natural areas could cause to urban (social) components (Marino, Horse 2014). Some of these problems could be: trees and shrubs in cities emit volatile organic compounds, they obstruct the view (landscape and un-safety); allergies and allergic reactions, damage to infrastructure (roots and microbe activities), damaging materials, the presence of unwelcome animals and insects, etc.)

### 3.2 FROM ECOSYSTEM SERVICES TO "POTENTIAL FUNCTIONS"

While developing the URMA Pilot Case, it turned out to be difficult to refer only to a "consolidated" list of categories of ecosystem services that can be implemented in periurban areas as this does not encompass the complexity - in an organic and effective way - of the multiple services and activities that can be offered in periurban areas and that can be a driver for the implementation of urban-rural partnerships projects.

By only considering the ecosystem services categories, it is not possible to include all the present and potential resources in the periurban area considered to be the transition transect (e.g. the ecosystem services cannot include the functions of architectural heritage, rural landscape or agricultural activities).

In order to consider all the services, functions and activities that can be activated/performed in the periurban areas on the basis of all the components of the territorial system (ecosystems but also "human" in terms of rural, social, cultural elements, etc.) a first proposal of "potential functions" performed in the URMA Pilot was proposed. Shifting the focus onto "services" and functions (not only those arising from the ecosystem), it is possible to highlight the potential that the periurban areas can offer (in terms of an ecotonal transitional transect) in order to create innovative strategies for the development of metropolitan



areas. This approach relies on the recognition of the potential of the transition areas for the effective activation of innovative strategies for regional and metropolitan development.

The preliminary identification of the functions (or services) offered, or that can be activated (potential functions) in the periurban areas is summarized in the table (Table 2). The functions and services listed derive from case studies existing in the Milan metropolitan area or in the Lombardy region (the table also underlines the diffusion of cases and practices). In parallel to the identification of potential functions, for example, some cases and practices already active in the Pilot area (or in similar areas of Lombardy) have been identified. This first proposal (partial and not yet completed) clearly shows the potential of periurban areas when approached as transitional transects and their potential in terms of a strategic vision leading to an innovative development model for metropolitan systems.

<b>Potential function or potential services</b>	<b>Case studies</b>
<i>Provisioning services (ES)</i>	
Energy chain – wood	Existing: e.g. the short chain of wood in the Ticino park
Energy chain – biogas	Existing and diffuse: biogas and other solutions for energy production from secondary agricultural products
Food production	Existing: with different characteristics (e.g. short chain, specific local food production, new products, reintroduction of traditional seeds and species ...)
<i>Regulating functions and environmental functions</i>	
Improvement of Drainage and water management	Existing: e.g. Parco delle Risaie  Renovation of urban/settled areas (reduction of water-proof surfaces)
Improving urban climate mitigation - green islands	Existing: Urban and periurban parks
Improving urban climate mitigation - green infrastructure /urban vegetation (shade, microclimate improvement)	Existing: diffuse cases of urban park and urban renovation (with green infrastructure and vegetation improvement)
Noise reduction (vegetation) - Retrofitting existing buildings	Existing: a few projects in the urban renovation project Existing
Improving CO2 absorption/storage services (carbon sequestration climate adjustment by urban vegetation) - Improved air purification services	Existing: diffuse cases of urban park and urban renovation + re-forestation of the periurban area (e.g. Metrobosco)
Improving pollination and seed dispersal services	Existing: beekeeping activities (e.g. Alvearu urbani initiative) and projects for the diffusion of vegetal species constituting the habitat for useful insect species (e.g. EUGEA)
Improving Biodiversity services - Natural	Existing: diffuse intervention for restoration and improvement of natural habitat (e.g. natural spring, ecological network...)
<i>Supporting functions (Habitat)</i>	
Diversity (agricultural biodiversity)	Existing: e.g. projects for agricultural biodiversity and ancient /traditional species cultivation (11 grani ...) existing (not in the Pilot area)
Moderation of extreme events Reduction of extreme events. Vegetation creates barriers against extreme events (floods)	
Water purification (wetlands) Waste treatment filtration of wastewater and nutrient fixation by urban wetlands	Existing: e.g. water waste treatment in wetland (phytopurification at the Nosedo water purifier)
Recovery of waste / waste	Existing: farms and plants for composting/reuse of organic urban waste and garden waste

Maintaining soil fertility - Reduced soil erosion	Existing: "good agriculture" project (including specific guidelines for soil conservation)
<i>Social functions and activity attractions (only few examples)</i>	
Leisure functions	Existing: large range of leisure activities in rural, periurban park...
Health /wellness (sport activities/functions)	Existing: e.g. the "ecological sports center"
Touristic / rural touristic functions	Existing: e.g. Parco delle Risaie info point, local restaurant, agritourism
Cultural and educational functions	Existing: e.g. the Connecting Culture initiative
<i>Economic functions and exchange (only few examples)</i>	
Market for the sale and promotion of local food products (food production and transformation - short chain)	Existing: e.g. Buonmercato, Genuinagente
Agricultural research and innovation	Existing: e.g. Nutrire la Città che Cambia (feed the changing city), new production chains and food processing
Horticulture associations (communities)	Existing: e.g. Associazione Parco Teramo
Educational function	Existing: e.g. Educational farms
Service sector innovation and research	Localization of research or tertiary activities (workshops, computer ...) possibly compatible with agricultural activities
Economies and social economic activities	Starting businesses and social enterprises (recovery of abandoned or under-used rural building)
"Health" Services and activities (rehabilitation, discomfort, disability recovery)	Starting businesses and social enterprises (recovery of abandoned or under-used rural buildings)

Tab.2 The "potential" of periurban areas: a selection of possible functions and services that could be performed or offered by or in periurban areas of the Lombardy Region Pilot area in the URMA project.

## 4 THE POTENTIAL OF PERIURBAN AREAS FOR THE RESILIENCE OF METROPOLITAN REGION

### 4.1 THE "ECOTONE" METAPHOR AND THE NEED OF STRATEGIC VISIONS FOR PERIURBAN SYSTEM RESILIENCE

In order to promote a strategic vision for a periurban system, it is necessary to redefine the "object": moving from "periurban" area (as the sum of the surfaces) to a vision able to recognize the role and potential of these complex system of transition between urban and rural/natural systems.

The map (figure 6) integrates the results of the characterization of periurban systems (URMA Pilot) and the characteristics of both "urban systems" (main neighborhoods or communities) and "rural systems" with different degrees of fragmentation and structuring of the agricultural system).

The first aspect that emerges from the study of the Pilot is lack of recognition of values, potential and resources of periurban systems. The absence of recognition of the strategic role that these systems play in the construction of innovative models of development of metropolitan areas implies a fragmented panorama of sectorial polices acting on "urban", rural or natural components and a lack of strategic visions and polices focusing and centered on the periurban systems.

The development of strategic visions and polices requires a redefinition (or an alignment / integration) of interpretative, design/planning and governance instruments.

An integrated and synergic renovation of instruments has to be based on a trans-disciplinary and crosscutting approach.

The metaphor of “ecotone” is proposed as a new “neutral” framework in which it will be possible to share, compare and renovate disciplinary instruments (but also institutional and governance instruments) connecting different disciplines and sectors.

Approaching to periurban areas as ecotonal zones of transition supports also the urgency/need to move the point of view from Urban/rural/natural to a renovated/new point of observation.

This leads not only to a new way of defining problems, but to give evidence to a set of problems that was not fully identified before. At the same time, this brings the opportunity of new integrated solutions.

The metaphor of “ecotone” is proposed to support this process of realignment of disciplines and governance sectors” in a “new” neutral framework

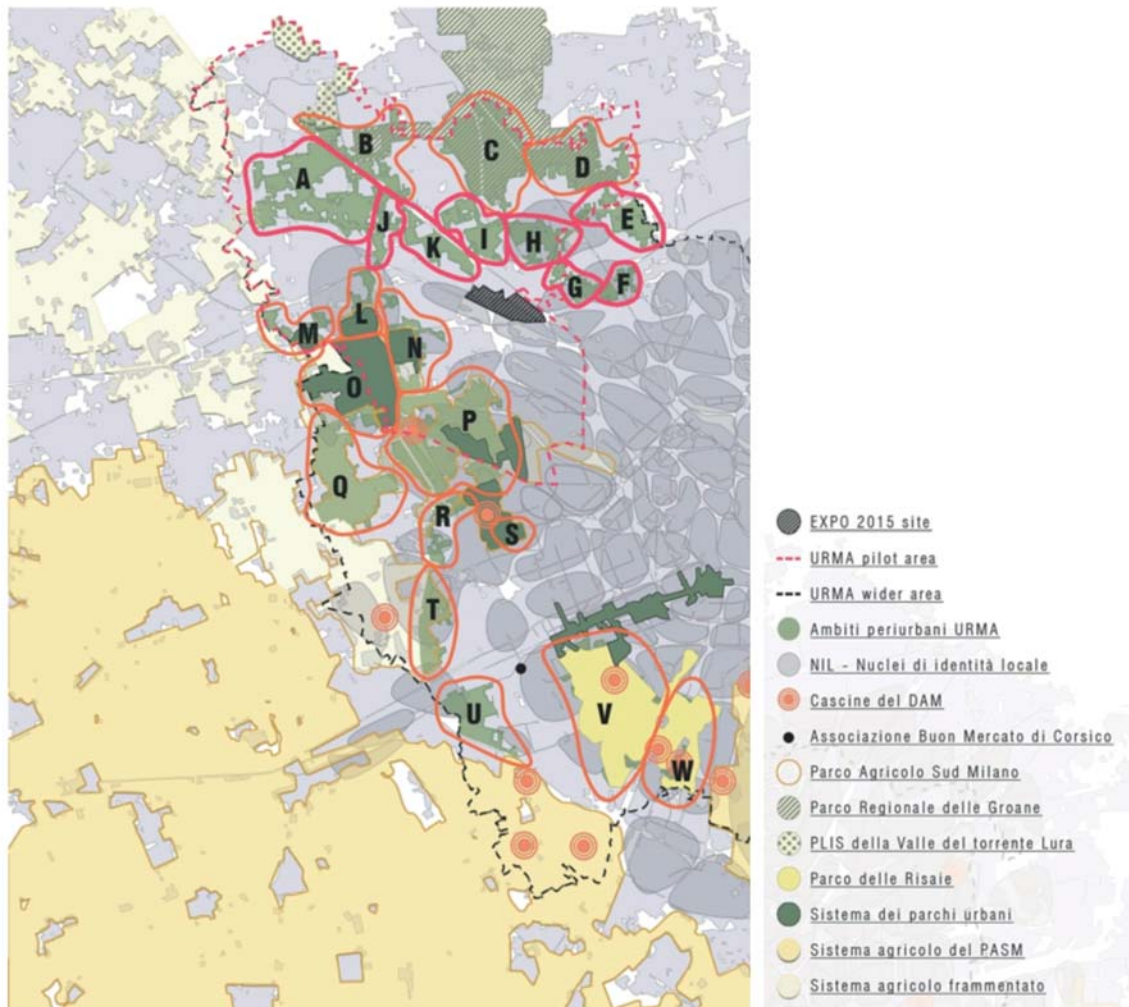


Fig. 6 Redefining the approach: the potential of the transition areas: the periurban sub-systems integrated to include the urban neighborhoods (urban communities and places) and agricultural systems.

The “ecotone” metaphor is proposed to support innovation in the approach to periurban areas. An ecotone is a transition area between two biomes. It is where two ecosystem communities meet and integrate. It may be narrow or wide, and it may be local or regional. It is a “zone of transition between adjacent ecological systems, having a set of characteristics uniquely defined by space and time scales and by the strength of the interactions between adjacent ecological systems” (Hansen et al, 1992).

