TeMA

Journal of
Land Use, Mobility and Environment

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

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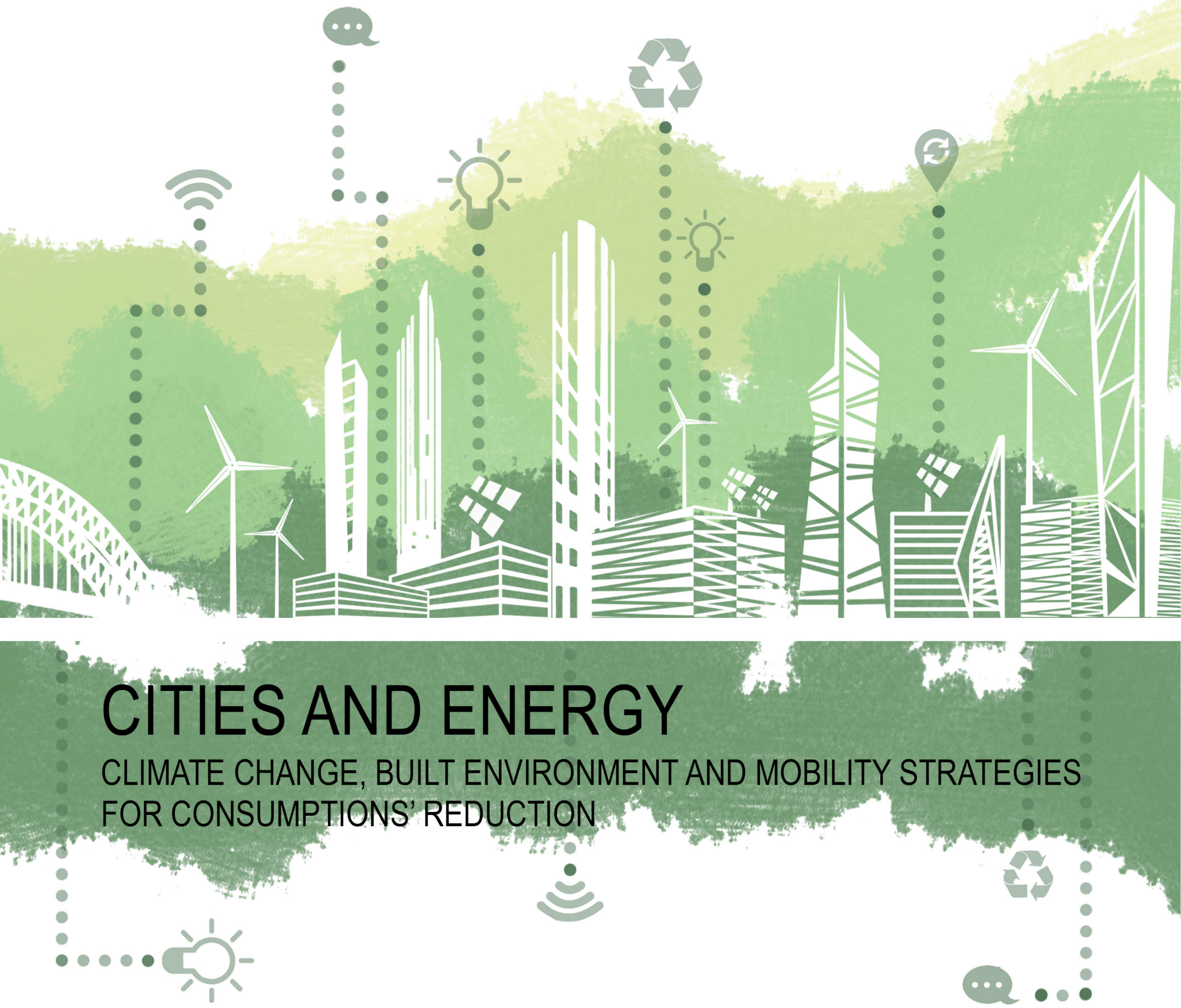

CITIES AND ENERGY

CLIMATE CHANGE, BUILT ENVIRONMENT AND MOBILITY STRATEGIES FOR CONSUMPTIONS' REDUCTION

Vol. 8 nn. 1 - 2 - 3 april-december 2015

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

CITIES AND ENERGY

CLIMATE CHANGE, BUILT ENVIRONMENT AND MOBILITY STRATEGIES
FOR CONSUMPTIONS' REDUCTION

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PON Ricerca e Competitività 2007-2013

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

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 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 TeMA*Lab* team of the University of Naples Federico II plays a twofold role, since it is engaged in the research and experimentation activities as well as in the training ones. Among those activities, the dissemination and divulgation of approaches and project's developments play a major role. The publication of this volume can be framed into these activities and represents an integration to the deliverables of the project.

Il Progetto di ricerca *Smart Energy Master (SEM) per il governo energetico del territorio* è co-finanziato dal Programma Operativo Nazionale Ricerca e Competitività 2007-2013 Smart Cities and Communities, "Azione integrata per lo Sviluppo Sostenibile - Energy Efficiency and Low Carbon Technologies". In linea con i più recenti orientamenti della ricerca europea e nazionale (Horizon 2020, Hit 2020), questo progetto si avvale di un ampio partenariato che integra università, imprese, enti di ricerca e pubbliche amministrazioni. *SEM* si conclude 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 TeMa*Lab* dell'Università degli Studi di Napoli Federico II è partner del progetto e riveste un duplice ruolo essendo impegnato sia nelle attività di ricerca e sperimentazione che nelle attività di formazione. All'interno di tali attività grande rilevanza viene data alla disseminazione e divulgazione degli approcci e degli avanzamenti del progetto. La pubblicazione del presente volume può essere inquadrata nel contesto di tali attività e rappresenta un elemento aggiuntivo ai *deliverables* del progetto.

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City of Naples. Image by Paolo De Stefano, digital processing by Raffaella Niglio.

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EDITORIAL PREFACE:

CITIES, ENERGY AND CLIMATE CHANGE

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Urban population is rapidly reaching two thirds of the global population; thus, cities are the core of a change that need to be driven: the rapid urban population growth involve a large energy consumption and high greenhouses gas emissions which drive cities to face environmental challenges like as climate changes and energy resources' scarcity. As remarked by the last Report of the United Nations on Sustainable Development, climate change is one of the greatest challenges of our time and adequate strategies capable of mitigating and adapting to its impacts represents an immediate and urgent global priority. This issue of the TeMA focuses on the topic of Cities, Energy and Climate Change, focusing on current strategies addressed to mitigation and adaptation.
The first article of this issue, titled "The Padanian LiMeS. Spatial Interpretation of Local GHG Emission Data" by Michèle Pezzagno and Marco Rosini focuses on the relevant role of spatial planning in the enforcement of climate change mitigation that could have a part in managing the development of new low-carbon infrastructures and increasing system-wide efficiencies across sectors, has been addressed at global level (IPCC, 2014 WGIII). The paper then stress on the role of local GHG inventories as a tool towards the definition of a coherent, inter-sectorial background for local planning, mitigation, and adaptation policies. Taking advantage of consistent GHG emissions data availability in the Lombard context, the article links local maps of direct GHG emissions with geographic data, including municipal boundaries, population data, and land-use information, produced and organized within the research PRIN 2007 "From metropolitan city to metropolitan corridor: the case of the Po Valley Corridor". The results of this mapping exercise have been evaluated on the background of consolidated knowledge about northern Italy urban patterns, including the Linear Metropolitan System – LiMeS – and preliminary observations about characteristics, potential, and limits of the tool are proposed.
The second article titled "Smart and Resilient Cities. A Systemic Approach for Developing Cross-sectorial Strategies in the Face of Climate Change" by Rocco Papa, Adriana Galderisi, Maria Cristina Vigo Majello and Erika Saretta focuses on the Smart City and Resilient City concepts. The article, based on the review of existing literature, analyses the synergies between the two concepts, highlighting how the Smart City concept is more and more widely interpreted as a process addressed to make cities "more liveable and resilient and, hence, able to respond quicker to new challenges" (Kunzmann, 2014). Nevertheless, current initiatives to improve cities' smartness and resilience in the European cities are very fragmented and

operational tools capable to support multi-objective strategies are still at an early stage. To fill this gap, embracing a systemic perspective, the paper identifies and arranges into a conceptual model, main characteristics of a smart and resilient urban system. The latter represents a preliminary step for the development of an operational tool capable to guide planners and decision-makers in carrying out multi-objective strategies addressed to enhance the response capacities of complex urban systems in the face of climate change.

The third article by Thomas Hartmann and Tejo Spit titled, "Implementing European climate adaptation policy. How local policymakers react to European policy", uses two Dutch cities as an empirical base to evaluate the influence of two EU climate adaptation projects on both the experience of local public officials and the adaptive capacity in the respective cities. The main conclusion is that EU climate adaptation projects do not automatically lead to an increased adaptive capacity in the cities involved. This is due to the political opportunistic use of EU funding, which hampers the implementation of climate adaptation policies. Furthermore, these EU projects draw attention away from local network building focused on the development and implementation of climate adaptation policies. These factors have a negative cumulative impact on the performance of these transnational policy networks at the adaptive capacity level in the cities involved. Therefore, in order to strengthen the adaptive capacity in today's European cities, a context-specific, integrative approach in urban planning is needed at all spatial levels. Hence, policy entrepreneurs should aim to create linkage between the issues in the transnational city network and the concerns in local politics and local networks.

The section Land-use, Mobility and Environment collect two articles. The first one titled Interactivity of Web GIS for the Simulation of Land Development by Tullia Valeria Di Giacomo focuses on the spatial data knowledge and the development of new ICT solutions, which can guide the planner towards strategic, reliable and shared decisions. The paper proposes a methodology useful to specialize the special approach established in previous projects developed by extending and implementing GIS technology Geographic Information System towards online interoperability. The control of the effects of changes in land use in environmental quality, particularly in the water resources management, can thus become operational in the network through the application of innovative tools able to meet the new challenges of urban regeneration.t

In the same section, the article titled "Cycle sustainability" by Francesca Pirlone and, Selena Candia shows the sustainability of cycling according to socio-economic (social and economic sustainability) and environmental terms (environmental sustainability), thought a CBA (Cost and Benefits Analysis) methodology specific to evidence the advantages of investments in cycling made by public authorities or private companies both, to promote and realize ecological infrastructures.

Finally, the Review Pages define the general framework of the theme of Smart City Environmental Challenges with an updated focus of websites, publications, laws, urban practices and news and events on this subject.

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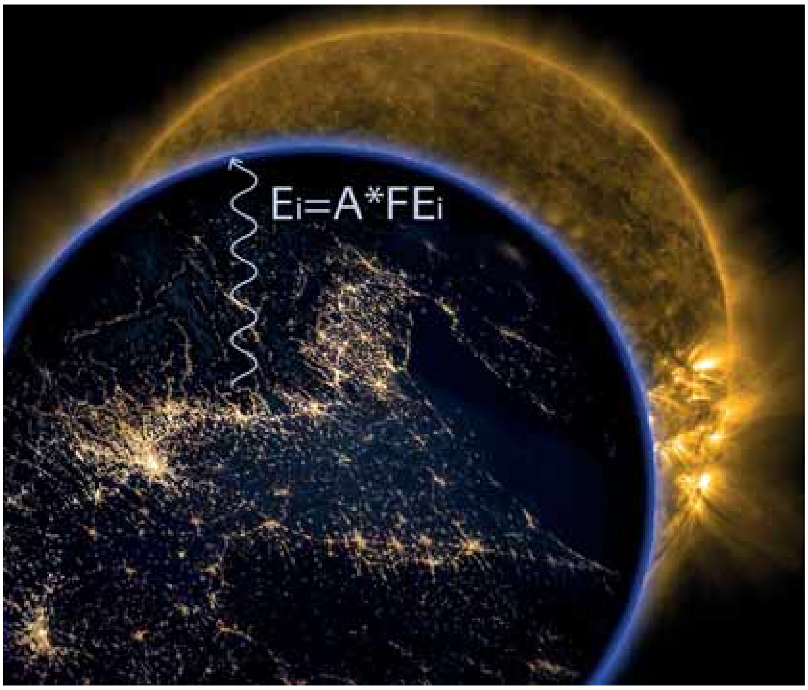

THE PADANIAN LIMES

SPATIAL INTERPRETATION OF LOCAL GHG EMISSION DATA

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ABSTRACT

The relevant role of spatial planning in the enforcement of climate change mitigation, managing the development of new low-carbon infrastructures and increasing system-wide efficiencies across sectors, has been addressed at global level (IPCC, 2014 WGIII). In this context, local GHG inventories appear a relevant tool toward the definition of a coherent, inter-sectorial background for local planning, mitigation, and adaptation policies.
Taking advantage of consistent GHG emissions data availability in the Lombard context, local maps of direct GHG emissions have been linked with geographic data – produced and organized within the research PRIN 2007 *From metropolitan city to metropolitan corridor: the case of the Po Valley Corridor* – including municipal boundaries, population data, and land-use information.
The results of this mapping exercise have been evaluated on the background of consolidated knowledge about northern Italy urban patterns, including the Linear Metropolitan System – LiMeS – and preliminary observations about characteristics, potential, and limits of the tool are proposed.

KEYWORDS:
local carbon emissions inventories, GHG accounting, climate change mitigation.

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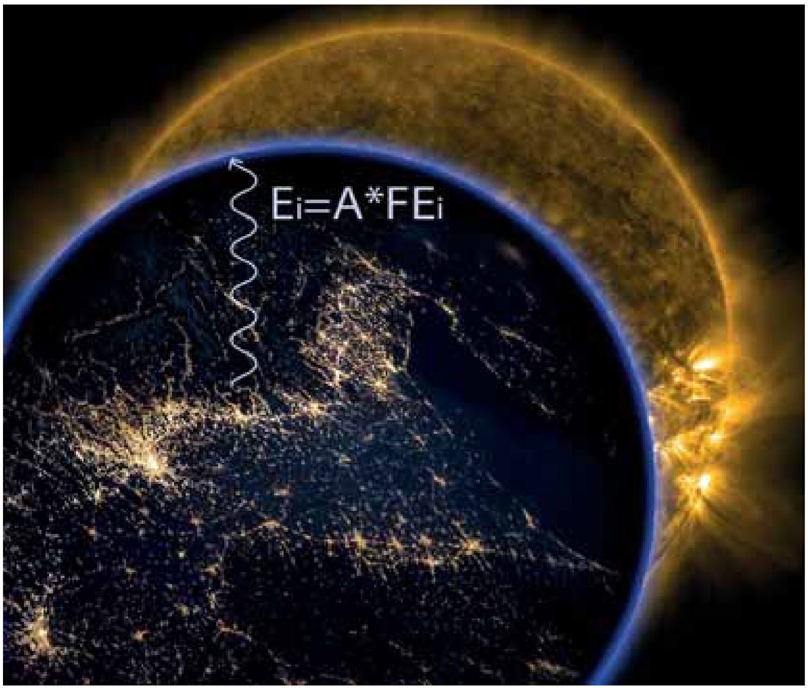

帕达尼亚 LIMES

对当地温室气体排放数据的空间解读

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摘要

空间规划在执行气候变化缓解政策、管理新低碳础设施的发展以及提高全系统效率中的相关作用已获得了全球层面的阐述 (IPCC, 2014 WGIII). 在这个背景下, 当地温室气体清单变成为当地的规划, 缓解和适应政策确定连贯, 跨部门背景的相关工具. 通过利用伦巴第环境中统一温室气体排放数据的可用性, 直接温室气体排放的本地示意图已与名为 从大都市到都市走廊:波河流域走廊案例分析 的 PRIN 2007 研究所产生和整理的地理数据相联系, 其中包括城市边界, 人口数据和土地利用信息. 本次图上演示的结果已在意大利南部城市形态的巩固知识的背景下进行了评, 其中包括线性都市系统“LiMeS”, 并提出了对这个工具的特征,潜力和限制的初步观察.

关键词
当地碳排放清单, 温室气体核算, 气候变化缓解

1 INTRODUCTION

The present effort in climate modelling, including global greenhouse gases (GHG) monitoring and accounting, is unprecedented in human history. The establishment of a global carbon budget, aimed at keeping the increase of global temperature within 2-Celsius degrees above pre-industrial levels, has deep economical, social and political implications. Therefore, carbon accounting methodologies are catalysing a growing attention from the most diverse disciplinary sectors.

The atmospheric carbon balance is only one of the key components of the global dynamic equilibrium: biodiversity, stratospheric ozone, nitrogen and phosphorous cycles represent other domains in which human action must be contained within global limits. However, what makes the concentration of GHG peculiar among global limiting factors is its pervasive influence on almost all natural and anthropogenic systems.

Rising the concentration of carbon dioxide and other greenhouse gases in the atmosphere we do not only increase the global temperature and its burden of perilous consequences, but we are notably reducing the dispersion of *entropy* toward the cold sink of outer space through thermal infrared irradiation, thus affecting the efficiency of almost every process occurring within the biosphere. Furthermore, anthropogenic climate change stands apart from all the environmental issues we have faced so far because we are challenging a global, pervasive limit that involves significant changes in all aspects of human activity, at least as long as our energy system is mainly supported by the use of fossil fuels.

The analysis and interpretation of GHG emissions values poses unique challenges since emissions are produced by a very large number of processes and the hyper-connected structure of our economy, as well as the role of technological evolution, should always be carefully considered.

At urban scale the multi-dimensional nature of the energy issue, which is deeply connected with carbon emissions, has been underlined and the limits of sectorial approaches have been described, in contrast with the need of quantitative, holistic studies (Papa, Gargiulo, Zucaro, 2014b). In this perspective, local carbon emissions inventories can represent a pertinent analytical instrument. However, cities and regions are open systems and, since the relative weight of the energy and material flows exchanged by local systems through their boundaries tends to increase as the scale of the system decreases, preparation and interpretation of local inventories pose several challenges that have to be properly addressed (Pezzagno, Rosini, 2014).

Under these premises, the present contribution is mainly aimed at summarizing the methodologies adopted for developing carbon inventories at local scale and at revising the main approaches adopted for addressing the 'responsibility problem'. A mapping exercise on the LiMeS urban system in Northern Italy, based on existing GHG emissions datasets, is then presented in order to discuss the relevance, the possible applications, and the limits of the tool.

Recent experiences have shown how the preparation and certification of local GHG inventories, together with the co-operation between academic, legislative and administrative organizations, are important points for a sustainable management of an administrative jurisdiction, providing positive environmental effects (Bastianoni, Marchi, Caro, Casprini, Pulselli, 2014).

In this context, the spatial mapping of coherent time series of carbon emissions data, including the analysis of sectorial emissions in relationship with land-use classes, can provide further insights and could be positively adopted as a significant reference for spatial planning and local decision-making.

2 CARBON ACCOUNTING AT LOCAL SCALE: GENERAL REMARKS

Anthropogenic greenhouse gases represent a peculiar category of pollutants: they affect the global ecosystem independently from their point of emission[1], while their direct effect on local ecosystems can often be considered negligible, like in the case of carbon dioxide. Furthermore, their generation is commonly

[1] This is not true for some categories of climate-influencing pollutants like black carbon (IPCC, 2014a).

connected with the production of electric power or goods that can be exported and consumed far away from the site of production. A local reduction of emissions – achieved, for example, by relocating an industrial facility in another region – can paradoxically represent an *increase* in global emissions, determined by the added relocation and transport costs (i.e. the emissions generated for building the new infrastructure and transporting the goods back to the original market).

For this reason, the theme of GHG emissions *responsibility* in open economies represents a complex and relevant topic that has been already discussed since in the earlier stages of development of carbon accounting methodologies (Munksgaard, Pedersen, 2001), when it soon became clear that the problem of properly assigning the liability for carbon emissions represents a primary issue at sub-national and local scales (Bastianoni, Pulselli, Tiezzi, 2004).

Producers and consumers, importers and exporters can be always considered co-responsible, and two main approaches have been proposed in order to solve the liability dilemma: the geographical (or producer-responsibility) and the consumer-responsibility approach, which will be summarized and commented in the next paragraph. Another major difficulty, when dealing with local inventories of greenhouse gases, is then represented by the fact that the relationship between the reduction of emissions and the overall performance, the health, and the resilience of local systems is not necessarily linear. With regard to the significance of local carbon emissions inventories at local scale for spatial planning, it is worth noting that GHG emissions can be, in the first place, considered as an *entropy-proxy*: a general representation of local processes energy-intensity. In this perspective, local carbon emission inventories can be used as a tool to discuss the efficiency and the evolutionary trajectories of cities and local systems with reference to their production of entropy, in the perspective proposed by Fistola and La Rocca (2014).

Furthermore, GHG emissions are strongly related with the dense idea of urban *resilience*.

The complex concept of resilience has been proposed as logic and semantic pivot for addressing climate change at local and urban level (Galderisi, Ferrara, 2012), including both mitigation and adaptation strategies. Indeed, although a differentiation between mitigation measures, aimed at reducing GHG emissions, and adaptation measures, aimed at adjusting natural or human systems in response to actual or expected climatic stimuli or their effects is widely adopted, it is worth noting that these concepts are deeply interconnected and should never be considered as independent. This observation is only apparently basic, and has relevant consequences when considering the role of spatial planning at regional and local scale for tackling anthropogenic climate change and its consequences.

While the importance of spatial planning is evident when dealing with *adaptation* policies for enhancing the resilience of infrastructures, ecosystems, and economies (IPCC, 2014, WGII), the role of urban and regional planning has been clearly addressed as pivotal[2] in the enforcement of Climate Change Mitigation (i.e. reduction of local GHG emissions, development of low-carbon infrastructures) only recently.

The relevance of cities as *loci* of energy consumption and GHG emission has been clearly underlined, since urban areas account for between 71 % and 76 % of CO2 emissions from global final energy use (IPCC, 2014, WGIII), but satisfactory models and practices for tackling mitigation at urban level still appear in their early stages of development (Papa, Gargiulo, Zucaro, 2014a).

This is hardly surprising: it's difficult to separate, to clearly distinguish the city from the evolving background of the entire human activity. In particular, as we recognize the fundamental importance of technological evolution (in power generation, industrial processes, transport, etc.), it appears quite natural to expect that cities could just follow the stream of technological innovation, progressively adopting better solutions as in the case of mitigation policies based on buildings energy-efficiency.

[2] As pointed out in IPCC AR5 - WGIII, Chapter 12, the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC, 2007) did not have a chapter on human settlements or urban areas. Urban areas were addressed through the lens of individual sector chapters. Since the publication of AR4, there has been a growing recognition of the significant contribution of urban areas to GHG emissions, their potential role in mitigating them, and a multi-fold increase in the corresponding scientific literature.