In these terms, periurban areas may be assumed to be ecotonal zones of transition between urban and rural or natural systems. The ecotone or ecotone system are characterized by specific proprieties and assuming the “ecotone metaphor” it is possible to 1) connect needs and critical questions to an homogeneous framework and 2) include the topic of periurban areas in the general framework of the resilience approach. The proposal is a first suggestion that requires further research, the reframing of the framework in order to underline how the proposed ecotone metaphor could be able to be an effective common framework for the activation of mutual and discipline and germination of renovated instruments. The ecotonal metaphor is able to connect concepts, phenomena and principles related to “ecotone” proprieties and characteristics, resilience approach principles (Colucci, 2012) and the phenomena and needs emerging from the territories (presented in the first part of paper).

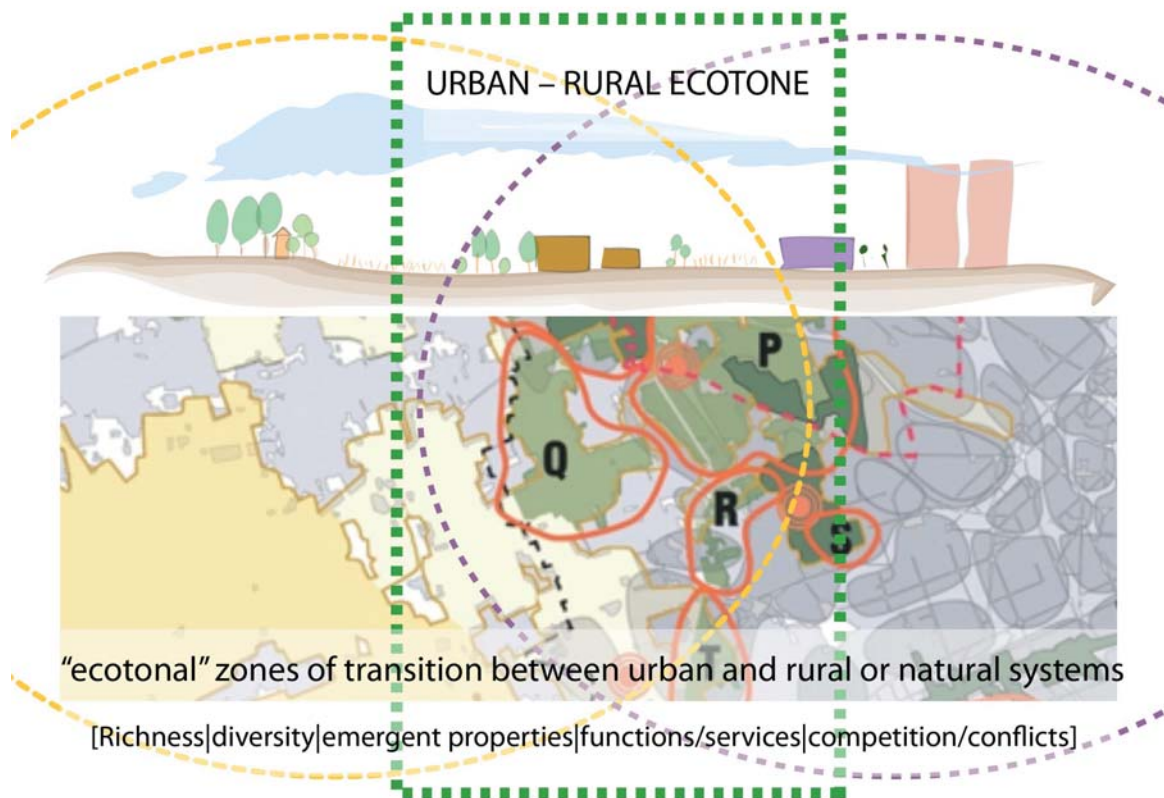


Fig. 7 Periurban areas may be assumed to be ecotonal zones of transition between urban and rural or natural systems

All the possible interconnections and conceptual reframing have to be developed but some connections could be synthetically underlined as examples.

The ecotone is local based (specific characteristic) but the ecotone components and characteristics are influenced and derive from the biomes.

The ecotones are characterized for different time-dynamics: there coexist rapid transformation and slow transformations related to the evolution of biomes and the habitat.

Both these characteristics have been underlined as relevant phenomena that characterize periurban systems. These concepts have been discussed in relation to the “Key concept 1. Understanding complexity (multi-scales in space) and dynamics (multi-scales in time)”. Traditional methodological instruments for the territorial analysis and interpretation are not able to include and understand the coexistence of different temporalities of territorial phenomena.

At the same time these concepts are coherent with some of the main shared "resilience strategies" for the socio-ecosystems like dynamic conditions, modularity and multi-scale dimensions in time and space, Cycles of adaptation or the Ecosystem organisation (A. Colucci, 2012).

The ecotone are characterised by emergent proprieties. In these terms, a renovated approach could support the identification of all the resources and opportunities and the specific values of periurban systems (that can not be assimilated to urban or rural or natural systems). These can be more precisely identified as specific new phenomena that involve at the same time patterns and components of both urban and rural / natural systems.

The same, this approach can allow to grasp other specific characteristics of ecotones, such as richness and diversity: in this way this approach may lead to highlight all the functions performed and the services that could be improved both for urban and for rural/natural areas.

#### 4.2 URBAN RURAL PARTNERSHIPS: GOVERNANCE TOOLS FOR RESILIENT METROPOLITAN AREAS

The principles and abilities related to the resilience approach can support a general framework and a strategic visioning able to move and activate different interests and stakeholders (citizen, institution private sector, professionals, academic and educational) towards integrated multi-issue projects. Existing trends and initiatives, and new policies and projects need to be integrated in a strategic vision (on a regional, metropolitan or territorial scale and at local level), to be supported by technical and methodological innovative instruments able to orient the decision-making process and lead to the implementation of innovative governance solutions. Flexibility and modularity are fundamental factors: the vision needs governance tools able to incorporate different and local solutions defining general strategic goals and priorities.

##### *Multiscale but place-based*

Urban-rural partnerships have to be built up on the basis of their different respective local/regional needs and potentials. Urban-rural partnerships should be acknowledged as a strategic approach at all levels of territorial cohesion policy and should be adequately supported. The respective functional areas should be reflected in national/regional spatial plans so that spatial planners can take account of the related development gaps and potentials from a joint development perspective, where disparities can be addressed. The instruments of governance (and government) must therefore ensure degrees of flexibility in defining the areas and geographies able to include the different possible forms of urban/rural partnerships.

At the same time, the rural urban partnerships and strategic vision related to these must have a territorial dimension. The urban-rural partnerships should be recognized also as "functional spatial entities". In particular, it is necessary for these forms of territorial cooperation between urban and rural areas to be recognized at all levels of strategic and territorial planning.

##### *Governance of processes*

The main barriers to the implementation of partnerships or projects that exist in integrated urban-rural periurban areas arise from the rigidity of the regulatory framework of the territorial government and the fragmented framework of regulations. The current instruments are the results of an industrial interpretation of the urban/rural relationship in terms of conflictual relationships between urban and agricultural systems. The rigid distinction within the instruments of territorial government between urban and agricultural areas is unable to identify the relationship between them and the opportunities that can arise from these. This view must be replaced by a new unitary vision of the city-region.



The multi-thematic character of urban-rural partnerships demands holistic and place-based approaches. Multi-level governance and cross-sectorial organizational models are the appropriate solution. The management of projects in periurban areas requires multi-level governance.

#### *Functions and services*

The strategic vision should be based on the identification of innovative "functions" as a strategic project that must involve urban and rural realities, and should be consistent and integrated at different spatial and time scales. It must be a renewed approach to enhance mutual synergies between the urban and socio-ecosystem, leading towards greater integration, able to recognize the value chains activating virtual processes of valorization of all the resources, and providing solutions to different needs and demands (from the rural and agricultural landscape, the cultural heritage, the environmental and ecosystems, from social and community scenarios, from the economy ...). The implementation of new functions must be supported by a review of the regional governance framework based on a vision able to define real coordination between most relevant territorial strategic decisions (e.g. mobility infrastructure / environmental infrastructure).

#### *Periurban areas as potential for the innovative development of urban and rural regional systems*

Urban-rural initiatives involve a wide range of stakeholders. A participative process, such as the Triple Helix approach (integrating academia, business and government in the decision-making and creative processes), the Quadruple Helix approach (the Triple Helix plus civil society), has to be promoted and supported in order to ensure the proper embeddedness of such projects in different thematic fields. The construction of the partnerships involves multiple stakeholders, encouraging local political leaders (mayors, councilors), NGOs and entrepreneurs to actively participate in urban-rural partnerships. Entrepreneurs, in particular, should take charge of ongoing projects (and be a driving force).

### 4.3 PERSPECTIVES

REsilienceLAB ([www.resiliencelab.eu](http://www.resiliencelab.eu), Figure 7) was launched in 2014 as an interdisciplinary network supporting the diffusion of resilience, sustainability and the adaptation of knowledge, policies and practices. RE|LAB (that has been an instituted association since December 2014) is a network of people from the academic, institutional, and professional sectors and from different disciplinary backgrounds; the network is "open" to the "resilience" definition and approaches and it is operative-oriented (RE|LAB is an operative network supporting initiatives related to, and focused on, sharing practices and the dissemination of knowledge). RE|LAB is social-oriented and non-profit-making and it is key partner in European and international networks on resilience (RRMS thematic group of AESOP, European hub of UCCRN). The main activities and purposes of the network are the comparison of experiences and proposals (with a theory-practice-theory approach), the promotion and support of local initiatives for the reinforcement of the resilience properties of complex systems, training and capacity building (guidelines, design solutions etc.), and networking activities.

In collaboration with REsilienceLAB and DASTU at the Politecnico di Milano, DIST at the Politecnico di Torino and the CURSA Consortium, the Environmental sector of the Fondazione Cariplo is launching a National Observatory on resilience practices. The initiatives and practices have to be multi-objectives (integrating different components of complex systems and resilience approaches) and have to include environmental strategies.



Fig. 8 The RE|LAB timeline. A synthesis of the activities developed since 2014 by the RE|LAB network.

"Observation" refers to different aspects reflecting the different goals of the research:

- mapping resilience practices/initiatives (practices path). The "mapping" concept refers to understanding local factors that influence and characterise initiatives in relation to different keys of interpretation;
- the methodological path: scientific and methodological advancement is based on research applied to initiatives. Tools include both evaluation and interpretative method and design/actions to support resilience experience;
- the cultural path: the development of conceptual instruments for the dissemination of the resilience approach. The multiplicity of resilience definitions and approaches will be highlighted and addressed starting from practices rather than theories;
- the networking path: national and international networking.

The topic of "periurban" (approached as an "ecotonal" complex system of transition between urban and rural/natural systems) will be a specific area of research and debate that will be developed in the forthcoming activities of the RE|LAB, with a specific focus on governance and process solutions and on the development of assessment/design methods supporting the decision-making process and initiatives of activation and implementation.

If "mapping resilience practices" is the general focus and aim of the Observatory of Resilience Practices project, a specific focus of the Observatory could be the systematization of the Panorama of the Milan metropolitan areas and the Lombardy regional context. It could take as its starting point the initial overview of the metropolitan and regional panoramas proposed here and from the main methodological and design perspectives developed in the CIVES and URMA projects.

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## IMAGE SOURCES

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## PUBLIC PRIVATE PARTNERSHIPS FOR ITALIAN RESILIENT COMMUNITIES

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### ABSTRACT

This article focuses on the role of local institutions in mitigation and adaptation to climate change, considering learning experiences in promoting public-private partnerships in resilient actions. It does so in the belief that climate impacts will affect disadvantaged social groups and small communities more disproportionately, and that local institutions centrally influence how different social groups gain access to, and are able to, use assets and resources. Considering that the increasing awareness that global temperatures will rise, a "Climate-smart" mentality must be adopted at all levels of decision-making. This approach involves finding synergies between climate change mitigation and adaptation, wherever this is possible. We consider similar pre-conditions for adaptation as for mediation. Based on these pre-conditions, we identify Public Private Partnerships as a challenging possibility to finance decentralized renewable energies and green infrastructure for resilient communities. The article aims to demonstrate two main unclear topics in the existing understanding about institutions and climate change responses: the correlation between Public Private Partnerships and the participatory process and how it leads to win-win climate response funding, a learning experience from the Sustainable Energy Action Plan within the MED Programme ZeroCO2 Project - and the Local Adaptation Plan development within the BLUE AP LIFE+ project .