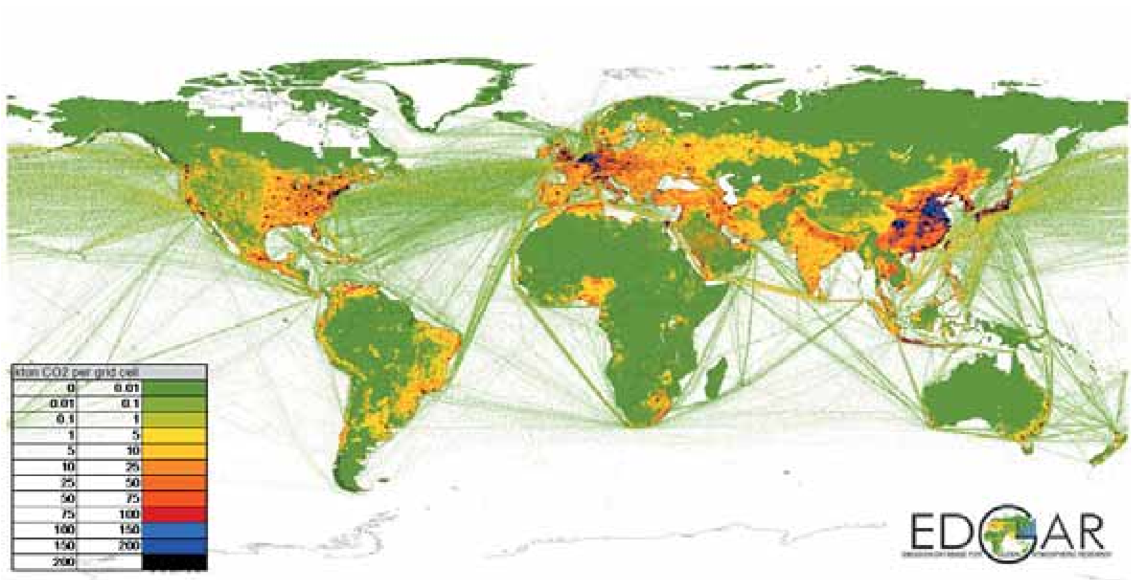

Fig. 1 Global gridded carbon dioxide emissions from fossil fuel and other anthropogenic direct emissions (excluding aviation and organic carbon emissions) expressed in kton of CO2 per 0.1x0.1 deg cell (2005 values). EDGAR inventory 4.0.

This assumption can appear fairly reasonable, but it is radically insufficient if we consider the countless opportunities of systemic, cross-sectorial efficiencies, industrial symbioses, and smart urban settings that can be properly addressed only through an appropriate spatial analysis and with effective planning tools.

3 GEOGRAPHIC AND CONSUMER-RESPONSIBILITY CRITERIA IN CARBON EMISSIONS ACCOUNTING

The Kyoto Protocol, adopted in December 1997 and finally entered into force in 2005, has established emission reduction objectives for Annex B[3] Parties, which are committed to develop, publish and regularly update national emission inventories of greenhouse gases as well as formulate and implement programmes to reduce these emissions.

In order to establish compliance with national and international commitments, national GHG emission inventories are compiled according to the guidelines provided by the United Nations Framework Convention on Climate Change (IPCC, 2006). Emission estimates comprise six direct greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), which contribute directly to climate change due to their positive radiative forcing effect, and four indirect greenhouse gases (NOx, CO, non-methane volatile organic compounds, and SO_2).

The IPCC guidelines for GHG accounting, developed from a revision of a precedent 1996 version, have been designed in order to ensure the transparency, consistency, comparability, accuracy and completeness of the inventory provided by the national authorities, and consider 4 emission sectors: (1) Energy, (2) Industrial Processes and Product Use, (3) Waste, and (4) Agriculture, Forestry and Other Land Use (AFOLU). It's worth noting that national inventories are updated annually in order to reflect revisions and improvements in the methodology and adjustments are applied retrospectively to earlier years, which accounts for any difference in previously published data.

The IPCC methodology adopts a polluter-responsibility approach, also indicated as territorial or *geographic approach*, since countries are held responsible for all GHG emitted from their domestic territory.

3 Annex B parties are industrialized countries and countries with economy in transition (Annex I Parties) with first- or second-round Kyoto greenhouse gas emissions targets.

The main problem determined by the adoption of a geographical approach as a reference for emissions reduction policies in a limited number of countries is represented by the risk of inducing *carbon-leaking* phenomena, i.e. the re-localization of energy intensive industries and technologies from nations with strict climate policies. Furthermore, adopting the geographic principle, a territory can be considered 'virtuous' even if imports energy and carbon-intensive goods, because it does not *directly* emit greenhouse gases.

The problem of *indirect emissions* is considered by other organization-based GHG accounting systems, like proposed in the EU LIFE LAKS project, or in the recently launched[4] GHG protocol for Cities (ICLEI, 2012), including the *consumer responsibility* (or just responsibility) *principle*.

In these frameworks the accounting of direct emissions, namely the emissions rising from within the city boundaries (see fig. 2, Global Protocol for Community-Scale Greenhouse Gas Emission Inventories, Scope 1), is followed by the accounting of indirect emissions generated for producing the imported energy (grid supplied power, Scope 2) and other indirect emissions (wastes, power transmission and distribution, out of boundary transportation, Scope 3).

The main advantage of adopting a geographical approach within a local context is represented by the consistency and coherence of results between different territories and different scales. A province or a municipality can be considered as a subsystem of the national inventory, its inventory can be compiled following the same methodologies, and consistently updated over the same time series.

Actually, the IPCC guidelines include the possibility of adopting bottom-up approaches for the compilation of higher-precision esteems. Local inventories can thus represent a contribution to national accounting efforts, just like national inventories compose the global esteem that can, and must, be verified in atmospheric concentrations.

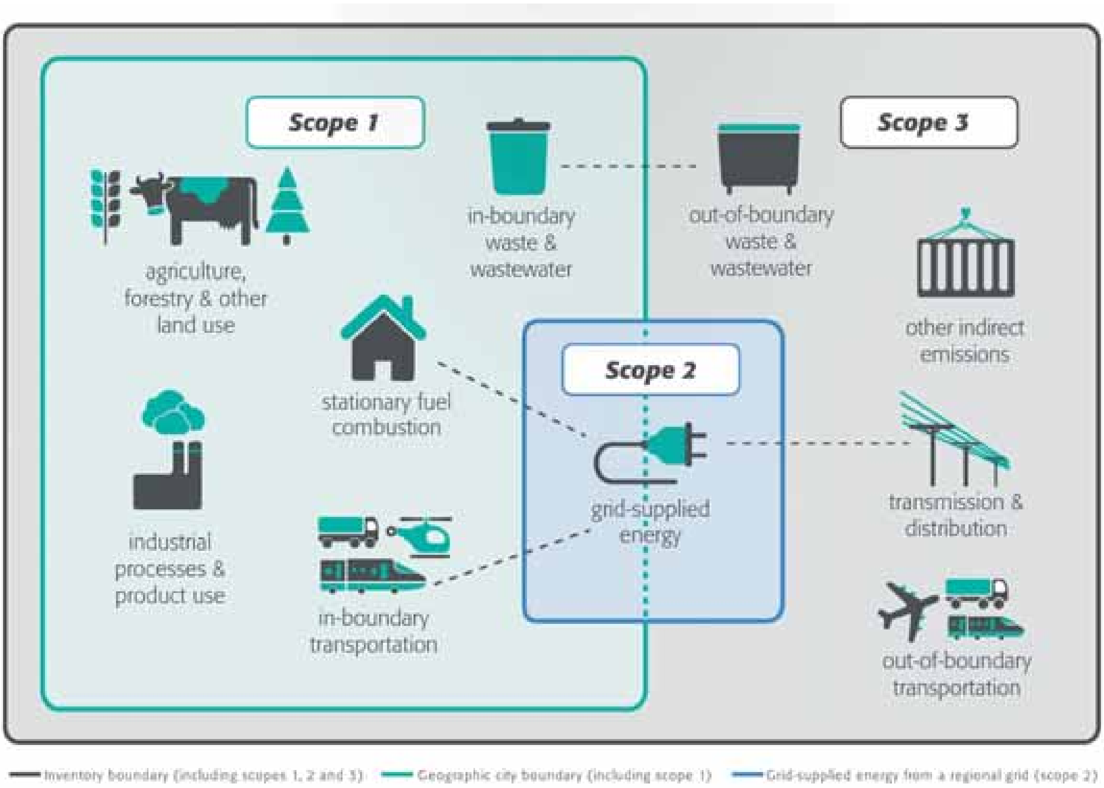

Fig. 2 Following the "responsibility principle": sources and boundaries of city GHG emissions in the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC).

[4] The GPC has been adopted, among other initiatives, by the Compact of Majors and has been launched on December, 8 - 2014 in Lima by the lead authors World Resources Institute, C40 Cities Climate Leadership Group, and ICLEI - Local Governments for Sustainability.

Direct measurements and remote sensing techniques can be used for comparison with direct emissions inventories, like in the case of the Megacities Carbon Project (Duren, Miller, 2012), or the CO2 MegaParis Project (Bréon, et al, 2015).

On the other side, the main advantage of adopting approaches developed including the 'responsibility principle' is that the results give a more complete, sound picture of the local context. Including indirect emissions, the interpretation of a result or of a trend is more univocal, since a low value of emissions can almost always be interpreted as *good*, and *lower* means almost always *better*.

These characteristics make protocols enforcing the responsibility principle particularly appropriate for informing and monitoring initiatives aimed at reducing emissions that are focused on local communities and are managed by local institutions, like in the Covenant of Majors initiative.

Unfortunately, since such approaches are conceived as autonomous accounting systems, overlapping and double counting issues between different areas are generally not considered, and therefore they are less suitable for spatial analysis purposes.

4 CARBON DENSITY MAPS OF THE LINEAR METROPOLITAN SYSTEM – LIMES – IN LOMBARDY: DATA AND METHODS

The availability GHG emissions data at municipality level, provided by the INEMAR project (ARPA Lombardia, 2014), has been exploited to create GHG emission density maps. The INEMAR atmospheric emission inventory, currently in its version 7.0, is a database developed in order to estimate emissions of pollutants for different activities (power production, heating, road transport, agriculture, industry, etc.). The system has been applied in the years between 2001 an 2012, and includes information from several administrative Regions in northern Italy. For the elaborations presented in this paper we have taken advantage of the final emission data for the year 2010, provided by the INEMAR database with distinct values for each of the 1546 municipalities of Lombardy.

Emissions are grouped by CORINAIR activity (group, sub-group, activity) and by fuel typology, and are available at different aggregation levels[5]. The value of greenhouse gas emissions is presented as tCO2e/y, taking into account the IPCC methodologies[6], and represents the sum of emissions weighted by the respective Global Warming Potentials (GWP).

A mapping exercise has been produced linking the INEMAR dataset with geographic data, including municipal boundaries, population data, and land-use information, produced and organized within the research PRIN 2007 *From metropolitan city to metropolitan corridor: the case of the Po Valley Corridor*.

The study, funded by the Italian Ministry of University and Scientific Research in 2007, has highlighted the urban and territorial phenomena in Northern Italy and proposed the concept of LiMeS (Linear Metropolitan System) to define the mega linear metropolitan area structured prevalently in East-West direction in the Po valley and mainly organized along the principal traffic corridor (Busi, Pezzagno, Eds. 2011). The research has identified transport, historic, traditional and new types of housing, communications, cultural tourism and leisure as major elements of the LiMeS and introduced the concept of *sprawling metropolis* as a structuring element, especially in the eastern area that is characterized by low-density expansions, determining a polycentric metropolitan area.

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[5] With reference to the categories introduced in the previous paragraph, the database considers direct emissions only: indirect (also named *shadow*) emissions, related to final energy consumption, are not estimated by INEMAR.

[6] The CORINAIR - SNAP 97 subdivision/nomenclature is not the same adopted by IPCC guidelines, but this is not deemed relevant for the spatial elaborations presented in this paper.