### KEYWORDS:

adaptation, mitigation, participatory process, climate change, resilience, risk

## 1 INTRODUCTION

Nowadays local institutions are essential to build resilient communities in a time of changing climate. It does so in the belief that climate impacts will affect disadvantaged social groups (Kates, 200) and small-communities more disproportionately, and that local institutions exert a centralized influence on how different social groups gain access to, and are able to use, assets and resources (IPCC, 2007a).

Considering the growing awareness that global temperatures will rise, a "Climate-smart" mentality must be adopted at all levels of decision-making. "Climate-smart" is a term that originated in agriculture, to describe actions in the agricultural sector able to increase the resilience of adaptive capacity for climate change and at the same time reduce greenhouse gas emissions (IPCC, 2007b). A "Climate-smart" mentality incorporates the analysis of climate change taking place in the definition of strategies and operational decision-making processes. This approach involves the search for synergies between climate change mitigation and adaptation, wherever possible. What we have learnt from mitigation actions is that climate change is inevitably local and that institutions influence mitigation and climate responses and vulnerability in three critical ways:

- a) Structural impacts and vulnerability
- b) They mediate between individual and collective responses to climate impacts and thereby shape the outcomes of actions
- c) They act as the means of delivery of external resources to facilitate responses, and thus govern access to such resources.

We consider similar pre-conditions for adaptation as for mediation. On the basis of these pre-conditions we identify Public Private Partnerships as a challenging possibility to finance decentralized renewable energies and green infrastructure for resilient communities.

An essential constraint for PPP implementation is the lack of a common European legislative framework. An initial harmonized scheme was produced as part of the Project ZeroCO<sup>2</sup> MED Programme<sup>1</sup>, in order to overcome the existing barriers to PPP in the energy sector. We selected mitigation initiatives using PPP to identify possible investment schemes for adaptation, especially due to the existence of win-win solutions. Taking into consideration the 2013 EU Adaptation Strategies and the attached document, *Adapting infrastructure to climate change*, the PPP scheme was deemed a key tool for financing resilient actions. To do this, a bottom-up approach needs to be adopted in order to identify the actions. As an example for Adaptation purposes, the BLUE AP<sup>2</sup> LIFE+ project considered the MED ZeroCO<sup>2</sup> results using a participatory process right from the planning phase, so as to improve private participation.

Based on existing experience, we will now examine two main, but unclear, topics in the existing understanding of institutions and climate change responses: the correlation between Public-Private Partnerships and participatory process, and how it leads to win-win climate response funding, a learning experience from the Sustainable Energy Action Plan and Local Adaptation Plan development.

## 2 FOSTERING A GREATER ROLE FOR INSTITUTIONAL PARTNERSHIPS IN FACILITATING MITIGATION AND ADAPTATION

Institutional partnerships are crucial to local mitigation practices, as they are for adaptation. If, for mitigation, it is important to ensure the realization of actions such as the Solar Purchase Pool, Hot-Water

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<sup>1</sup> Kyoto Club was a partner in the ZERO CO<sub>2</sub> MED Project [www.medzeroco2.eu](http://www.medzeroco2.eu)

<sup>2</sup> Kyoto Club is a partner in the LIFE+Project BLUE AP Bologna Local Urban Environment Adaptation Plan for Resilient City – [www.blueap.eu](http://www.blueap.eu)



Heater Purchase Pool, Frame Purchase Pool to mitigate CO<sup>2</sup> emission in residential private buildings, support for such partnerships can greatly enhance informal institutional processes leading to adaptation. Partnerships among local public and civil society institutions are more closely associated with adaptation practices relating to diversification and communal pooling. Partnerships between private and civil society institutions are relatively uncommon and need greater encouragement. In the context of adaptation practices, they tend to be more closely associated with exchange and are storage based. Mobility, although often neglected in adaptation literature, is essential in dealing with high levels of climate variability.

## 2.1 SEAP DEVELOPMENT: ZERO CO<sub>2</sub> PARTICIPATORY PROCESS

There were several benefits deriving from the involvement of different stakeholders in the ZeroCO<sup>2</sup> decision-making process. In very general terms, ZeroCO<sup>2</sup> engagement improves the likely outcomes of decision-making in small-communities such as the participating municipalities. This improvement is brought about by:

1. Facilitating clear communication and exchange of information, with all parties involved developing a more thorough understanding of issues, potential solutions and alternative perspectives,
2. Improving the effectiveness of decision-making processes, gaining better insight into potential equitable outcomes, solutions to conflicts, and effective planning
3. Strengthening the resources of the groups involved, by increasing awareness, confidence, skills and co-operation,
4. Improving the sustainability of any initiatives, by increasing the quality of decisions and their acceptance by stakeholders.

This list of benefits seems compelling; however the use of engagement is by no means the norm in decision-making processes. There are many reasons for this, but of particular importance is the fact that engagement is intensive in time, resources and skill requirements, and involves giving up a degree of control to people beyond the instigating group or organization, which can threaten the adoption of a preferred outcome.

Some ways of improving the participatory process are also being developed in Foiano della Chiana, where the monitoring and evaluating process calls upon the supporting tools realized by AzeroCO<sub>2</sub> – ESCo - the private partner development strategies in the municipal areas. In this case, Tuscan Regional law n.69 of 27 December 2007 created a legal framework for citizen involvement introducing the obligation to design participatory processes for territorial planning actions such as an Energy Plan, Infrastructure Plan, and Investment Scheme.

## 2.2 ENHANCING LOCAL INSTITUTIONAL CAPACITIES

Although local institutions play a critical role in supporting mitigation and adaptation, the intensity of adverse future climate impacts is likely to increase – thereby also increasing vulnerability and reducing existing adaptive capacity. External intervention in the form of new information and technology aimed at improving coping capacities, institutional coordination for better articulation (connections among institutions) and improved access (connections between institutions and social groups), and inflows of financial support for local leadership will be critical in strengthening local institutional capacities.

### *ZeroCO<sub>2</sub> Public Private Partnerships:*

The Regional and Provincial partners in the ZeroCO<sup>2</sup> project are promoting sustainable development and renewable energies through direct lending, changes to legislation, financial incentives, and building and construction regulations and indicators. From the implementation of their Sustainable Development

Strategies, it emerges that PPP – Public Private Partnership - financing is often the appropriate answer to renewable energy investment. In fact PPP models offer a number of benefits, including:

- Risk Reduction - public authorities are able to share the risk of investment with private companies (IPCC, 2012);
- Knowledge - private organizations may have technical expertise that city governments lack, or vice versa;
- A Local Focus - compared with centrally-lead development schemes, Public Private Partnerships are designed for the urban area, employ local actors, and allow local authorities greater freedom and control over service provision;
- Added Social, Political And Economic Benefits - the collaboration of local organizations can encourage civic engagement and job creation in the area (World Bank, 2011).

As a result, they decided to test and improve the existing scheme by means of the MED Programme, involving a number of municipalities in their area. Fourteen municipalities were selected to set-up a Public Private Partnerships model to finance renewable energies and energy efficiencies, testing a variety of forms based on the needs of those involved and the parameters of the national legislation. The diversity of PPPs is also evident through the emergence of Energy Service Companies (ESCOs) and Multi-Utility Service Companies (MUSCOs), organizations composed of public and private partners established to finance, build and manage linked-up energy and utility services in urban areas.

Looking at the Italian PPP set-up case study and the benefit produced by statutory provisions to protect the environment and landscape's infrastructure, while mitigating the environmental risk on the other hand, increases the likelihood of the occurrence of administrative risk. In fact, this risk must be understood as any delay to the project generally due to inefficiency government or the complexity of administrative procedures earmarked for the implementation of the project. In such cases, implementing SEAP will facilitate the creation of an adequate administrative structure as required by the Covenant. Hence, the contracting authorities need to pay particular attention to handling these types of risks during the planning of phase. Italian law has set rules for awarding PPP contracts. This is clear evidence that in PPP projects, the existence of private capital means that greater attention is paid to the environmental risk run by private investors that could result in long delays and increased costs to mitigate the risks and gain consent for implementation of the work a posteriori.

In other words, environmental risk is embodied in any extra cost and delay in implementing the infrastructure due to a lack of identification of the risk of environmental sustainability. Again, monitoring the SEAP indicators for the actions included in the plan could lead to direct testing of the PPP environmental risk index. This means a reduced possibility of partial or total environmental risk to the extent of blocking the execution of the work itself. From the foregoing, it is evident that the environmental risk inherent in PPP projects can be mitigated through a properly controlled organization of the process and the administrative proceedings by all the public bodies involved, as may be guaranteed by implementing SEAP.

Lastly, we indicate some tools for mitigating environmental risk (EEA, 1999) with a view to reducing the occurrence of risk and, therefore, to contain the time and costs of PPP implementation when implementing SEAP:

- a) Implementing comprehensive environmental studies of the territorial framework and infrastructure to be implemented (Baseline Emission Inventory for mitigation responses and Local Climate Impact Profile for adaptation responses),

- b) Preparing feasibility studies. Covenant of Mayors practices for small-communities could improve identification of the works apt to meet the public needs and indicate the technical/financial needs and climate responses. [*The LCIP - Local Climate Impact Profile must also contain the same analysis of the actual state of all components and any intervention in its historical and artistic, architectural and landscape components, and its environmental sustainability, as well as socio-economic, administrative and technical matters, that could be enhanced by down streaming adaptation measures.*]
- c) The participatory process enhances the timely and correct preparation of public works programs through consultation between the institutions with the involvement of citizens in a more realistic identification of the precise location of the intervention, and compensation works, to be determined beforehand during the design phase, are identified in conjunction with the community affected by the project;
- d) Covenant Supportive structures, such as the Province of Massa Carrara for ZeroCO<sup>2</sup>, and the Kyoto Club, as associated Covenant partners, guarantee the involvement of different levels of government to share the benefits arising from the implementation of infrastructure within the participatory process, , and facilitate coordination between the different agencies involved
- e) The Climate Caravan and Information Campaign increase the involvement of citizens (as individuals and/or associates) and the provision of timely and transparent communication between all parties involved
- f) Finally, the pro-active approach of municipal councils to support the *a priori* creation of a social and political consensus.
- g) Sustainable Energy Action Plans with adaptation actions and downstream climate proofing investment for each of the actions identified.

The tools listed are used to properly define the risk that should best be allocated. Generally, given the nature of climate risk and the related difficulties in finding adequate insurance coverage, this form of risk is handled by the contracting authority (Giupponi et al., 2008).

### 2.3 UNDERSTANDING THE LOCAL INSTITUTIONAL STRUCTURES AND ACCESS PATTERNS BEFORE PROVIDING RESOURCE SUPPORT FOR ANY DEVELOPMENT PROJECT.

Different small communities, social groups and individual households have varying levels of access to existing institutions. Vulnerable groups generally have lower institutional access than those who are more powerful or better off. Before external support for greater adaptive capacity is made available, therefore, an analysis of the nature of institutional linkages and access on the part of different social groups becomes critical. Only after a clear understanding of such relationships has become available should particular institutions be selected as intermediaries for channeling resources.

## 3. SUPPORTING TERRITORIAL DEVELOPMENT: THE ITALIAN CLIMATE SYNERGIES

Revisiting the issue of governance in the context of the ZeroCO<sup>2</sup> Project from the local perspective, the practice shows that the various forms of PPPs have proven especially suited to securing economic, social, and community development in the current period showing tendencies for expansion of local governance. Partnerships are considered an effective form of governance, first because they can build collective responsibility for the combined process of activity development, i.e., planning, decision-making, problem solving, project implementation and evaluation.