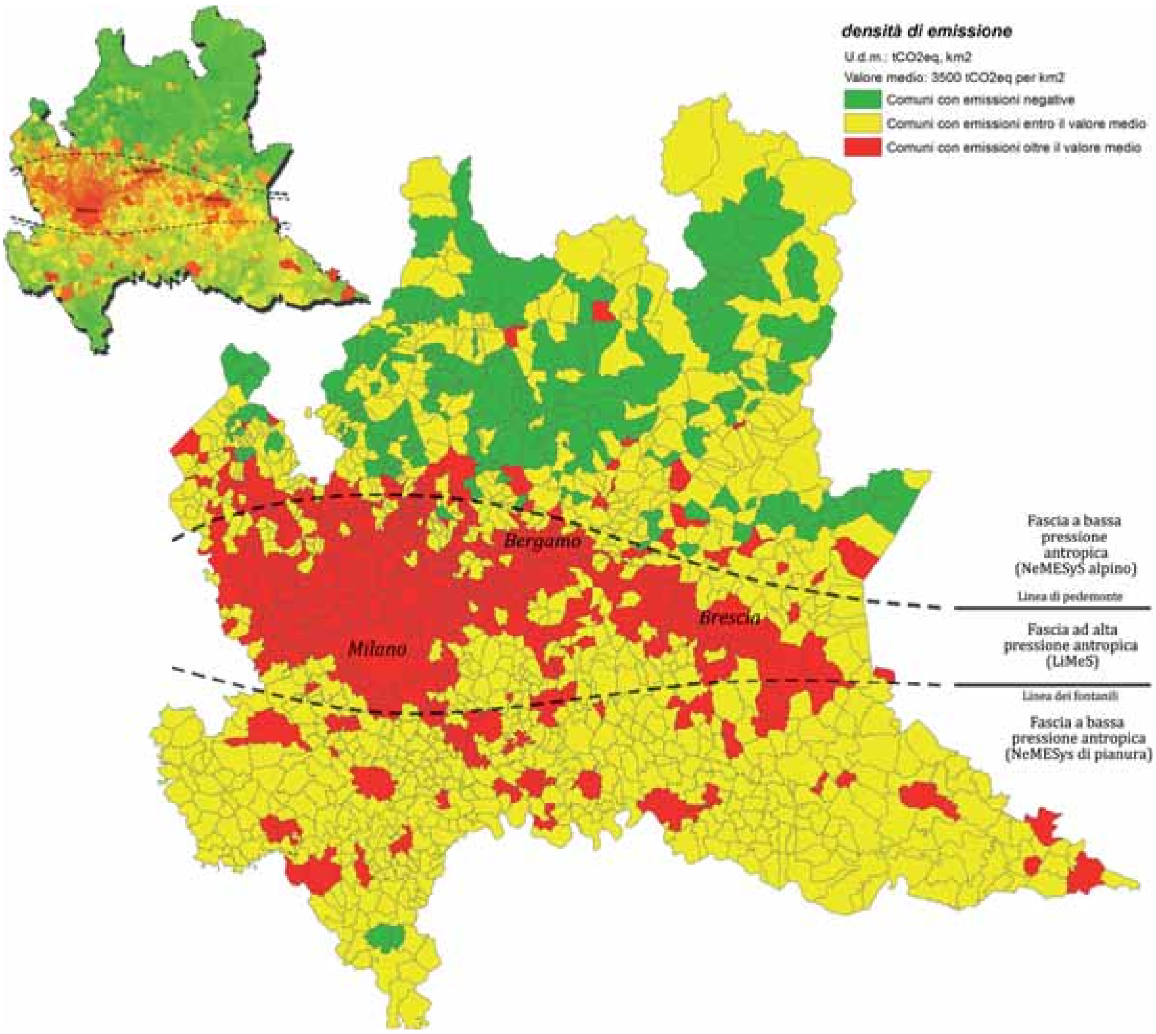

Fig. 3 Density of GHG emissions for municipality, expressed as tCO2e/km2, in the Lombardy region (2010). The gradient representation (top-left) has been forced in three classes: negative emissions, emissions up to 3,5 ktCO2e, and above

The spatial analysis of GHG emissions in Lombardy has been conducted on the relevant background of the LiMeS research: the basic structure of urban phenomena has been confirmed, and relevant information has been produced identifying specific anomalies.

The analysis has firstly considered total GHG emissions per municipality. However, the representation of absolute data within administrative boundaries can be poorly significant, if not misleading, due to the very different extension of municipalities. In order to produce a first significant picture of the metabolism of the territory at stake it is necessary to consider emissions densities, obtained dividing local GHG emissions by municipality areas.

In Figure 3 a representation of aggregate GHG emissions density for the Lombard regional area is presented. A rough classification between high, medium and negative emissions has been adopted, in order to highlight the basic distinction between high and low-anthropic pressure areas examined in depth by the PRIN research. The northern part of the region, named as the Alpine NeMESyS (Neighbouring Mega Ecological Systems) in the research cited above, is characterized by negative or low emissions, the intermediate urban LiMeS area contains the highest values, while medium values with some significant exception appear in the Plain NeMESyS.

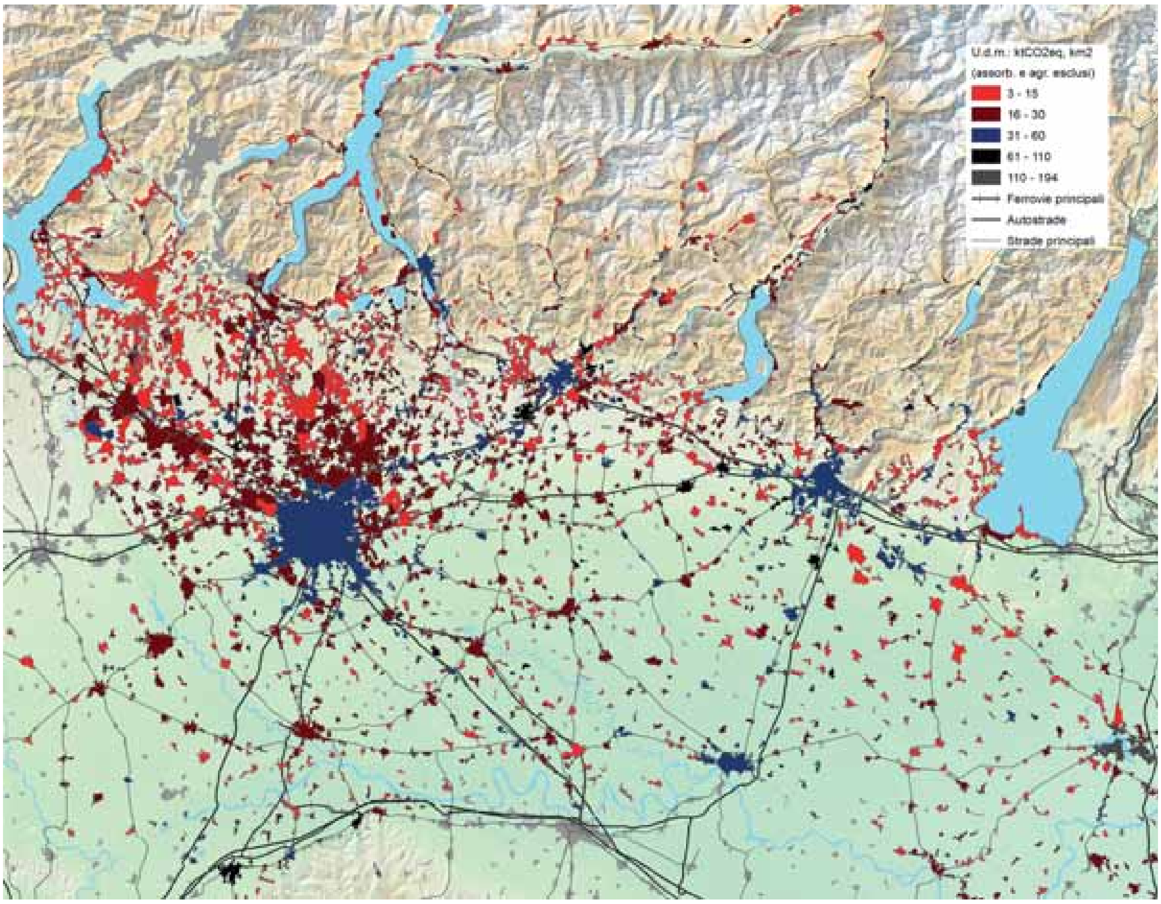

Fig. 4 GHG Emissions densities, excluding absorptions and emissions from the agricultural sector, relative to urbanized areas

The availability of disaggregated data within the INEMAR inventory (as in all IPPC-compliant emissions datasets) permits to analyse specific sectors, or to exclude them from the analysis. Taking advantage of this flexibility, the EU standard CORINE Land Cover classification has been adopted to give a first, but replicable sample of the potential insight achievable by studying the spatial correlations between sector-specific emissions and related land use classes.

In the case proposed in Figure 4, for example, the attention has been focussed on urban areas. Carbon absorptions and emissions from agriculture have been excluded (i.e. macro-sectors 10-11 of the CORINAIR classification[7]), and the resulting emissions have been mapped solely on the urbanized areas (as defined within the CORINE Land Cover classification).

The density of emissions per urbanized area significantly reflects the intensity of urban phenomena, and the resulting patterns confirm the structure of the central sector of the LiMeS. The Milan Universe characterizes the western part of the Region, with its radial propagations along the main transport infrastructures (e.g. toward the node of Bergamo), while at East the western portion of the Cenomane Dipole (Brescia-Verona) is incomplete due to the lack of data regarding the Veneto Region, but appears already intelligible. Within this general picture some significant anomalies can be identified, characterized by the highest values of emissions density (above 100 ktCO2e/km2) like in the case of Mantua, strongly characterized by the presence of a large chemical center, showing the highest values of emissions per square kilometer of the region.

In order to further enhance the perception and the understanding of exceptional values, urban emissions densities have been further elaborated, and subdivided by the number of inhabitants.

7 One of the most significant anomalies emerged in this study has been the relative weight of agricultural emissions in the southern belt of Brescia, determined by the high concentration of intensive livestock farming plants.

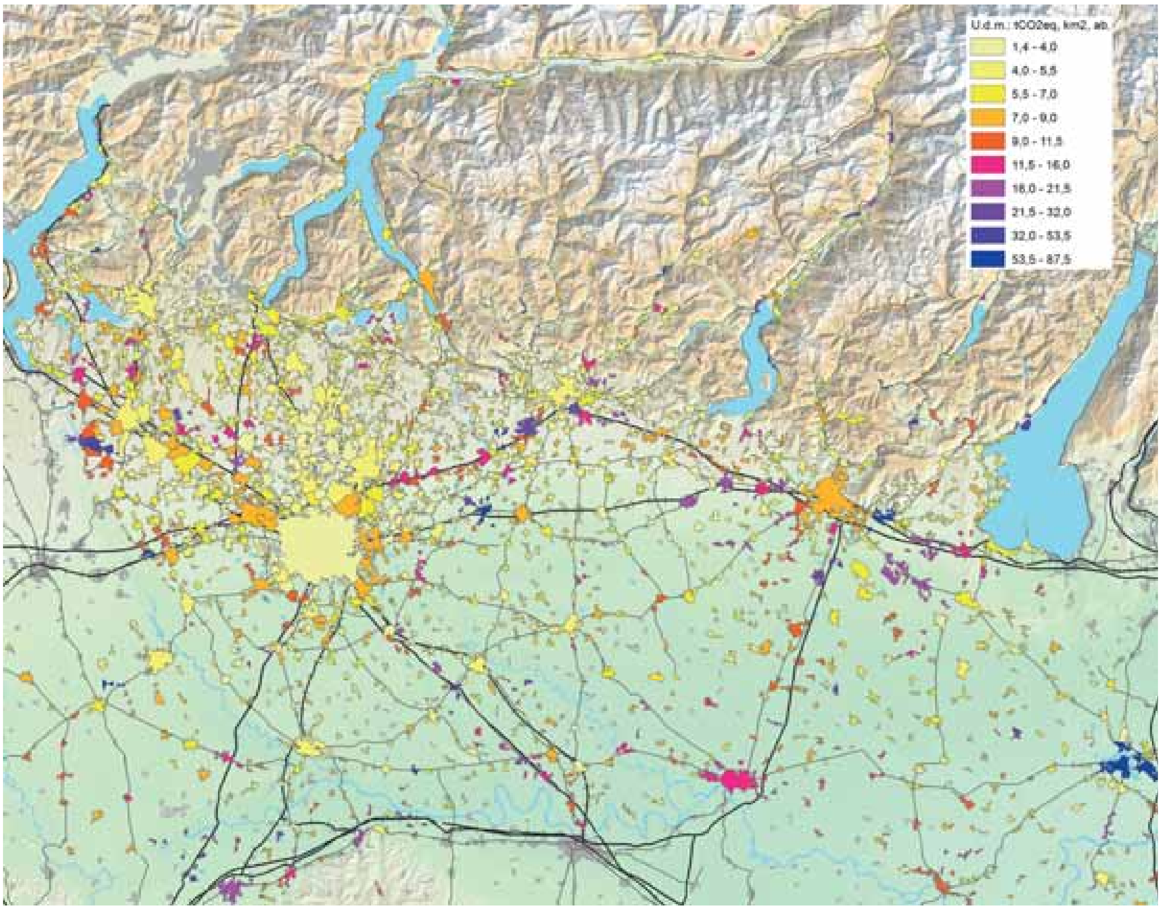

Fig. 5 Urban GHG emission densities per inhabitant: high density anomalies are represented by power plants or energy intensive industrial facilities

The resulting map, presented in Figure 5, clearly identifies an increase of emissions per inhabitant in peri-urban areas, and several, high-density anomalies that correspond to thermoelectric power plants or energy intensive industrial plants. (e.g. chemical plants, cement and paper industries).

The correlation between low-density urbanization patterns and higher per-capita emissions observed in peri-urban areas within the LiMeS is mainly driven by transport emissions[8], and confirms patterns that have been observed, applying a similar methodology, in suburbanized areas in the US (Jones, Kammen, 2013).

Considering household carbon footprints (HCF) Jones and Kammen (2013) have summed up and expressed with the common unit of GHG emissions (tCO2e/household) intensity values coming from electricity, natural gas, fuels, food, services, etc. The combined result has shown distinct carbon footprint rings surrounding urban cores, with suburbs exhibiting noticeably higher HCF, as shown in the maps reported here in Figure 6.

5 DISCUSSION: GHG EMSSION MAPS IN PERSPECTIVE

The brief GHG emissions mapping exercise proposed in Lombardy has so far confirmed behaviors and characteristics of urban systems already identified by precedent research, showing specific anomalies in correspondence with critical processes or phenomena related with large scale, energy-intense activities.

The intensity of GHG emissions per area is a viable representation of anthropic pressure on the environment that can be further detailed linking sectorial carbon emissions with land use classes.

8 This correspondence was already observed analyzing transport costs in the cited PRIN research (Busi, Pezzagno, Eds. 2011, pag. 51).

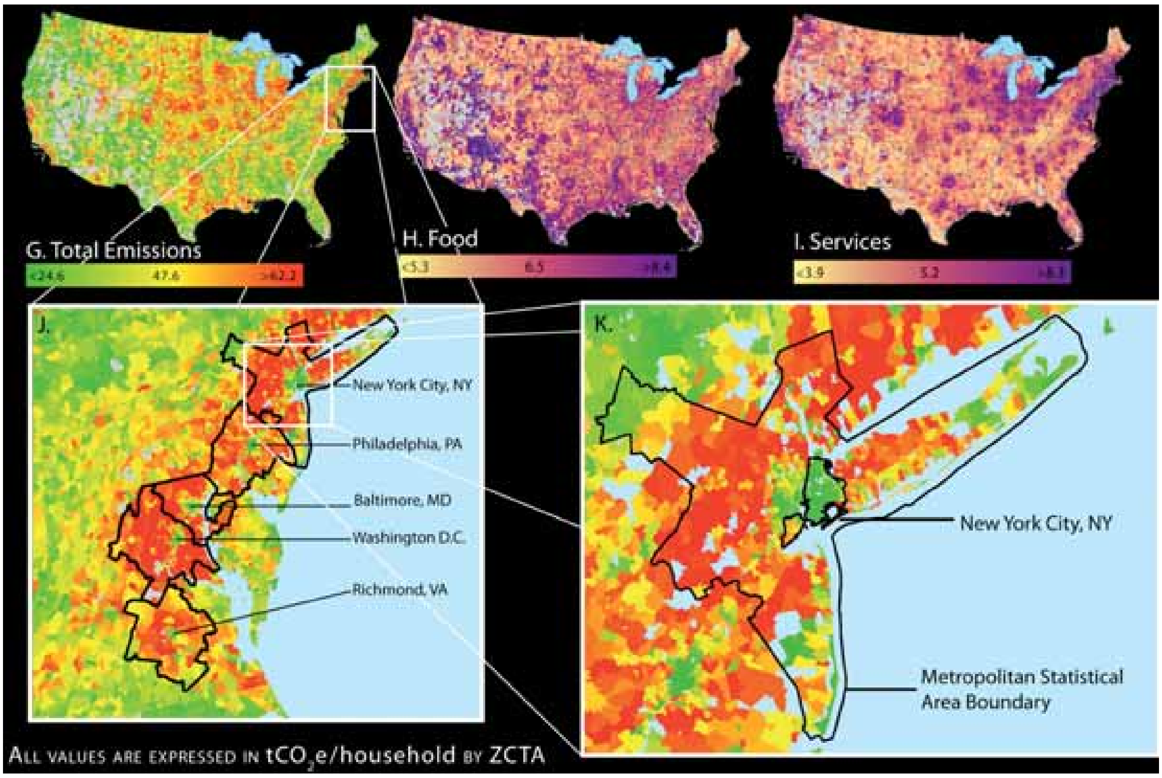

Fig. 6 Average Household Carbon Footprint - Eastern United States (Jones, Kammen, 2013)

The exclusion of emissions from the agriculture sector and the attribution of the resulting values to urbanized areas allowed a better description of urban phenomena. Within urbanized areas, the relationship between GHG emissions and population density has indicated higher carbon intensity values in correspondence with low-density settlements.

These preliminary results allow foreseeing a reasonable potential for further research, with specific regard to the development of the tool for the analysis of the metabolism of regional and local systems. With regard to smaller scales, however, it must be stressed that the higher granularity implies a level of accuracy in GHG inventories that generally cannot be provided following a top-down approach (as in the INEMAR project), in which local breakdown factors are applied starting from data harvested at the large scale.

The case of higher per-person emissions observed in lower density areas, or the case of high intensity centers identified within the LiMeS, are useful to underline the nature of the tool represented by direct emissions inventories and their spatial analysis, which require a fairly different attitude with respect – for example – to local inventories including indirect emissions.

Planners and decision makers should always approach emission density results as a signal of intensity, of consumption of resources, but also of a relevant *potential* for a transformation that always involves complex relationships between different spatial scales, infrastructures, hierarchies, and technological variables.

For example, low-density suburbs are a specific form of the city that can be considered poor regarding urban quality: i.e. mono-functional residential areas lack of socio-cultural attraction, and are difficult to target with innovative high quality public transport systems due to the low demand. However, should the ongoing advancements in distributed power generation (PV, micro wind), energy storage solutions, and electric transportation respect their promises, these settlements can be probably converted in a zero-emissions profile easier than the denser central districts. Similar considerations can be done with regard to other existing infrastructures, like the ones evidenced in emission hotspots determined by thermal power plants: should power-to-gas technologies[9] become the main strategy for long-term energy storage in the European

[9] Production of methane from peak renewable power production through water-splitting + methanation or Sabatier reactions and its storage, including relatively high percentages of hydrogen, in the gas grid.

context, and/or should fossil methane be substituted by biogas generated from agricultural waste, suddenly the entire Italian natural gas infrastructure could completely change its "meaning"[10].

Cities are complex systems that cannot be understood or defined through single-issue perspectives. Even taking into account the pervasive importance of climate change we need to improve our understanding of how GHG emissions may be managed, given the other dimensions, constraints, values and complexities of the urban system (Chester et al., 2014).

In this perspective, the integration between GHG emission inventories and land-use mapping represents a useful tool to better understand the complexity of phenomena and improve knowledge in relation to:

- achievable targets on specific topics (i.e. an emissions reduction form a specific plant or sector);
- complex policies needed in overlapping phenomena (i.e. when on the same area relevant emissions are rising from different activities / sectors without a clear profile or dominance);

toward a better use of funding and public resources and a better oriented urban regeneration.

5 CONCLUSIONS

There are unique challenges and opportunities ahead for reducing GHG emissions acting on the metabolism and on the built environment within regional and local systems. In this context the establishment of reliable representations of direct emissions at local scale can provide a common and consistent background for linking local change to the global targets defined by international goals and treaties.

We must recognize that the economy de-carbonization path ahead of us is far from being a linear or a homogeneous one. For example reducing GHG emission from urban systems in developed regions, where infrastructure is established and the capital stock turnover limited to incremental change will require solutions to different challenges than in developing regions.[11]

In this extremely complex and evolving context, local carbon emissions mapping can be represent a useful analytical tool to support the knowledge of local systems and contribute to define mitigation and adaptation policies. However, spatial mapping of direct GHG emissions should not be ingenuously interpreted and the difference with local inventories including indirect emissions should be properly addressed.

We have stressed the importance of considering GHG spatial mapping as a *tool* for producing a very general knowledge: a thermodynamic *proxy*, meaning an indicator of the intensity of the processes occurring in a local system, without implicit goal functions, which represents a starting point for further research and for pursuing appropriate mitigation strategies.

In this perspective, and taking into account the dimensional limits of top-down inventories at the smaller scales, the tool can be profitably used as a low-level reference, the much-needed common and consistent background for linking local change to global de-carbonization pathways.

In conclusion, spatial mapping should cautiously be considered a discipline in its early stages of development, with an interesting potential for supporting spatial planning and mitigation policies at regional and local scale.

[10] Fast modulating thermal power plants, together with pumped hydro plants, can play a vital role in grid short and long-term stability in a power generation scenario with high content of intermittent renewable sources.

[11] The greatest opportunity for configuring cities for low GHG emissions may be in developing regions. The majority of urbanization in the next 50–100 years will be occurring in medium-sized towns in Asia and Africa. As half of urban land in existence in 2030 is yet to be developed the next decades offer a critical window of opportunity to influence how cities are built. The way that these cities urbanize and the type of infrastructure developed will have large impacts on GHG emissions in the future (Chester et al., 2014).

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IMAGE SOURCES

Cover image: free composition with the INEMAR inventory basic formula, considering emissions from activities for relative emission factors. Background image, eclipse from NASA Solar Dynamics Observatory (SDO); Front, nocturnal image of northern Italy – with the LiMeS urban system highlighted – from the ISS. Credits ESA/NASA.