In many instances they have created networks to share knowledge, resources, and common goals. PPPs (World Bank, 2007) have also served as catalysts for sustainable community dialogue, integrated solutions, and long-term local change. A flexible design and a constant feedback mechanism have largely proven critical to their success. In summary, partnerships can be considered innovative tools in terms of both policy and action because they can account for both (i) the activity and its resolutions and (ii) the implications on the broader community development. However, as the practice indicates, partnerships must be carefully designed and operated to produce efficiency and benefits for all. For the Italian case studies in the context of the ZeroCO<sup>2</sup> project, the four main actors have played an important role involved in the identification and design of PPP scheme, through a participatory process as indicated in the literature to ensure effective implementation of the scheme.

The actors were: Local Authorities of different institutional levels (Province of Massa Carrara as ZeroCO<sup>2</sup> partner; Bagnone, Comano and Fivizzano as pilot case Small Communities; the Ministry of Economic Development and the Tuscany Regional Government participated as stakeholders), Citizens, Non-Profit Consultant Agencies (Kyoto Club Service – ZeroCO<sup>2</sup> partners) Civil Organization (Legambiente – ZeroCO<sup>2</sup> partners and Legambiente Lunigiana –Environmental Associations as stakeholders), and Private Companies (Local manufacturers and industries as well as AzzeroCO<sup>2</sup> ESCo – as stakeholders)

### 3.1 IMPROVING INSTITUTIONAL COORDINATION ACROSS SCALES

Existing national mitigation and adaptation plans in Italy, Spain, Greece and Portugal seem to have paid little attention to the role of local institutions in designing, supporting, and implementing mitigation and adaptation. However, if mitigation can be implemented at national and regional levels, adaptation is inevitably local; there is a great need to involve local institutions more centrally in planning for and implementing adaptation policies and projects (Agrawal, 2008). At the very least, there must be far greater coordination between adaptation policies and measures adopted by institutions and decision-makers at the national level and their counterparts at the local level.

*BLUE AP – The Bologna Adaptation Process.* Starting from the ZeroCO<sup>2</sup> toolkit, it is possible to play a pilot role and thus improve and innovate other cities' practices in terms of forms of government, particularly regarding sustainable development and climate change policies. In Southern European countries, and in Italy in particular, it is a strategic need, due to the large number of cities potentially affected by climate change impacts and the large number of cities formally engaged (over 1,000 are signatories to the Covenant of Mayors), but still lacking experience in adaptation strategy development. The Bologna Adaptation Process (BLUE AP) intends to meet these needs, which may be generalized to other European local contexts and the demonstrative character of the process, which could be of interest to an international audience.

The process to be implemented is based on participatory process mitigation responses and aims to demonstrate that:

- 1.A local – comprehensive and integrated – scale analysis and a “tailor made” planning process represent the correct approach to addressing environmental problems generated on a global level, but with a direct local impact (Kaylen et al., 1992);
- 2.Awareness-raising campaigning and a participatory and inclusive dynamic between private and public bodies are the most effective ways to activate local policies to tackle climate change adaptation needs and manage adaptation strategies;
- 3.It is helpful to offer local enterprises and stakeholders coaching support (such as auditing, feasibility analysis, cost assessment, problem-solving actions) in order to start concrete and positive pilot actions leading to the full implementation of local adaptation plans.

PPP schemes are already implemented in the GAIA re-forestation projects, aiming to make industrial areas more resilient to the changing climate.

BLUE AP will also attempt to demonstrate that co-operation and the sharing of responsibilities between public and private sectors can be effective when supported by a mutual, step-by-step management cycle (undertaking commitments, target setting, planning, monitoring, and reporting). In addition, the project demonstrates that local governments engaged in the development of adaptation strategies enhance their urban planning strategies with regard to water management, green areas, health and social services. The benefits of the proposed approach will be shown through the participatory planning process in the Municipality of Bologna and by means of pilot scale applications. Bologna has environmental and economic characteristics that can be compared relatively easily to most Italian and European medium-size cities facing similar climate change effects on urban ecosystems. These characteristics will play a part in developing a common approach easily adaptable to different local conditions (Figueira et al., 2002).

The bottom-up methodology and the on-the-field approach represent strong success factors for the transferability of the system developed and the guidelines that will be drawn up in the light of these experiences.

*The BLUE AP Protocol, to structure the Bologna stakeholders' engagement process.* The Kyoto Club and Ambiente Italia, with the support of the Municipality of Bologna<sup>3</sup>, designed the "BLUE AP Protocol for Bologna stakeholder engagement in climate adaptation" (Janssen et al., 2006). The assumptions of the Protocol are that:

- Climate impacts and vulnerabilities are highly context-specific.
- Top down generated plans do not work.
- Adaptation plan implementation requires the activation of a number of differentiated actors.
- Stakeholder engagement is essential, but must be mainly targeted towards groups with the potential to have a direct and proactive role in implementing the Plan actions.

The Protocol aims to clearly structure the process with the scope of increasing stakeholders and decision makers:

1. Clear awareness of climate change dynamics and the degree and nature of vulnerability to climate change. The Local Climate Profile provides a scientific vulnerability assessment, Best Practices Guidelines as a whole, and manages knowledge transfer to stakeholders. Task 2 has been structured to ensure that the information is tailored to stakeholders' needs.
2. Sense of responsibility. A fundamental pre-condition of all engagement is a level of willingness to be involved with the stakeholders. Task 2 provides an overview of the level of willingness and contributes to strengthen it (Surveys and focus groups).
3. Adaptation planning itself requires a capacity for strategic planning, which not all stakeholders possess. Task 2, thanks to peer review and exchanges helps the development of this skill.

*Tools to identify Stakeholders' needs and resources (Surveys and District meetings).* The aims for stakeholder and community involvement are:

1. To raise awareness of climate change and the need for climate change adaptation.

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<sup>3</sup> [www.kyotoclub.or](http://www.kyotoclub.or), [www.ambienteitalia.it](http://www.ambienteitalia.it), [www.comune.bologna.it](http://www.comune.bologna.it), [www.arpa.emr.it/sim/](http://www.arpa.emr.it/sim/)



2. To involve the community of stakeholders in identifying the most appropriate and effective potential responses for the local situation.
3. To develop, together with the stakeholders, the necessary conditions for a start up Plan and its implementation.

*The target.* The Local Climate Profile provides an extensive information system of particularly vulnerable areas and population sectors. Three major vulnerability groupings have been identified: water management, heat islands and primary industries, enterprises and communities. The main targets of the stakeholders' engagement programme are:

1. Specific Communities, Urban Areas or District Zones which are vulnerable on the basis of their location and social characteristics
2. Single Buildings or Services or associated groups
3. Local agencies responsible for the management of water, energy, green areas, building property, warning and emergency management
4. Business associations and companies, specifically and potentially interested in playing an active role in defending their own properties
5. Associations, experts and non-governmental organizations, committed to climate issues, built up environments and natural environment protection.
6. Local decision-makers.

*The Tools, 100 "Stakeholders Challenges" Surveys* submitted to private companies and organizations aim to collect objective data and subjective perceptions about vulnerability, risks and local resilience resources. The survey complements the analysis carried out in the context of the Local Climate Profile, but it is directly targeted to the stakeholders listed above. The emerging data will contribute to identifying similarities and differences in stakeholders' perception and to refine the Maps and the overall assessment developed in Action 1.

*100 "Financing Challenges" Surveys*, delivered to private companies and organizations aim to determine whether, and how, each main stakeholder category can contribute by activating financial opportunities to start up specific adaptation actions able to support the complete implementation of the Local Adaptation Plan. A pooling of potential funding options will be provided to help stakeholders and the Bologna municipality to understand and explore which funding schemes can be activated for their specific situation (PPP model, local loans, revolving funds, EU financing options such as JESSICA and JASPER, and Structural funds). A report on the outcome to present the main results will be prepared.

Series of local or thematic dialogues with stakeholders and financing institutions are under way. Local workshops (2 in each of the 9 District Zones) and thematic focus groups will be organized with the aim to explore more area-specific aspects together with the involved stakeholders and to validate Adaptation Strategy development before formal adoption of the Plan. These workshops will include various actors representing different interests and potential technical and financing solutions.

Workshops and focus groups with stakeholders together with relevant local or regional Green Blue Infrastructures management agencies or building companies and potential funding institutions (e.g. local/regional/national banks) will contribute to starting up Adaptation Plan implementation. The main discussion results will be collected and shared.

*Tools to create and mobilize local planning capacity: peer review and good practice exchanges*

Peer Review is a process of presenting a project or process to the scrutiny of others who are experts in the same field in order to improve it. The Scientific Board set up by the project will act as peer reviewers (“critical friends”). The work conducted in this Task includes:

1. Preparation of audit and review documentation.
2. Advice from Scientific Board representatives on possible strategy generation or improvements.
3. Enhanced understanding by the Bologna officials and politicians on developing and implementing the Adaptation Plan.
4. Preparation of a list of actions/recommendations that will accelerate and improve the development/implementation of the Bologna Adaptation Plan if implemented.
5. Preparation of a list of suggestions on communication issues (how to obtain consensus, improve visibility, transparency and relations with citizens).
6. Discussion/analysis on the outcome of peer reviews at the partners’ meetings.
7. At least one discussion session with other cities that have already developed an Adaptation Plan and two round tables with climate change adaptation experts involved in EU LIFE+ and other relevant EU adaptation projects. Cities and experts will also be involved in one intermediate public event (Bologna) and in the Final Conference (Rome or Bologna) at which the lessons learned will be made public.

#### 4. FOCUS ON TERRITORIAL DEVELOPMENT STRATEGIES TAKING BOTH VULNERABILITIES AND CAPACITIES INTO ACCOUNT

Actions for improving adaptive capacity in the context of small-communities projects need to attend better to mitigation and adaptation practices facilitated by different forms of external support. The multiple linkages among external interventions and local adaptations can only be understood by focusing on the mediating role and linkages among different institutions in a given territory, and their influence on production and adaptation possibilities (Giupponi, 2006).

*ESCo: delivering Win-Win solutions for climate responses*

Up to now, ESCo interventions have mainly been considered as mitigation responses to climate change, and the possibility of compensating for CO<sub>2</sub> emissions by setting up “Green Infrastructures” and operating in the carbon voluntary market and white certificate scheme (e.g. Italy, Portugal for ZeroCO<sub>2</sub> country partners) for energy efficiency and renewable energy define a clear role for the ESCo in territorial development and, in these dedicated case studies, for PPP schemes. The ESCo market has been developing over the last 5 or to 10 years, depending on the countries, supporting the exploitation of RES and RUE objectives. Now, adaptation is needed and has to become an attractive prospect for local companies. Adaptation responses as similar characteristics as mitigation, above a list of the key-factors that during the project implementation we observe as crosscutting issue between mitigation and adaptation:

1. Local companies engaged in setting up an Adaptation Plan and climate proof building codes will strengthen their relationship with local government and will create highly dynamic and competitive advantages. This can be compared with SEAP development and implementation; in fact energy efficiency actions are strictly connect to an Energy Plan and Building codes.

2. By demonstrating sensitivity to different social and environmental issues, local companies can also support the wider EU Sustainability Strategy. Indeed, the challenge of this Strategy is to maintain a dynamic that mutually reinforces economic growth, social welfare and environment protection.
3. Local companies need to respond to general market pressures. Thus the possibility of participating in a social partnership network, of accessing know-how and innovative skills, of being supported and guided in the development and implementation of innovative environmental solutions and management instruments, is a significant advantage for companies.
4. Local companies engaged in adaptation practices will gain benefits also in terms of their “positive image” on the market.

## 5. CONCLUSION: ADOPT AN ADAPTIVE PERSPECTIVE ON INSTITUTIONAL DEVELOPMENT

As climate change and its impacts become more evident, it is increasingly important to integrate concerns for managing risks faced by households and communities into earlier concerns for growth, poverty alleviation, equity, and sustainability. In the Italian ZeroCO<sub>2</sub> experience, the need to integrate climate risk development, like adaptive development, has become a real need after the three extreme floods that occurred during the two-year project. Adaptive development will require local institutions to take on a greater role in the planning and implementation of development projects. While, in the case of mitigation, little is known about the most effective ways institutions can facilitate local mitigation, the situation is even more complicated in the case of adaptation because the blueprints available for developed countries at the moment are still being monitored and can be developed for planning adaptive development. An adaptive perspective on development will require willingness to experiment, the capacity to risk making mistakes (Agraval, Lemos, 2007), and the flexibility to make room for social and institutional learning.