Fig. 1: EDGAR inventory 4.0 - http://edgar.jrc.ec.europa.eu/part_CO2.php

Fig. 2: ICLEI. (2014)

Fig. 3, 4, 5: Berni, A. (2013)

Fig. 6: Jones, Kammen. (2013)

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SMART AND RESILIENT CITIES

A SYSTEMIC APPROACH FOR DEVELOPING CROSS-SECTORAL STRATEGIES IN THE FACE OF CLIMATE CHANGE

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ABSTRACT

Climate change is considered one of the main environmental issues challenging contemporary cities. Meanwhile, urban development patterns and the growth of urban population represent the main contributors to climate change, affecting the total energy consumptions and the related greenhouse gas emissions. Therefore, a breakthrough in current urban development patterns is required to counterbalance the climate-related issues.
This study focuses on the Smart City and Resilient City concepts that, according to current scientific literature, seem to play a leading role in enhancing cities' capacities to cope with climate change.
In detail, based on the review of existing literature, this study analyzes the synergies between the two concepts, highlighting how the Smart City concept is more and more widely interpreted as a process addressed to make cities "more livable and resilient and, hence, able to respond quicker to new challenges" (Kunzmann, 2014). Nevertheless, current initiatives to improve cities' smartness and resilience in the European cities are very fragmented and operational tools capable to support multi-objective strategies are still at an early stage.
To fill this gap, embracing a systemic perspective, the main characteristics of a smart and resilient urban system have been identified and framed into a conceptual model. The latter represents a preliminary step for the development of an operational tool capable to guide planners and decision-makers in carrying out multi-objective strategies addressed to enhance the response capacities of complex urban systems in the face of climate change.

KEYWORDS:
smart city, resilient city, systemic approach, climate change, climate adaptation

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智能与弹性城市

为应对气候变化制定跨部门战略的系统方法

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摘要

气候变化被视为对当代城市构成挑战的主要环境问题之一.　同时,城市发展模型与城市人口的增长是气候变化的主要原因，　影响着总能耗与相关的温室气体排放.　因此，为解决气候有关的问题题，需要当前的城市发展模型实现突破.
本研究聚焦于“智能城市”与“弹性城市”的概念;具体而言,本研究以现有文献回顾为基础，　分析了这两个概念之间的协同增效，　强调了智能城市的概念如何越来越广　　泛地被诠释成使城市“更宜居、富有弹性，　因此能够更快速地应对新挑战”的过程(Kunzmann，2014).　然而，　当前欧洲各城市提高城市智能与弹性的举措过于碎片化能够支持多目标战略的运营工具尚处于早期阶段为填补这一空缺，通过采取系统方法 智能弹性城市系统的主要特征已经得到识别并被　　整合为一个概念模型.　后者代表了运营工具开发 的初步阶段，该工具能够指导规划者与决策者落 实多目标战略，　以提高复杂城市系统对于气候变化的响应能力.

关键词
智能城市，弹性城市，　系统方法,气候变化，
气候适应

1 INTRODUCTION

According to the available trends and projections (UN, 2014), urban population has overcome the rural one since 2005 and it is expected to further increase by 2050. Even though cities represent only the 4% of the Earth's land (UNEP, 2014), they consume about the 67% of the global primary energy (IPCC, 2014) and, due to urban lifestyle and economy, they are responsible for more than the 70% of greenhouse gas (GHG) emissions (Birkmann et al. 2010; EU, 2011) that are, in turn, the main contributors to climate change. Thus, according to current trends, the expected growth of urban population will further increase energy consumptions, worsening the current energy scenario. Moreover, the "continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system" (IPCC, 2013), with effects that will be particularly severe in urban areas, due both to the concentration of people, assets and strategic activities and to the peculiarities of cities that may exacerbate the impacts of the heterogeneous climate-related phenomena.

Fortunately, cities can be interpreted as "cauldrons of diversity and differences and as fonts for creativity and innovation" (Florida, 2003): therefore, although playing a major role in the creation of current environmental challenges, they can be considered as a central part of any response.

Thus, mitigation strategies, addressed to reduce energy consumptions, combined with adaptation strategies, aimed at counterbalancing climate-related impacts, represent crucial challenges that cities have to deal with, in order to guarantee a sustainable urban environment for the rapidly growing urban population. Indeed, on the one hand, mitigation actions can allow the reduction of CO_2 emissions and, consequently, of climate-related impacts on urban areas. On the other hand, adaptation actions can enhance urban capacities to cope with unavoidable impacts of climate change (fig.1).

The issues related to the reduction of energy consumptions and to the urban adaptation to climate change have been considered as crucial in most of the recent metaphors related to urban development and addressed to improve cities capacities to cope with urgent environmental challenges (Moir et al., 2014): eco-cities, low-carbon cities, transition cities, smart cities, resilient cities represent only some examples.

We will focus here on the metaphors of "smart" and "resilient" cities, which seem to play a leading role due both to the growing attention paid by scholars all around the world to these terms and to the increasing number of on-going initiatives both on the global and on the European scale.

In detail, according to some scholars, 40 global cities will become smart by the year 2020 (EIP, 2014) and by 2025 the number of Smart City all around the globe will climb from 21 of the 2013 up to 88 (Smart City Council, 2014a).

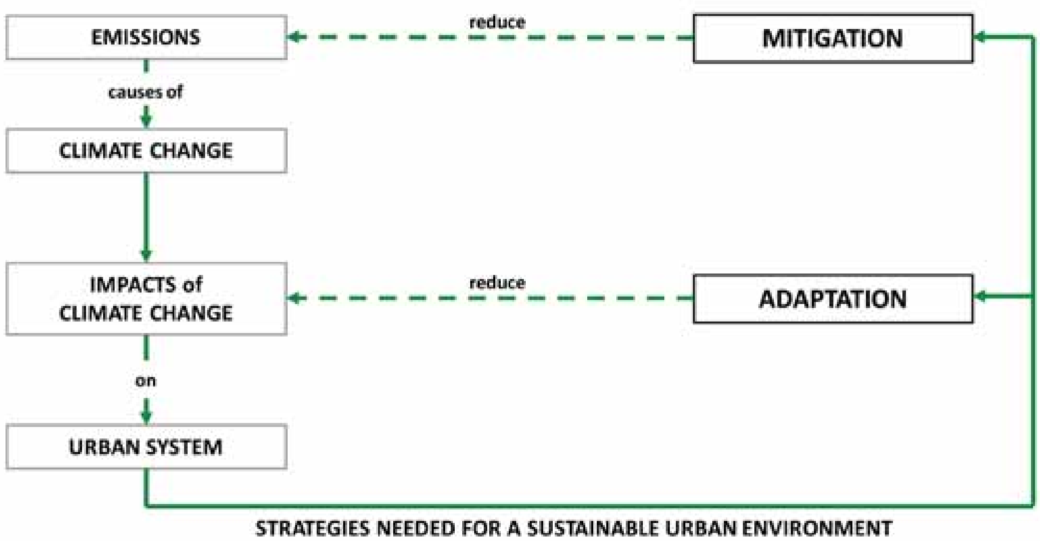

Fig. 1 Relations between urban system, climate changes, mitigation and adaptation (elaborated by Füssel et al., 2006)

Moreover, the European Commission has launched the European Innovation Partnership for Smart Cities and Communities for supporting "energy production, distribution and use; mobility and transport; and information and communication technologies (ICT)" to "improve services while reducing energy and resource consumption and greenhouse gas emissions" (EIP, 2013). Meanwhile, about 2100 cities all over the world have joined the "Making Cities Resilient" Initiative, launched in 2010 (UNISDR, 2012a) and, in December 2014, 100 cities have been selected by the Rockefeller Foundation Initiative for the "100 Resilient Cities Challenge" (Rockefeller Foundation, 2015). In Europe, a strategy addressed to enhance cities' adaptation to climate change in order to realize a "more climate-resilient Europe" has been established (EU, 2013) and the "LIFE+ Program" focused on urban resilience (EU LIFE, 2014) has been launched.

Despite the numerous on-going initiatives, both Smart City and Resilient City are still vague and fuzzy concepts. In the case of the Smart City, about 30 definitions have been proposed since 2000 (Caragliu et al., 2009). In current literature a Smart City is generally characterized by the wide use of Information and Communication Technologies (ICTs) for traditional infrastructures as well as for improving the active participation of human and social capital (Caragliu et al., 2009; Toppeta, 2010; Dameri, 2013). Such technology-based approach is often considered capable of dealing with different urban problems (Batty et al., 2012; Lee et al., 2013), guaranteeing both the quality of the urban environment and the sustainability of its development. On the opposite, it is worth noting that not many definitions of Resilient City have been provided even though the concept of resilience – developed since the Seventies – seems to be particularly suitable for urban areas (Galderisi, 2014). Focusing on the resilience concept, some authors emphasize that resilience is "in danger of becoming a vacuous buzzword from overuse and ambiguity" (Rose, 2007), "increasingly viewed in a rather vague and malleable meaning" (Brand and Jax, 2007). Notwithstanding, some organizations agree on a definition of a Resilient City as a city capable to withstand or absorb the impact of hazards, shocks and stresses through adaptation or transformation, in order to guarantee a long-term sustainability, as well as its basic functions, characteristics and structures (UNISDR, 2012b; ICLEI, 2014a; Resilient City, 2014).

Thus, based on the review of existing literature and embracing a systemic perspective, this contribution will highlight synergies and mismatches between the two concepts, identifying the main characteristics of a smart and resilient urban system and framing them into a conceptual model, showing the relationships between these characteristics and outlining the processes for building up smart and resilient cities, according to different temporal perspectives, from short to long-term.

This study represents a first step for shifting from current "silo" approaches - based on the fragmentation of knowledge, strategies and responsibilities (EEA, 2014) - towards a systemic one. Such an approach could better support cross-sectoral strategies and multi-objective actions, more and more crucial in the face of climate change in an era of limited public resources, for enhancing the capacities of complex urban systems to deal with more and more interconnected challenges.

2 SMART AND RESILIENT CITIES: TOWARDS NEW PARADIGMS?

Currently, Smart City and Resilient City are drawing an increasing attention by urban planners, decision-makers and municipalities, as shown by the proliferation of academic researches, as well as of institutional initiatives on these topics. Thus, Smart City and Resilient City are becoming widespread labels, despite the lack of shared definitions.

Approaching the terms, the first issue arising refers to their definition as concept or paradigms: some scholars indeed refer to the Smart City as a paradigm (Auge et al. Blùm, 2012; New City Foundation, 2014; Bencardino and Greco, 2014), while others consider it as a concept (Washburn, 2011; Cretu, 2012; Dameri, 2013; BSI, 2013; EIP, 2013). It is worth noting that also halfway positions exist, looking at the Smart City as an emerging paradigm (Kunzmann, 2014). The Resilient City is a recent term based on resilience that some scholars define as a concept (Rose, 2007; Davoudi, 2012) or even as a "new umbrella concept", able to take into account "risk management, ecological, sustainability or political sciences" (Chelleri, 2012), while others as a paradigm (Ercoskun, 2012; Rogers et al., 2012).

It has to be underlined that a paradigm can be defined as a "universally recognized scientific achievements that for a time provide model problems and solutions to a community of practitioners" (Kuhn, 1970); whereas a scientific concept is generally represented through three parts: a label, a theoretical definition that permits "others to understand our theory and be able to criticize and reproduce our observations" and an operational definition that "translates the verbal meaning provided by the theoretical definition into a prescription for measurement" (Suppe, 1997).

Hence, due both to the lack of a shared scientific definition of the two terms and to the heterogeneity of city programs and initiatives addressed to improve urban smartness and/or resilience, it seems hard to define them as paradigms: both Smart City and Resilient City contribute in offering solutions and opportunities for urban problems but, so far, they do not represent a "universally recognized scientific achievements". On the opposite, they can easily considered as concepts: both of them are more and more used as urban labels (Hollands, 2008; Caragliu et al., 2009; Davoudi, 2012), numerous definitions of each term are currently available and, even though their operational definition is still at an early stage, some basic elements have been developed, such as domains (for the Smart City concept), characteristics and indicators.