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## IMAGE SOURCE

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## EXPLORING ISSUES LIMITING THE USE OF KNOWLEDGE IN DISASTER RISK REDUCTION

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### ABSTRACT

This paper highlights issues that appear to have hampered the development and use of knowledge and discusses what these imply for applying (or not) the concept of smart cities in different contexts. The conclusions are based on the findings of four sets of work in the context of the KNOW-4-DRR project. From the findings of these activities, it emerges that although there are differences in context, risk and culture, there is a surprising degree of commonality in opinions about why there is insufficient development and application of knowledge for disaster risk reduction, despite the large volumes of information developed on this subject. As regards ICTs, findings suggest that technology, although useful, is not the sole solution for knowledge-based decision making for DRR. In this respect the benefits of smartness in cities are uncertain and depend on the context, where the employment of simpler or more traditional means can be more appropriate for enabling knowledge.

A final conclusion is that no matter how useful, knowledge itself is not a panacea for DRR. Decision-making is invariably influenced by conflicting priorities, objectives and constraints, and not necessarily in all stakeholders' interests or even reflecting their objectives. For example in the midst of the Greek economic crisis, disaster risk awareness and acceptability are becoming less a matter of DRR information and knowledge and must rather be addressed with a view to the new hierarchy of risks (socio-economic, health, emerging) generated by the crisis. However, acknowledging the complexity of the issue should not stand in the way of much needed efforts towards enabling knowledge for DRR with all the tools available in today's changing world.

### KEYWORDS:

disaster risk reduction, knowledge, communication, smart cities, civil society

## 1 INTRODUCTION

Information and communication are increasingly becoming a matter of interest in contemporary cities and especially in areas of higher vulnerability. Before becoming knowledge, information is transferred via communication tools. With this, conceptual variants, such as the smart city, intelligent city, or creative city, are readily used and reused. In a broad definition, a city may be called 'smart' "when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory government" (Caragliu et al. 2009 as referred to in Schaffers et al. (2011). Of special interest for this paper is a knowledge-based conceptual vision of the smart city, centered on people's information and knowledge of people, in order to improve decision-making processes, as has been suggested by Negre et al. (2015).

Recently, there are several studies focused on better management of knowledge in Disaster Risk Reduction. White et al. (2001), is the milestone article that stresses on the increasing social and economic losses after each disaster, although we know more about Disaster Risk Reduction. The growing literature on the subject tries to find a reason behind the increasing number of losses and to provide solutions. Mercer et al. (2010), Gaillard and Mercer (2012) state that there is a need to concentrate on integration of indigenous and scientific knowledge. Besides, Engel et al. (2014) focus on the cultural differences. Another group of researchers concentrate on developing applicable knowledge management systems. The latter include the Know-4-DRR project group (Menoni et al. 2014, Weichselgartner and Pigeon 2015, Spiekermann 2015), as well as Tom de Grove et al. (2013), and Cash et al. (2003).

Within this notion, this paper focuses on disaster risk reduction (DRR) as a means to mitigate the erosion of sustainable economic growth and quality of life caused by disasters. Our effort is to understand what has hampered the use of knowledge that has been developed so far by various stakeholders, in conjunction or disjunction from each other, in order to make appropriate decisions for risk mitigation and further on to transform these decisions into practice.

In this frame, and despite considerable progress made in DRR over the last decades, and whilst a great deal of both information and knowledge about DRR and CCA exists, such information and knowledge is not necessarily available to those who need it most, or at least it is not available in a form or in a timely manner conducive to helping concerned stakeholders make use of it in actions to reduce risk and adapt to the challenges of climate change (Norton et al, 2014).

Does this mean that smart access to information and related systems may not, at least not yet, always be the right way to go? Does it suggest at least that to go in a more balanced way giving attention to both existing and new ways of communication and information and knowledge management? This is reflected in the paradox that the immense enlargement of disaster-related research and the increase of scientific activities have so far had limited impact on reversing the upward trend in disaster damage (Spiekermann et al, 2015) and precisely expressed by White et al. (2001) as "knowing better and losing even more". It raises the question about who actually 'knows better', and about how best to share this?

When considering risk and disaster risk reduction, an inherent feature of the challenge of disaster risk reduction and, even more so, that of addressing both known and as yet unknown consequences of climate change, is the issue of uncertainty. Whilst there will always be things that are not fully understood, given the complexity of world systems (Brodine, 2013) and consequently there will always be degrees of uncertainty, so too we can see that at a more focussed level related to the quality of information and knowledge, and the way it flows between and within stakeholder groups, the quality of this communication also directly contributes to either generating or reducing uncertainty in the DRR decision-making and response process.

## 2 THE CASE MATERIAL - METHODOLOGY AND THE QUESTIONS.

The authors individually employed a wide range of research tools to tackle the issue of information and knowledge use.

Firstly, based on case studies of disaster events, and actions both before and after these, there has been an effort to map and assess information and knowledge flows from and to different stakeholder groups in different contexts of risk and vulnerability, to examine where information and knowledge flows support, or not, disaster risk reduction by different stakeholder groups within and between different social groups. The authors asked the project partners submitting these case studies to focus on a set of questions, listed in the next section, to explore what happened in the flow of information and the sharing of knowledge.

Secondly, surveys were performed in Istanbul and Mexico City, addressing the same questions (see below) about information flows and knowledge development for DRR put to representatives of civil society, private and public sectors, scientists and NGO's in order to obtain different contextual views.

Thirdly, further analysis was carried out through focus group discussion in Athens (Know-4-DRR Deliverable 2.4. Dandoulaki et al, 2014). The Athens work considered in particular the impact of current economic crisis on disaster risk reduction and climate change adaptation and the various fallout impacts on practices and society that have changed as a result of crisis.

Finally, a Living Lab exercise in Vietnam over a period of two years, building on the NGO 'Development Workshop France's' 25-year experience promoting the preventive strengthening of houses and public buildings to resist the impact of floods and typhoons (Norton et al. 2015) in Vietnam and neighbouring countries, has contributed one source of multi-stakeholder experience and views on information flows and knowledge development in areas with frequent disaster events.

## 3 MAPPING INFORMATION AND KNOWLEDGE FLOWS IN DIFFERENT SITUATIONS OF RISK AND DISASTER

### 3.1 METHODOLOGY AND ANALYSIS

Eleven cases providing information on both European and non-European events and experience were used as a basis for the mapping of information and knowledge flows from and to different stakeholder groups in a spectrum of contexts of risk and disaster, to examine where information and knowledge flows support, or not, disaster risk reduction by different stakeholder groups and within and between different social groups. A series of questions were put to project partners who had provided disaster-related case studies in order to identify possible answers. How is "available" knowledge used? Has the information sent been received, understood, and acted open by various actors in at risk environments?

The case studies<sup>1</sup> are listed below:

- Severe floods along the ELBE river, Germany, August 2002;
- Relocation of landslide survivors in Chiapas State, Mexico, 2005 and subsequent years;
- The Lorca earthquake, Spain, 11th May 2011;
- Typhoon events, 2006 & 2009, Vietnam;
- Ilia forest fires, August 2007, Greece;
- Kalamata earthquake, Greece, 1986;
- Sea level rise & Climate Change Adaptation, Greece;
- Flood event in the Salzach catchment, Austria, June 2013;
- Umbria Flood event, Italy, November 2012;

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<sup>1</sup> The case studies were provided by partners in the EU FP7 Project n° 603807 'KNOW-4-DRR'

- La Faute-sur-Mer flood disaster, Atlantic Coast, France, February 2010;
- People-centred tsunami early warning, Padang, West Sumatra.

The case studies considered, in broad terms, communication and knowledge development between four stakeholder groups: the Public Sector, Scientists, the Private Sector, and Civil Society, including households and individuals.








What several of the case studies indicated is that whilst there is learning and progress about pre- and post-disaster performance at public sector and scientist level, overall, at civil society level, there appears to be much less information usefully sent *by* higher level stakeholders, including the public sector and scientists, but that even less is received from civil society stakeholders. As such, although the information exists, it does not adequately constitute “knowledge that can be acted on”, particularly at local levels. There are also insufficiencies in the degree of feedback that reaches up *to* the “higher level” stakeholders and decision makers among the stakeholder groups consisting of scientists and the public sector. Overall there are indications of a gap between these different stakeholder groups. Quite often, one group of people, for example, researchers or Public service ‘information senders’ do not know what became of their information. They may also not know what knowledge and information is developed by other people even within their own stakeholder group – e.g. scientists not communicating between themselves - , and they are very often unaware of the measures employed locally by civil society to address DRR. For this reason, the focus of questions addressed to KNOW-4-DRR partners on knowledge flows, were aimed to determine what happened to information ‘sent’, and how and why it was used (or not used) by the different stakeholders with differing priorities, needs and capacities. The case study providers were asked to focus on the following questions:

What?	What information was sent by this stakeholder about the identified risk or hazard (or event) in this case study?
How?	How was this information sent? How often? Was the information fragmented in this process and did this hinder its use? How?
To whom?	Who was the information sent to (to which initial target stakeholders)? Was there an indication that the message/information was received?
Onward transfer?	Was the information passed on by a receiving stakeholder to other/additional stakeholders (e.g. from the local authority to households)? Was information shared/networked?
What action? By whom?	How was the information used? Did it influence any decision-making or not? How and who by?
Why not?	If information was not, or was only partially, used by this stakeholder to influence decision-making or action, why was this? E.g. Other priorities: finance, etc.
Feedback?	Was there feedback from this stakeholder (recipient) to the sender of information? Did feedback/evaluation influence subsequent policy/actions?
Uncertainty?	Did the information help reduce risk or uncertainty? How and why?
Wisdom?	Did information become knowledge/wisdom?

The resulting information received from case study providers enabled the authors to develop a “snapshot” of what happened to the information flow and knowledge development in circumstances and related actions that led up to each disaster event, what communication occurred as the event unfolded, and what then followed in its aftermath. Note that the cases do not necessarily reflect the longer term loops of changes and wisdom that might have gone on to improve subsequent resilience and disaster risk reduction, but the cases have shown that whilst lessons are indeed learned and improvements are made, communication to and from the private sector and civil society is insufficient. For example, in the 2013 Salzach Catchment flood event in Austria, the meteorological service (ZAMG), as reported by the University of Salzburg, said that faced with a large number of partners, they

assumed that the information sent had reached these partners, confirmation being in the form of signs of responsive action (Norton et al, 2014)

To complete the mapping exercise, the authors considered that it was vital to present case study information visually, as graphic visualisations more readily convey meaning that can be lost in text. We mapped each case study as a single-page graphic, on a matrix that brings together the stakeholders in four groups on the Y axis, and, on the X axis, a simplified version of the Disaster Management Cycle Phases to show at which point in the Disaster Management Cycle (DMC) information was transmitted, to whom and how, and whether it helped decision-making in a DRR context. Between the X and Y axes, data (drawn from the case material) was inserted in the form of notes to which a visual analysis was added using the following symbols:

-  a blockage – no decision-making
-  unsure result
-  knowledge leads to action
-  information flow (up or down)
-  an alert for a situation/context which is altering the environment or context, and is thus potentially changing decision-making attitudes and priorities
-  Media hub
-  Knowledge acquired but not wisdom

The intention has been to be able to see quickly where blockage occurs or action is taken on the basis of the information transmitted. An example of one of the European case studies is provided on the following page.

To a certain extent, the actual detail in the notes is less important than the snapshot impression – is there a problem or not?

An example table is provided on the next page, and one can see in this case study provided by the Harokopio University of Athens (Dandoulaki et al, 2013), on the forest fires in Greece in 2007. Past forest use linked to turpentine harvesting; now undergrowth cutting neglected & little local participation. Poor preventive action makes firefighting harder. The fires caused huge losses. Afterwards lessons learnt for fire prevention. But uncontrolled urbanisation keeps fire risk high.

Prior to the fires, in the critical period when structural and non-structural mitigation and early warning could have taken place, there were quite considerable failures in transmission and reception of information; positively, there was then better learning and improvement in the recovery phase of the event.

Once completed, the 'information flow' tables were reviewed to highlight answers to the question: did information help decision-making and a DRR outcome or not?

Here the Figure for the Ilia Forest Fires is included.



ILIA FOREST FIRES, AUGUST 2007, GREECE: DISASTER MANAGEMENT PHASES						
STAKEHOLDERS	Before the fires	Early warning	During the event - action	Recovery & reconstruction	Period after recovery	
Public sector	National Civil Protection authority	Annual warning about forest fire risk & advice	NCP daily forest fire warning on web site	Role of state agencies reduces traditional community engagement in preventing fires	Central govt calls for donations	New risk reduction plans
	Local authorities	Message OK; but Forest Fire Risk not a priority; lack funds, so often no action	Municipality & services issue daily fire warning correctly	Alert signal not linked to efficient mobilization & management system	Bureaucracy simplified	Adaptation options promoted
	Forest service (FS) Greek Fire service (GFS)	Tension between old FS & new GFS blocks knowledge sharing after transfer of responsibilities to GFS			Ilia disaster generated changes for Forest Fire management	Local authorities gain experience & bring changes
Scientists	Risk experts	Published Climate Change scenarios but did not influence policy or decision making			Scientists/civil society prepare reconstruction plans; NOT USED	Forest fire mitigation studies may be used in future
Private sector	Media		Media communicate about prevention measures	Media created fear & insecurity	Media spreads call for donations	Media promoted reforestation by volunteers.
	Volunteers				Donations	Volunteers given legal status as result of disaster
Civil society	NGO & Citizen associations	NGO deliver information about CCA impacts & adaptation actions		Media info not used:	Donations	NGO active in raising public awareness on CC agenda & prevention policies
	Communities/ Households / individuals	Forest management linked to turpentine production ceased, prevention culture & community response lost. Clearing of undergrowth not maintained. Change in socio-economic situation & uncontrolled urbanisation increase risk; houses surrounded by undergrowth & trees exposed to fire risk.	People do not know how to confront forest fires, only have theoretical knowledge	Old forest management knowledge declines; Despite repeated fires, awareness of forest knowledge may have decline	Media encourage volunteers	NGO work on forest fire assessment, for future use.

Fig. 1 Information flow: Ilia forest fires, August 2007

### 3.2 THE OUTCOME FROM MAPPING THE CASE STUDIES

#### “INFORMATION THAT HAD A NEGATIVE OR LOW IMPACT”

#### DID THE INFORMATION HELP DECISION-MAKING AND A DRR OUTCOME? WHO FOR?

- Multiplicity of organizations and agencies dealing with aspects of the disaster management cycle.  
Several of the case studies indicate that the multiplicity of services and agencies - at national and sub-national levels of authority and amongst various departments and services - has hindered efficient DRR decision-making and has also been one of the sources of confusion felt amongst subsidiary stakeholders.
- Top-down strategy and policy too theoretical and difficult to implement.  
The case studies linked concern about macro-level decision-making in DRR strategy with concern that top-down DRR policy, planning and instructions are based on broad brush theory resulting in instructions and action plans that were not easy to operate locally, highlighting a gap between decisions coming from central and even decentralised government on the one hand, and the realities of local implementation needs and capacity on the other.
- Information too little or late, sometimes incorrect or not understood by target stakeholder.  
Information about what action to take that can become useful knowledge to inform decisions about DRR; the results have often been found to be inadequate, e.g., that people did not fully appreciate the risk, that there was no time to take any action, or that they were ill informed. And plainly, especially for rapid onset disasters when early warning is not possible, there is the important need to develop and maintain long-term awareness of both the risk and required risk reduction actions.
- Stakeholder capacity building and awareness raising.  
Several case studies indicated that for the dissemination of information to be useful for target stakeholder decision-making about DRR, more attention needs to be paid to stakeholder capacity building and related awareness-raising regarding the need for preventive action and thus what action to take. This means doing more to enable stakeholders to correctly interpret and understand information that is being disseminated, so that they will be in a position to consider what it means for them and what action could be taken in their local context and circumstances.
- One way information flow/insufficient feedback.  
There is recognition that the flow of information should be considered as a flow of information in many directions, an exchange of information, with information and lessons learned returning to inform and improve the quality of data and information that will then, in turn, contribute to knowledge about DRR and CCA. The case studies suggested that this does not happen nearly enough. There is insufficient feedback and exchange.
- Loss or absence of knowledge: the value of local or indigenous knowledge about risks and responses:  
Local collective and indigenous knowledge is still seen as being of great importance (Sendai 2015). Concern was raised in the case studies that indigenous knowledge and practice are being lost or undervalued, and there are examples of people coming into new environments, for example in the “la Faute sur Mer” flood disaster case (Pigeon, 2013), where people did not know of the risks, nor did they know what to do in the event of a disaster.
- Media as an uncertain communication interface  
Media as an uncertain communication interface.  
In the process of transferring information to other stakeholders, and especially to the private sector and civil society, the most cited method used is communication through the interface of public and social media. A 2007 survey by scientists following the Ilia forest fires (Karanikola et al., 2013)

suggested that “during the awareness raising period, the mass media is a most effective communication tool”. But the case studies actually highlighted that the role of, and the quality of information imparted through, public media has given mixed results, both bad and good, sometimes being too late or inaccurate.

- Decision-making influenced by other priorities, objectives and constraints not necessarily in the interest of the vulnerable.

Decision-making in times of crisis (Dandoulaki et al, 2014) is but one example where collective and individual decision-making for DRR may be a low priority, and the Faute Sur Mer flood disaster in 2010 (Pigeon, 2013) showed that the desire for economic and population growth in the commune took priority.

#### “INFORMATION THAT HAD A POSITIVE IMPACT” (DECISIONS MADE/ACTION TAKEN, KNOWLEDGE ACQUIRED & USED).

- In the majority of the cases studied, but not all, the reported disaster event has been a catalyst in bringing about legal, institutional and social change in both awareness and practical knowledge related to DRR and, by extension, has improved the exchange of knowledge and the development of wisdom to support DRR. Many of the measures taken are inscribed in new legislation and one can expect such action to have sustained results.
- Although the case studies are limited in the time period they cover, there are nevertheless indications that there is a general evolving improvement in DRR procedures. For example, in both Europe and South East Asia, there are indications that disaster risk management structures and practice are being rationalised, including information sharing. In particular, efforts have been made to simplify the coordination of information that has to be disseminated in the period before, during, and after disaster events.
- There have been increases in inter-disciplinary work, with examples between universities and public institutions, between insurers and governments. All the parties concerned have tended to become more aware of the risks and of the need for an exchange of information about knowledge and the lessons learned. This was confirmed after the Iliia forest fire event in Greece in 2007 which generated changes in Forest Fire management (Norton et al, 2014). In the case studies there have also been improvements in multi-stakeholder involvement.

## 4 FACE TO FACE QUESTIONNAIRES, WITH RESPONDENTS IN ISTANBUL (TURKEY) AND MEXICO CITY (MEXICO), TALKING TO PEOPLE FROM THE PUBLIC AND PRIVATE SECTORS, SCIENTISTS, AND CIVIL SOCIETY

### 4.1. METHODOLOGY AND ANALYSIS

The face to face questionnaire surveys used the same questions, slightly reformulated to allow multiple-choice answers. Here too, somewhat unexpectedly, there are common points in the responses despite the differences in context and culture.

Overall, the details concerning hazard and associated risk and vulnerabilities, what was done in preparation, what actually happened, and what was communicated – or not – is only an indicator of a bigger picture of the shortcomings or successes of communicating information and knowledge for DRR action and, hopefully, of moves towards climate change adaptation.

## 4.2 A SHORT SURVEY IN ISTANBUL

Istanbul is located in the Northwest part of Turkey, in the "Marmara Region", surrounded by the Black Sea on the north, the Marmara Sea on the south, and the "Bosporus Strait" in the middle, connecting the two seas. Istanbul is the largest city in Turkey, among the largest urban agglomerations in Europe, and among the largest cities in the world with a population of 13,483, 052 people (TUIK, 2011). Today Istanbul is the primary city of Turkey as it covers an area of 5,512 kilometres square, with 18% of Turkey's population and 23% of the GDP (IMM, 2008).

However, this uniquely located cultural, commercial and economic centre of Turkey is under risk of seismicity due to the North Anatolian fault line which lies under the Marmara Sea. This fault line is one of the most active boundaries in the world and resembles the San Francisco fault line in terms of characteristics of seismic activity. The two recent earthquakes on this fault line occurred in 1999 with magnitudes of 7.4 and 7.2 on the eastern part of Istanbul. The recent earthquakes have increased risk of a major earthquake with an epicentre close to Istanbul due to an east-to west progression of earthquakes along this fault line. Apart from causing extensive damage, these two earthquakes also raised the issue of the vulnerability of structures in this region and the faults in the existing emergency system of Turkey in general.

In the Istanbul case, the respondents for the survey were chosen carefully. The first step of the survey includes exploratory interviews conducted during the conference in August 2014. The second step includes online questionnaires sent to people through emails. The participants of the online questionnaires had again been carefully chosen. In total, 17 subjects participated in the survey regarding the information flow and knowledge production in the newly constructed DRR system after the 1999 Marmara Earthquake.

On one hand, the results are in line with those obtained from the case studies in Europe, but on the other, they also include some local issues that can be seen only in Istanbul due to the particular historical and political background of the country. There are three prominent issues deserving to be mentioned here. These three issues concern "outreach of the information to public", "lack of coordination" and "implementation".

First of all, "can outreach of the information to the public really help to increase public awareness?" Respondents from public organizations mentioned their concerns about this issue. In the case of Istanbul, there is a huge gap between the information available to the public and the amount of information received by the general public. Having information available for public access does not mean that the public knows about it, or that they will receive sufficient and correct information. Lay people's general tendency is to ignore information regarding DRR, although their awareness of risk is very high (Atun, 2013; Atun 2014). Both the organizations which provide information and the general public need to collaborate on this issue. One of the respondents suggested that there should be pilot studies conducted by the experts with the involvement of the public to set an example for further studies.

Secondly, several respondents stressed the lack of coordination between the various organizations. Due to Istanbul's vulnerability to major earthquake risk since the 1999 Marmara earthquake, the system in Turkey has moved from post-disaster response to disaster risk reduction. There are several organizations both from public and private organizations working to achieve the same aim. However, there is a need for better collaboration between those organizations if they are to implement plans and policies successfully. To achieve better collaboration, trust-building activities are necessary, especially between NGO's and public institutions.

Last but not least, one of the respondents from a private organization pointed out an interesting issue regarding the implementation of the disaster risk reduction projects. He stressed that the disaster-risk reduction-related projects conducted in Istanbul aim to construct disaster resilient modern living areas. However, according to the respondent, those projects should have a society-centric approach. In Istanbul

there are regeneration projects implemented in the areas most vulnerable to earthquake. The common characteristic of those areas is that they are socially depressed. Inhabitants of those areas can no longer afford to live in the same areas after regeneration, as the newly constructed modern buildings attract high income groups. As a result of this, owners of the vulnerable building stocks are forced to leave their neighborhoods. It may be said that the regeneration projects conducted in the high level risk areas decrease structural vulnerability in the area, but at the same time, these projects may cause an increase of social vulnerability not related solely to the earthquake.

#### 4.3 ROUND TABLE DISCUSSION AND FOCUS GROUP INTERVIEWS IN MEXICO CITY

During the Mexico City workshop on "Gathering Knowledge between Latin America and Europe on Disaster Risk reduction and Climate Change Adaptation" at Ciesas, in Mexico City, (April 2015) one of the activities was a round table discussion where we conducted the questionnaires and afterwards the discussion with the representatives of the four stakeholder groups: scientists, NGO's, the public and private sectors. The KNOW-4-DRR participants had already presented the key points aligning Vietnam and Europe that were presented at the end of section 4.1. 'Considering Europe and Vietnam.'