Thus, according to such interpretation, definitions, evolution paths and goals of the two concepts will be reviewed and compared, highlighting their synergies and mismatches, as a starting point to develop an integrated operational approach to Smart City and Resilient City.

The Smart City concept has gained an increasing attention, in the last decade, by scholars, practitioners and decision-makers in conferences, scientific and political meetings, even though "a clear-cut, common definition of smart cities is still lacking" (Moser et al., 2014). The attention paid to this concept since the 2000 has significantly increased, not only in the scientific arena, as clearly highlighted by the search query data from Google Trends (fig.2), which provides information about how often, all over the world, a particular search-term is entered in respect to the total search-volume.

Studies and researches on Smart City developed in the last years, arising from different disciplinary fields and perspectives (academic, industrial, institutional) and focusing on different topics, have led to a number of heterogeneous definitions.

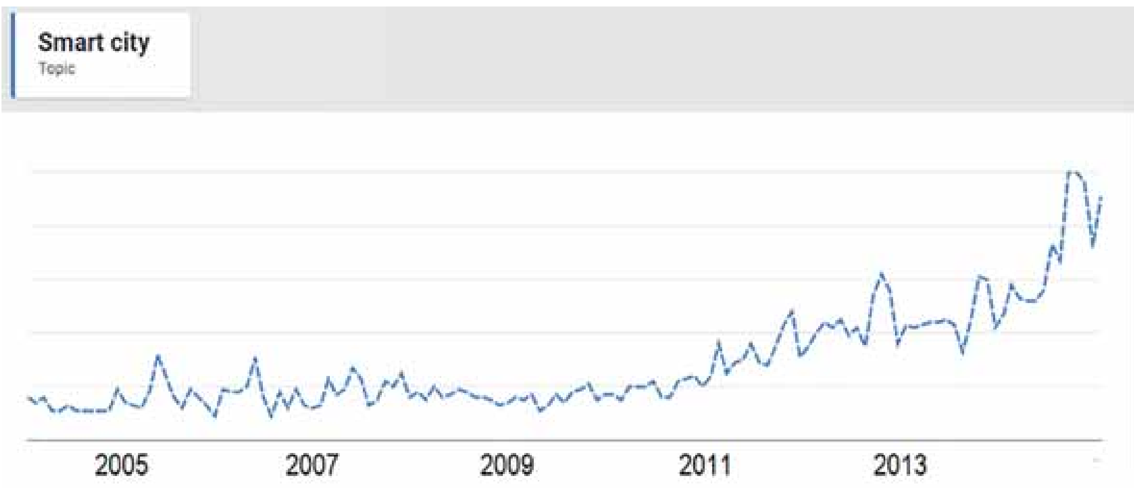

Fig. 2 Google Trends for "Smart City"

Some of them focuses on environmental issues, paying large attention to the efficient use of natural resources and to energy consumptions (EIP, 2013; Karnouskos et al., 2013, Kramers et al., 2014); others on socio-economic issues, highlighting the importance of social and human capital (Moser, 2001; Florida, 2003; Partridge, 2004; Glaeser and Berry, 2006; Giffinger et al., 2007; Dirks et al., 2010); others on institutional aspects, emphasizing the potential of ICTs in improving current decision-making processes and supporting the empowerment of local communities (Coe et al., 2001; Eger, 2009; Paskaleva, 2009).
Nevertheless, although the large variety of studies and researches focuses on different aspects, they agree on the crucial role of ICTs (Mosannenzadeh and Vettorato, 2014), assigning to technology different weights, according to the different disciplinary perspectives. Summing up, the numerous definitions of Smart City currently available bring out a variety of approaches and interpretations of the concept, although this multiplicity can be effectively reduced to two broad categories:

- a first one comprises the definitions referred to a "technology-based" approach, mainly focused on urban physical infrastructures (e.g., Hall, 2000; STERIA, 2011; Lazaroiu and Roscia, 2012; Aoun, 2013)
- a second one includes the definitions based on a holistic approach to the Smart City, capable to take into account the numerous and interconnected components that characterize an urban system (e.g., Giffinger et al., 2007; Nam and Pardo, 2011; Lee et al., 2013; Papa et al., 2013).

Among the numerous collected and analyzed definitions (approximately 30), the most relevant ones have been selected (Tab. 1), based on the number of quotations of the article comprising such definitions reported by Google Scholars. It is worth noting that all the selected definitions, which represent the most cited ones, refer to the second category. According to some scholars (Moir et al., 2014), also the "Resilient Cities is a concept growing in use". The term appeared in 2002 in the "Resilient Communities Program Concept" and it was used by Pickett et al. (2004) as a "*metaphor (…) to help link ecology and planning*".

REFERENCE	DEFINITION	CITATIONS
Caragliu et al. 2009	We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.	358
Komninos N. et al., 2011	The Smart Cities concept (…) is connected to notions of global competiveness, sustainability, empowerment and quality of life, enabled by broadband networks and modern ICTs.	291
Giffinger R. et al., 2007	A Smart City is a city well performing in a forward-looking way in these six characteristics, built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens.	207
Nam T., Pardo T.A., 2009	Smart city integrates technologies, systems, infrastructures, services, and capabilities into an organic network that is sufficiently complex for unexpected emergent properties to develop.	103
Odendaal N., 2003	A smart city or region (…) is one that capitalizes on the opportunities presented by Information and Communication Technology (ICT) in promoting its prosperity and influence.	93
Batty M. et al., 2012	A Smart City is a city in which ICT is merged with traditional infrastructures, coordinated and integrated using new digital technologies. Smart cities are also instruments for improving competitiveness in such a way that community and quality of life are enhanced.	87

Tab.1 Smart City Definitions

The term was largely widespread thanks to the book edited by Vale and Campanella (2005) and titled "The Resilient City". The volume focused on the persistence of cities in the face of disasters and namely on their capacity to "rebound from destruction", being the cities "among humankind's most durable artifacts". Nevertheless, only recently the term "Resilient City" is gaining importance both in scientific debate and on the institutional level. Indeed, the Google Trends query for "Resilient City" (Fig. 3) highlights that the term entered the search queries in 2012, after the Sandy Hurricane that caused about 19 billion dollars of total damage. Such trend is arguably related to the priorities of national and local governments, which - in the face of the human and economic losses due to climate-related events - pushed towards the adoption of strategies and initiatives aiming at enhancing urban resilience, thereby promoting studies and research on this issue.

Also for the Resilient City concept, heterogeneous definitions are available; some of them have been provided by scholars (Newman et al., 2009; Fusco Girard et al., 2012), others by institutions (UNISDR, 2012a), large international organizations (World Bank Group, 2011) or private foundations (Rockefeller Foundation, 2015). Nevertheless, all the available definitions agree on the main idea that a resilient city is a city capable to absorb external pressures or to adapt or transform in front of such pressures, guaranteeing the safety of settled communities and the preservation of its basic functions during a crisis. Referring to the same temporal span, it is worth noting that the total number of definitions of the term Resilient City that can be found in current literature is by far lower than those available for Smart City. The most quoted definitions or the most widespread on the international level are shown in Table 2. Nevertheless, it has to be underlined that despite the definitions of Resilient City are fewer than those related to the Smart City, this concept roots in the wide research field focused on resilience, and namely on the resilience of social-ecological systems (Adger et al., 2005; Folke, 2006; Brand and Jax, 2007), to which a growing attention has been paid since the 2000 (Fig. 4). Numerous studies and researches have been carried in the last decades on the resilience of socio-ecological systems in the face of heterogeneous pressure factors, such as:

- natural hazards/climate change (e.g., Sapountzaki, 2010; Bahadur et al. , 2010; Jabareen, 2013; IPCC, 2013; Galderisi, 2014);
- energy consumptions and oil dependency (e.g., Newman et al., 2009; Hopkins, 2008; North, 2010);
- economy (e.g., Rose, 2007; Drobniak, 2010; Simmie and Martin, 2010).

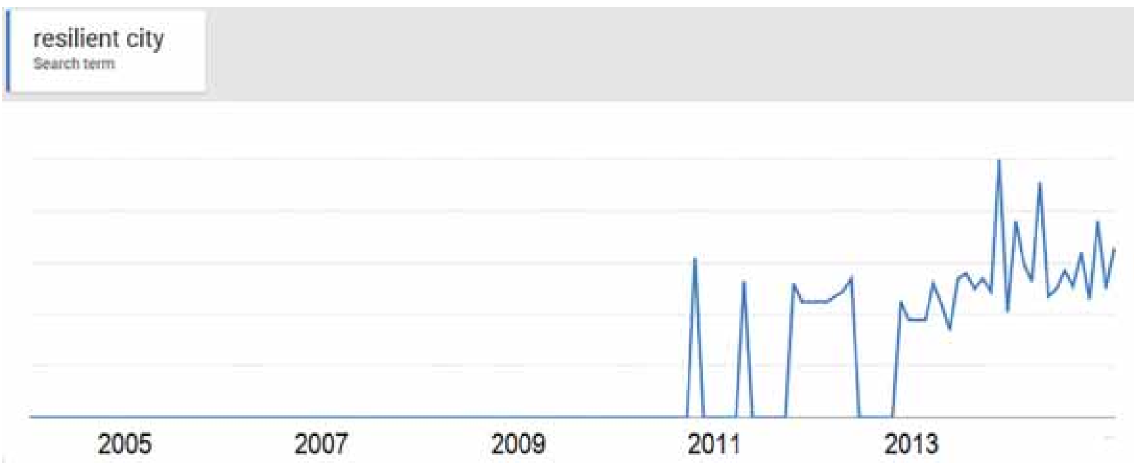

Fig. 3 Google Trends for "Resilient City"

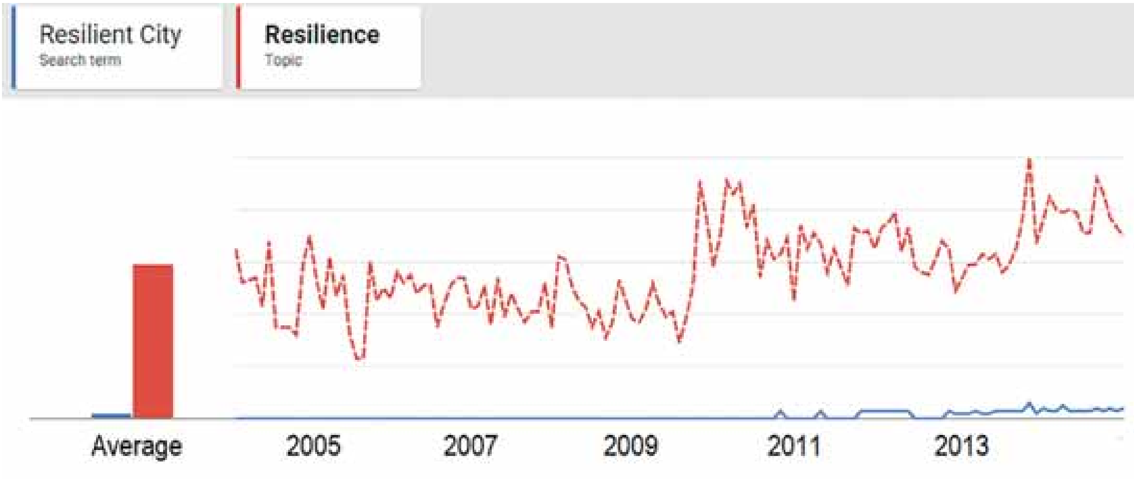

Fig. 4. Google Trends for "Resilience" (red) and for “Resilient City” (blue)

However, here we will refer only to the definitions of Resilient City, purposely neglecting the numerous and heterogeneous definitions of resilience, in order to allow a more immediate comparison with the Smart City definitions. Similarly to the case of Smart City, even in the most commonly used definitions of Resilient City there is a tendency to take into account different disciplinary perspectives, considering social, economic and environmental factors and their interrelationships as a key for an effective understanding of the complexity of urban systems and namely of their behaviors in the face of heterogeneous pressures. Briefly, according to the proposed definitions, the Smart City is a widespread label underlying a vision of the city based on the potential of ICTs as a key tool "to fuel sustainable economic growth and a high quality of life" (Caragliu et al., 2009).