The round table discussion started with the state of the notion of knowledge. The participants all agreed that knowledge is produced in academia, and in the Latin American approach, 'local knowledge' does not exist. They prefer the term of "*saber*" instead of saying local knowledge, which means "*to be informed*" in English. One respondent went on to say that the role of academics is to focus on ways to increase knowledge. Regarding one of the participant's recent research projects, in Latin America, 40% of the research projects are produced in universities. However, one problem is that the research topics are chosen without considering current needs, and most of the time the interest of the researchers and their ability or the funding agencies' wishes, dictate the form of the research. So, it is possible that the knowledge produced is not needed in the field, where somebody solves the existing problem with the tools they already have. Secondly, a problem is that knowledge is easily lost when the research project finishes. The question raised at this point is thus how to close the gap between real knowledge demand with the production of the knowledge, and how to prevent knowledge being lost.

Indeed, some organizations have tried to bridge the gap between knowledge demand and production by including local partners. However, one respondent stated that the success criterion in the academic system is the number of publications, not their effort to work with and collect local information from the local actors. This vision does not encourage academics to involve the stakeholders directly, as this is very demanding.

Another barrier to effective knowledge production is institutional segmentation. Having a complex system with different actors negatively affects the production of knowledge. Besides, there are two different epistemological communities for DRR and CCA knowledge, and according to one of the respondents, knowledge transfer does not occur between these two communities.

The discussion on the understanding of risk continued, on one hand regarding the understanding of risk in DRR and CCA communities, and on the other hand, the understanding of risk among non-experts. The agreed point was that in both directions there is no common understanding of what we are dealing with. Regarding the former, some of the respondents stated that disaster risk reduction is ignored like some other types of risk, such as the cigarette industry, where despite the fact that people know that smoking kills they continue smoking. There is encouragement to continue bad practices. In terms of laymen, there are several economic and social segments within the society. For example, what does risk mean for very poor people, for example? Within the community, people are concerned about unemployment. When you go to local level, locals say that the problems are illnesses, immigration and land degradation. So, the question that has to be raised is "what is the place of DRR in the problems mentioned?"



One of the respondents underlined the gap between humanitarian aid volunteers/staff and local people. In DRR, people from different cultural backgrounds with different approaches try to communicate, so, he asked whether it is possible to construct an absolute view of knowledge which can be understood by people using different logical chains and terminologies.

*"People working on humanitarian aid never understood the logic of the people who are living in a risky place. I wonder whether we can construct an absolute view of knowledge?" (Anonymous)*

These considerations indicate that disasters don't connect with the reality of people during their daily routine. Another example can be given from Brazil. One of the respondents from a public institution indicated that they are currently conducting a research project to collect memories and perceptions about historical disasters. As there are no volcanoes and no major earthquakes in Brazil, the respondent said that there is a need to change the mentality of stakeholders regarding risks before trying to apply DRR strategies.

Last but not least, all the respondents agreed on power relationships as one of the major barriers. As in the following, there are several statements coming from the respondents regarding the difficulty of power relations in Latin America. All the statements have been kept anonymous.

- "There is a political influence on how we produce and use knowledge". (Anonymous)
- "Power relations are very hard in Latin America. There is a lack of governance and there is violence at the local level. It tells you what you can do, and what you cannot do." (Anonymous)
- "Science is not objective. Governments defend some specific interest in the social sector. That's why we think saliency is important." (Anonymous)
- "Nobody asks about doing research on tax policy. That's because the tax system responds to certain interests. There are increasing numbers of non-academic institutions generating knowledge and producing huge amounts of documents without passing through peer review – and they have enormous impact (e.g. World Bank literature is considered as 'scientific literature')" (Anonymous)
- "In the institutions people are hired by governments. They already know the answers that need proof." (Anonymous)

One final remark during the discussion was that DRR is a specific social sector in Latin America, one that is almost powerless in a power game. There are many reasons for them to agree that DRR is not a priority. The crucial issue, as suggested by one of the respondents, is to think about how it is possible to change this status quo and how to change this beyond the law.

At the end of the discussion, asked if the participants agreed or not with the conclusions aligning Europe and Vietnam (see end of section 7.1), the replies from Latin American participants agreed with the points aligning Vietnam and Europe based on both European and Vietnamese findings in the KNOW-4-DRR project.

## 5 FOCUS GROUP DISCUSSION ON THE RELATIONSHIP BETWEEN THE USE OF KNOWLEDGE AND DRR IN THE ERA OF ECONOMIC CRISIS IN GREECE

This case has considered the socio-economic crisis in Greece and its impact on enabling knowledge for DRR. A main challenge for the task at hand has to do with trying to understand how things change while they are changing. Here too there is an inherent uncertainty related to crisis and its evolution.

This uncertainty then adds to the uncertainties associated with global trends and emerging risks associated with disaster risk and climate change. Hence there was a need to conduct research in order to bring up first hand input. To do this it was decided to first identify the main issues to be further investigated and then to attempt to bring together key informants from different fields to exchange views on those issues in an organised manner.

## 5.1 METHODOLOGY AND ANALYSIS

Three focus groups were organised: the first group with scientists from different fields of expertise, roles and experiences, the second with people from the public sector with various backgrounds and dealing with different sectors and phases of a disaster, and the third with civil society entities. Due to the characteristics of the private sector in Greece, it was decided that a focus group discussion would not be the appropriate method to draw useful insights. Instead, a literature review and an internet search were used. The discussion developed around the following series of topics:

- a. Crisis and disaster risk
- b. Knowledge production, diffusion, maintenance and use in times of crisis
- c. DRR/CCA policies and their implementation in the midst of crisis
- d. The use of knowledge in DRR/CCA policies and their implementation in the crisis era.

## 5.2 ENABLING KNOWLEDGE FOR DRR IN A TIME OF ECONOMIC CRISIS – THE GREEK CASE

Although each group of stakeholders brought up different insights, one may establish some common notions.

- The current economic (and subsequently social, institutional and political) crisis, with both positive and negative effects, is reproducing existing strengths and weaknesses in the social system. By being a part of that system, entities dealing with DRR face a number of differentiated threats and, in parallel, are also being challenged by some opportunities which they are currently exploring.
- Everyday short-term considerations prevail over long-term strategies and planning. Thus DRR and climate change adaptation lose ground to emergency management. This visible shift calls for convergence between the separated practice and academic communities concerning civil protection, civil defence, and security on the one hand and disaster risk reduction, climate change, and the environment on the other.
- The environment, and especially disaster risk reduction, has lost much of its predominance in the public sphere. Disaster risk negotiates its position with socioeconomic risks and emerging risks. Disaster risk awareness and acceptability are becoming less a matter of information and knowledge, and must be handled within the new risk milieu: crisis.
- Fiscal and economic constraints compel us to set aside the quality of infrastructure and environmental concerns. Quality of life is compromised and so too is disaster risk reduction as part of it.
- Acute shortages in the national budget result in dependency on EU funding and dominance of European policy priorities regarding CCA and DRR to which concerns and interests at a local and national level are forced to adjust.
- Brain drain, merging and abolishing public entities, staff reduction and mobility, forced retirements etc. generate a real concern about data, information and knowledge maintenance and updating.
- In a crisis environment, decisions are hasty and are taken under stress; the political agenda leaves out science. Although knowledge, creativity and inventiveness could be especially beneficial in policy making, evaluation and implementation during times of crisis, this is not the case especially as regards DRR/CCA.

## 6 THE VIETNAM LIVING LAB: KNOWLEDGE TRANSFER BETWEEN STAKEHOLDERS IN CENTRAL VIETNAM FACED WITH REGULAR TYPHOONS AND FLOODS

### 6.1. BACKGROUND ON THE DWF PROGRAMME IN VIETNAM

The study in Vietnam builds on the DRR experience gained by DWF in Central Vietnam since 1989. DWF's work has promoted the concept and practice of preventive strengthening of houses and small public buildings so that they can resist the impact of typhoons, whirlwinds and floods. It encourages national and local authorities, local builders and families to integrate the key principles of safer construction into new building and in the retrofitting of existing buildings, especially those of the poor and the very poor. Communication of principles of safe construction and ideas about preventive action to reduce risk and losses are central to this effort. Prevention based on applying generic principles of safety is slightly different from applying regulations and codes for construction, the former encouraging people to understand and apply good and proven practice that can make a large variety of buildings safer against given risks, whilst the latter more often apply to formal sector buildings and less often respected in the realities of the informal sector. For very poor communities, the application of safe construction principles has a greater chance of social appropriation compared with building codes, for various reasons related to poverty and the often incremental process of house building by the poor.

Within this an important part of this strategy is related to getting people to believe that preventive action is possible, useful and affordable. Communication to those who need knowledge of what to do is a key in developing a change in attitudes and ideas about safety. To do this, various stakeholders have participated in ways of communicating ideas about safety in construction and the need for it, and have developed concepts using both old - for example, puppetry and theatre - and new means - increased use of mobile phones and TV for practical messages on what to do - that help lodge the idea of prevention better in the longer term memory; one of the challenges being that of encouraging people to undertake prevention work in periods of the year when it may not seem like a priority.

This mix of old and new communication - always evolving - is most pertinent to the debate about the pros and cons of emerging smart information management systems working alongside older and still valid knowledge sharing approaches: when does emerging media tools such as the use of smart phones convey adequate and actionable information, and when does actionable communication still require face to face contact and door to door visits? Where one has a growing gap between the less vulnerable wealthy middle class and the highly vulnerable poor, this issue is most important.

### 6. 2. THE LIVING LAB IN VIETNAM - METHODOLOGY AND ANALYSIS

The Living Lab in Vietnam - building on the tasks in the KNOW-4-DRR project and also inspired by the GNDR<sup>2</sup>/DWF "Action on the Front Line" programme - was constituted as a stakeholder interaction initiative where 'external' stakeholders had long term collaborative links in communities exposed to typhoons and floods, and where there has been an opportunity to work and interact with various implicated stakeholders each with different responsibilities and needs related to a specific hazard or disaster event.

Underpinning the format of the Vietnam Living Lab were the same questions used before for the development and analysis of the case study material and questionnaires mentioned earlier in this paper.

The grass roots "Living Lab" has included enquiry and consideration of how the exchange of information and the co-production of knowledge between various social/institutional groups might more successfully take place or, on the contrary might be hampered under differing circumstances.

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<sup>2</sup> Global Network for Disaster Reduction

The surveys, community meetings and workshops were held in the provinces of Thua Thien Hue and Quang Binh. These activities tracked and assessed the evolution of communication, communication channels and the efficiency or inefficiency of information transfer. They have considered the development of knowledge for disaster risk reduction and in recent years, the search for a better understanding of how to interact/act on climate change and adaptation to climate change. In this Living Laboratory experience, the aim has been to consider and understand the barriers and bridges for information transfer and knowledge development and then to see how communications systems and their success are evolving. This evolution is pivotal to understanding how different stakeholders in Vietnam can be better engaged in the DRR (and CCA) process. The "Laboratory" has covered an eight year period of experience, always considering the flow – or not - of information and knowledge:

Firstly, the DW Vietnam team prepared a benchmark case study to set the overall scene before, during and after, typhoons in 2006 and 2009: typhoon Chanchu (May 2006) and typhoons Xangsane (October 2006) and Ketsana (September 2009) that hit central Vietnam and caused severe damage.

Then in 2013 the team surveyed recent experience after typhoons Wutip (09/13) and Nari (10/13) that hit Quang Binh province and Thua Thien Hue provinces in central Vietnam to provide a contemporary view of information flow and knowledge development on the issues of DRR and CCA, and went back several times to talk to families and local authorities.

Finally, a workshop in September 2014 in Hue, Central Vietnam brought together many different stakeholders, from villagers up to Ministry representatives, to consider the results.

This proved interesting. The observations not only aligned with findings from the field surveys, but interestingly, also aligned with findings from the case studies mentioned earlier in this paper and addressing other societies and regions of the world. (Norton, 2014)

In Vietnam, on the one hand the growing use of newer media opportunities over the past ten years is able to deliver better quality information. Today, most families have a television and watch the evening news. The press, TV and mobile phones have all become important tools in knowledge development. The communication *possibilities* are getting 'smarter'. But against this, the gap between the rich and the poor (as of 2011 still over 12 % live below the poverty line (UNData, 2013)), and the urban-rural gap in Vietnam in particular, remains very significant. This has various consequences related to the safety of poor families and how information about action in emergencies, and for preparedness and prevention can be delivered efficiently to these groups. The Living Lab shows that delivering information to poor and vulnerable families still relies very heavily on direct contact and house-to-house visits. But then, the same can still be said in Europe, for example during the Elbe floods in 2002 in Germany, for this event the case study material suggested that the same kind of direct household communication was also necessary.

In Vietnam, a presentation by Nguyen Thien Nhan (President of the Vietnam Fatherland Front Central Committee (Nhan, 2015)) on the way cities are changing as rural-urban migration becomes a fact of life, he recognised that smart cities technology may certainly be very beneficial (as being tested in several cities in Vietnam). But he suggested that there are issues such as population growth and environment, health, traffic and housing that remain hurdles, and he suggested that these require political will, administrative skill and the participation of citizens. The implication is that alongside smart cities there is a lot to be done that that addresses more fundamental issues linked to socio-economic constraints and values, and these require a mix of old and new information management approaches.

## 7 DISCUSSION OF RESULTS FROM THE VARIOUS RESEARCH ACTIVITIES

### 7.1 CONSIDERING EUROPE AND VIETNAM

In reviewing the findings of the Living Lab in Vietnam alongside the findings in the European case studies referred to earlier, one can observe the differences in the socio-economic and political systems that variously condition DRR development in Europe and in Vietnam:

- Europe: democracy, freedom of speech and the ability to critique State interventions in writing, in cartoons and on the street suggest greater opportunities for stakeholder engagement for change and thus for better DRR. But not always, since the environment in which disasters take place is increasingly complex: financial crises, uncertainty and conflicting interests and objectives, increased complexity of risks and associated requirements are just some examples that compound risks and vulnerability - the Université de Savoie case study on the “La Faute sur Mer/Xynthia 2010 catastrophe” that left many dead is only one example of conflicting interests (Pigeon, 2013). Mobilizing social engagement and knowledge sharing in bringing about better safety can still be considered inadequate in many instances.
- Vietnam: an authoritarian political system with low potential for political and social expression; at the same time very considerable experience and concern about the safety and protection of all members of society with an excellent preparedness record. But overall, there remains a separation between instructions on what to do and the means to act on the one hand, and still insufficient lessons that could be learnt from what people at the frontline of risk actually do to protect themselves.

However, between these two different contexts, the various case studies actually suggest that there are quite strong similarities in terms of the delivery of information on DRR and CCA and the development of viable knowledge suited to today's needs across most cases – and the mapping of the exchange of knowledge to support DRR (Norton et al, 2014) supports this conclusion.

Some key points aligning Vietnam and Europe align with a wider summary in 7.2.:

- a multiplicity of agencies with different responsibilities and aims does not always contribute to well-coordinated and clear decisions about DRR and emergency actions; there are some signs of rationalization but more needs to be done; communication is still often poor and does not enhance knowledge development;
- top down strategies criticized as being too theoretical and at times difficult to implement on the ground
- information on extreme weather events criticized for not always being accurate or timely enough, and information sent out is not always understood by the local stakeholders;
- problems of terminology; scientific and even weather warning information not always understandable
- insufficient community feedback;
- loss of local and indigenous knowledge;
- divergent objectives and priorities;
- need to enhance the role of social media in delivering good and useful information, progress being made;
- slowness in knowledge sharing and interdisciplinary work, but getting better;
- lack of resources for local action.

These are all areas where both local stakeholders and representatives of the public sector, scientists and civil society agree that greater awareness of the issues will contribute to improving the quality and delivery of information, and the development of knowledge that leads to a safer environment.



## 7.2. COMPARISON AND COMMONALITY OF OPINIONS

Considering the various case studies and surveys that have been carried out by the authors and partner organisations in the KNOW-4-DRR project, it goes without saying that there are many variations in each context, be it exposure to particular hazards and risks, the political situation, or the socio-economic nature of the region and its population; when each disaster event is considered, one sees specific shortcomings (and some successes) in the way information for DRR and/or CCA has been handled and how knowledge has, or has not, developed and been put into use.

Thus, on a larger scale, there are different economic and political systems and problems regarding DRR and CCA. However, when one zooms in especially to the opinions of lay people, one realizes that although systems and context are different, they have great similarities in the perception of information development and sharing and of knowledge and understanding at local scale.

We have considered these opinions in three states:

- **Dissemination** – Whether information is proactively disseminated or not. Whether there are established mechanisms for dissemination;
- **Cooperation** – Whether knowledge is shared amongst stakeholders;
- **Implementation** – Whether knowledge is enacted and decisions implemented.

To do this, we drew on the findings of the initial Case studies plus the Istanbul, Latin American and Vietnamese surveys.

Overall, there are of course differences of opinion in every case based on experience, so one person says, “Personally, I received the information that I need to accomplish my task too late”.

Whilst another says, “Personally, I received incorrect information”

But there are a number of common views, of which the most frequent is that interdisciplinary collaboration is necessary, and this is reflected in the findings of the Vietnam Living Lab, where working with, and bringing together, people from different stakeholder groups, and people and groups in different social and economic situations brings great wealth to understanding where communication information sharing and knowledge development can be enhanced. The most common opinions are:

- **the multiplicity of organizations** involved does create difficulty for the implementation of disaster risk reduction policies;
- most of the time, disaster risk reduction **policies are top-down – they can be very difficult to implement locally**;
- decisions regarding disaster risk reduction policies are **too theoretical/not grounded on true local needs**;
- **information flow is one way**, which, among other things, represents a big difference between NGO behaviour and the Private sector but, above all, the failure of the Public Sector to listen to local opinion and concerns;
- **knowledge is often lost** because of lack of sharing and implementation; problems of information being inaccurate when passed on by intermediary communicators, including the media;
- **difficulty in understanding the terminology being used**, e.g., a weather alert may use terms that lay people do not understand;
- There has been an **improvement in the quality of data and information** in recent years but errors and lateness persist;
- Awareness of **DRR and the gradual importance of CCA** are rising among stakeholders but it is **often not a priority** when compared to other and often day-to-day priorities, so that DRR action, for example, habitually takes place too late and, as a consequence, often in a rather haphazard manner.

These already serve as pointers for further action at the levels of scientific research and knowledge development and dissemination

## 8 CONCLUSIONS

Extended research using a range of methods and techniques was used to identify what hinders the use of knowledge for disaster risk reduction in settings with a different culture, economy, political and socio-economic context and in different risk and disaster situations.

The findings reveal a variety of barriers, many of which depend on context and hazard. However, there are also unexpected shared features, which in turn point to areas where more attention should be paid in research, and to the nature and quality of communication, timeliness and the pertinence of such communication of information and knowledge. For example, there is a broad consensus that the multiplicity of organisations involved in DRR and CCA and often with similar responsibilities, contributes to difficulties in delivering clear, coherent and consistent messages and in turn makes the implementation of disaster risk reduction policies harder; there are frequent examples of difficulties with terminology, so information may be received but not understood.

Whilst this commonality exists when one focusses on the local scale, it is true that other voices suggest, for example in the recent **European Climate Change Adaptation Conference (ECCA) 2015**, that a different geographic spread might have produced more diverse results.

Overall one can see that there are serious issues about the quality of communication and the usefulness of the information imparted and its ability to develop actionable DRR knowledge that can also be of increasing importance for CCA.

If there a general difficulty in terms of actionable knowledge development for DRR and CCA, this becomes even more critical in times of crisis. But we can also see that overall, with over half the world population now living in cities, urbanisation too develops its own forms of crisis and uncertainty, especially for those forced to live in vulnerable areas of urbanised cities.

A criticism made in the Hue Workshop and emerging from the case study surveys is that information flow is one way, and is often not grounded on true local needs, making instructions difficult to implement.

Knowledge and information flows often indicate insufficient feedback and exchange. There seem to be more difficulties in this when other priorities prevail. There are assumptions in the public sector, on the part of service providers and scientists that the act of sending information, publishing it or indeed simply making it available on the Internet fulfils a task of "communication", when in reality in many instances no such assumption can be made. This leaves open the question of 'uncertainty' about who has, or has not been informed in a manner that could lead to decision-making and DRR action. The case studies provided a good deal of comment about "not knowing what to do" and of "information not containing useful guidance". A study after the Iliia forest fires in Greece in 2007 (see table 1) indicated that whilst "during the awareness raising period mass media is a most effective communication tool", two-way communication and discussion are suggested as being an important tool when encouraging stakeholders to embark on new or innovative actions that need explanation, understanding and conviction (Karanikola et al., 2013).

What then of the smart city, where many parts are vulnerable and where the opportunities to meet and exchange and where two-way communication potential may be even more constrained than it was in the past? There is in effect a need for smart communication that bridges the gap between sending out information on the one hand and enabling knowledge development and consequent action on the other.

ICTs could facilitate information. However they too are subjected to organisational, institutional, legal, structural and intrinsic barriers that hinder information and knowledge use. Hence, investment in ICTs should be seen in connection with the broader knowledge and information production and management

framework. Moving on from this, greater use of new social and classic media can also facilitate knowledge development for DRR and awareness of actions for CCA, but we have seen that the media interface between information providers and the desired end user audience can on the one hand be unreliable (e.g. news provided late or misinterpreted), suggesting that more interaction between the public sector, scientists and media would lead to better understating of the issues well in advance of events, thus at the very time when one should be encouraging DRR, but on the other hand, it is also clear that professional communicators have a great potential for improving the quality and viability of the information communicated. (TiConUno, 2014). Faced with challenges to improve knowledge development for DRR and CCA, there are ever-developing ITC and media opportunities that need to emulate past information, communication and knowledge development that not only addressed the technical and practical issues of DRR and CCA, but integrated the social and cultural aspects of communication, exchange and knowledge development that was couched in the framework of local needs and realities. This remains a challenge.

Last but not least, no matter how useful, knowledge itself is no panacea for DRR. Decision-making is invariably influenced by conflicting priorities, objectives and constraints, not necessarily in the interests of all stakeholders or even their objectives. For example, in the midst of the economic crisis, disaster risk awareness and acceptability are becoming less a matter of information and knowledge and must be addressed with a view to the new hierarchy of risks (socio-economic, health, emerging) generated by the crisis. However, acknowledging the complexity of the issue should not stand in the way of much needed efforts towards enabling knowledge for DRR.

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## IMAGE SOURCES

Cover image 1: Development Workshop France.

Fig. 1: Harokopio University of Athens, Greece (Data) & Development Workshop France (Analysis table)

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President, Development Workshop France (French NGO) specialising in human settlements development problems in less developed countries; masters in Architecture (DIP.AA). Director and co-founder in 1973 of 'Human Settlements Development Workshop'. John Norton has a principle role in policy, strategy and programme development, project organisation and implementation and management of interdisciplinary teams over 40 years in SE Asia, Africa and the Middle East. Programmes include disaster risk reduction & hazard impact mitigation; environmental and energy resources management; rehabilitation and revitalization of communities, including educational facilities; rural and urban planning; income generation, particularly with women; capacity building & training at grass roots and professional levels; promotion of the use of local resources and skill development, and the strengthening of interaction between civil society and local authorities. As well as developing capacities in communities to address emerging issues and rapid changes, he has worked on EU FP7 research including the KNOW-4-DRR project, the EU/Mexico Fonciyct Risk and Vulnerability Network, and has published widely on all aspects of his work.

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The Project *Smart Energy Master (SEM)* for energy management of territory has been co-financed by the National Operational Programme for 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 October 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 sectorbased 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 TeMALab 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.



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