The Resilient City promotes a vision of the city in which efforts are addressed to increase the ability of the city to respond to heterogeneous pressure factors (climate, environmental, energy and economic), with the ultimate aim of ensuring a higher quality of life and sustainable urban development. Furthermore, numerous scholars point out that ICTs, key tools for increasing urban smartness, could play a significant role also in reducing urban vulnerability and improving cities’ resilience.

REFERENCE	DEFINITION	CITATIONS
Newman et al., 2009	Resilient cities have built-in systems that can adapt to change, such a diversity of transport and land-use systems and multiple sources of renewable power that will allow a city to survive shortages in fuel supplies.	344
Nijkamp P. et al., 2012	A resilient city is also a creative city, able to reinvent a new equilibrium against destabilizing external pressure. It multiplies the potential of people to build new opportunities/alternatives.	13
Resilient Communities Program Concept, 2002	Resilient City is a city that supports the development of greater resilient in its institutions, infrastructure and social and economic life. Resilient cities reduce vulnerability to extreme events and respond creatively to economic, social and environmental change in order to increase their long- term sustainability.	n.a.
UNISDR, 2012	A resilient city is characterized by its capacity to withstand or absorb the impact of a hazard through resistance or adaptation, which enable it to maintain certain basic functions and structures during a crisis, and bounce back or recover from an event.	n.a.

Tab.2 Resilient City Definitions

According to Heeks et al. (2013), indeed, "ICTs can help strengthen the physical preparedness of communities by helping those communities to optimize the location of physical defenses" and "can also strengthen institutions needed for the system to withstand the occurrence of climatic events".
Summing up, the analysis and the comparison among the definitions of Smart City and Resilient City highlight important commonalities between the two concepts, even though the lack of clear-cut common definitions and the fact that both concepts are still evolving make a conclusion still open and harbinger of future research developments.

3 THE EVOLUTION OF THE SMART AND RESILIENT CITY CONCEPTS

In the previous paragraph, the definitions of the Smart City and of the Resilient City have been compared with reference to a time span ranging from the 2000 to the 2014. However, the considered definitions already refer to an end-point, although not a final one, of an evolutionary process that is far more temporally extended since the roots of each concept, can be traced in research works carried out some decades ago. Hence, to better understand current similarities and/or differences among the two concepts of Smart and Resilient City, the evolution path of each concept will be sketched, highlighting the variety of contributions arising from different disciplinary fields that contributed to building up their current meanings.
In respect to the Smart City, it is worth reminding that the term "smart" has been primarily used in the Nineties by the Smart Growth American movement, which "refers to policies for the management of growth of urban and suburban settlement and to a set of principles for designing". Moreover, the Smart Growth also refers to "an idea of the city" capable to "provide an alternative to sprawl" (Pellegrini, 2003). The movement, mainly referred to the development of new residential areas, was addressed to reduce soil consumption and sealing, promoting more sustainable developments (Moccia, 2012).
Nevertheless, the main roots of the term Smart City as it is currently interpreted "have to be traced in some of the phenomena that characterized the Eighties and the Nineties, namely, in the evolution and diffusion of ICT and in their outcomes in terms of globalization of economy and markets" (ABB-Ambrosetti, 2012; Papa et al., 2013). The term Smart City was coined at the beginning of the Nineties in order to point out an urban development more and more dependent on technology and on innovation and globalization phenomena, mainly by an economic perspective (Gibson, Kozmetsky and Smilor, 1992).
Thus, since the Nineties ICT represented a key tool for increasing efficiency, attractiveness and competitiveness of cities. Starting from the early 2000s, large industries such as Cisco, Ericsson, IBM have significantly invested in the integration of ICTs within cities, strongly supporting the spread of a techno-centered approach to the Smart City concept. Nevertheless, in the mid of the 2000s a human-centered approach, focused on the key role of the human and social capital as starting levers for a "smart" urban development, began to take shape. In the second half of the 2000s, thanks to the study of Giffinger et al. (2007), the Smart City concept gained larger room in the scientific debate. Giffinger et al. (2007) provided a model of Smart City, interpreted as "a city well performing in 6 characteristics, built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens" and a method for measuring and comparing urban smartness. The six characteristics - or, better, the sectors in which a Smart City has to ensure high performances - can be identified as follows: smart economy; smart people; smart governance; smart mobility; smart environment; smart living.
Hence, this study paved the way to an integrated approach to the Smart City concept and, based on this numerous scholars have recently provided an interpretation of the smart city as a city in which ICTs are addressed to improve the overall urban performances and, above all, the quality of life of citizens. Among them, the research work carried out by Caragliu et al., (2009), focused on the relationships among technological and social aspects, intellectual capital, health and governance issues, and the studies of Mark

Deakin (2012), who proposed the model of the "Triple Helix" for promoting social innovation, stressing on the close relationships between sustainable development and Smart City.
As a result, recently "a broader conceptualization of Smart Cities places emphasis on good city governance, empowered city leaders, smart or 'intelligent citizens' and investors in tandem with the right technology platform" (Moir et al., 2014), supporting strategies addressed to improve both "hard" (infrastructures, ICTs, etc.) and "soft" urban components (human and social capital).
As mentioned above, the term "Resilient City" gained large attention by institutions, policy makers and scholars after the Hurricane Sandy that, in 2012, hit the North Eastern part of the USA and the city of New York, causing 43 deaths and economic damage for about 19 billion dollars. In the last years, the constantly increasing popularity of the concept is mainly due to its widespread use and promotion by international organizations (eg. the UNISDR that in 2010 launched the Making Cities Resilient campaign, addressed to involve local Authorities and enhance urban resilience in the face of natural and man-made hazards); private organizations (eg. the Rockefeller Foundation, which identifies specific "challenges" that cities have to deal with - from natural hazards to social issues – promoting the initiative "100 Resilient Cities") and associations of cities and local governments (eg, ICLEI that deals with urban resilience against climate-related impacts).
Although the concept of Resilient City has recently come to the fore, the studies on resilience have been developed since the Fifties through different disciplinary fields, from physics to psychology, from ecology to management science. Referring to previous research works for an exhaustive description of the evolution path of the resilience concept (Martin-Breen and Anderies, 2011; Alexander, 2013; Galderisi, 2014), we will here point out some milestones along this path. Resilience found large room in Ecology during the Seventies, thanks to Holling (1973) that firstly focused on the behavior of natural systems in the face of external perturbations. In the mid of the Nineties, Holling provided a clear distinction between an engineering and an ecological approach to resilience. According to Holling (1996), engineering resilience refers to stability, efficiency, constancy, predictability, return time to a previous state and, above all, to the idea of a single, stable equilibrium, using "resistance to disturbance and speed of return to equilibrium (…) to measure the property". On the opposite, ecological resilience emphasizes "conditions far from any equilibrium steady state", recognizes the existence of multiple equilibrium states and can be measured according to "the magnitude of disturbance that can be absorbed before a system changes its structure". Thus, ecological resilience focuses on the twofold possibility for a system to absorb changes, maintaining its main features, below a given threshold of disturbance, or change its state, moving towards a different one, not necessarily better than the previous one, above such a threshold.
The engineering perspective has been largely widespread in the studies on risks, as opportunity for improving cities' capacities to deal with emergency and recover from disasters (e.g., IFRC, 2011; Vale and Campanella, 2005; Gunderson, 2010): according to this perspective, resilience has been interpreted as the capacity of a system to return to a previous equilibrium steady-state, to "bounce back" after disturbances.
The "ecological" approach to resilience has been significantly strengthened when the focus of studies and researches on resilience shifted from natural to socio-ecological systems and intertwined with those related to the complex adaptive systems, capable of learning from experience, processing the information, adapting and even transforming themselves in face to changes. By this perspective, resilience was less and less conceived as a bounce-back to a previous state and progressively adapted to the behavior of complex systems, that is non-linear, self-organizing, characterized by uncertainty and discontinuities (Berkes et al., 1998; Holling, 2001; Walker et al., 2004; Bankoff et al., 2004).
Recent research works have further extended the concept of resilience, defining the latter as a "dynamic interplay of persistence, adaptability and transformability across multiple scales" (Folke et al. 2010). Moreover, some scholars have pointed out the importance of "continual learning" (Cutter et al., 2008), providing an idea of resilience as 'bouncing forward', which includes the idea of 'improvement' of systems' essential structures and functions (IPCC, 2012).

Hence, current approaches to resilience seem more appropriate to grasp the complexity of urban systems' evolution (Davoudi, 2012; Chelleri et al., 2012) and suitable for framing urban policies in the face of a large set of heterogeneous phenomena, from the climate-related impacts to the scarcity of resources. In some cases, indeed, the concept of persistence, addressed to improve the capacity of a system to withstand sudden impacts and to rapidly and effectively recover previous conditions, can be significant. In other cases, being current conditions unsustainable or inadequate, novelty and innovation become crucial to drive the system's transition towards new conditions. The milestones of the evolution path of the resilience concept are shown in fig. 6; it has to be noticed that the Resilient City definitions mainly refer to the more recent interpretation of Resilience, since it is generally interpreted as a city capable to absorb, adapt and/or change in the face of external pressures. However, although the Resilient City concept is nowadays largely widespread among planners and decision makers, some scholars highlight the numerous criticalities that may arise when the resilience concept is applied to urban systems. For example, human intervention is not taken into account in the "adaptive cycle" of ecological systems, while it is crucial in case of urban systems; moreover, the need for clarifying the goals - "resilience to what ends?" – as well as the field of action - "resilience of what to what?" – and the beneficiaries - "resilience for whom?" – of policies addressed to enhance urban resilience have been largely emphasized (Davoudi, 2012).

These criticalities point out the need for improving urban resilience taking into account both "hard" and "soft" components of urban systems. The former refer to structural, technical, mechanical, and cyber systems' qualities, capabilities, and functions of infrastructures. The latter are "related to family, community, and society, focusing on human needs, behaviors, psychology, relationships, and endeavors" (Kahan et al., 2009). The difference between "hard" and "soft" components is also highlighted by some of the major networks devoted to the resilience issues (e.g., ICLEI, 2014; ACCCRN, 2012) and it is largely mirrored in the field of adaptation strategies and measures that are generally distinguished between "hard", when they "involve capital-intensive, large, complex, inflexible technology and infrastructure", and "soft", when they "prioritize natural capital, community control, simplicity and appropriateness" (Hallegatte, 2009; Sovacool, 2011).

Summing up, even though the term Smart City is rooted in the evolution and spread of ICTs and in their outcomes in terms of globalization of economy and markets, along its evolution path it has been increasingly used to indicate a city in which ICTs are addressed to improve the overall urban performances and, above all, the quality of life of citizens. The concept of resilience – which underlies the Resilient city concept – extending the concept of resilience from natural to socio-ecological and urban systems and embracing change and complexity, is more and more interpreted as a key concept for improving cities' performances in the face of the different factors currently threatening their future development, by managing a large set of interconnected properties and adaptive capacities (Norris et al., 2008; Galderisi and Ferrara, 2012).

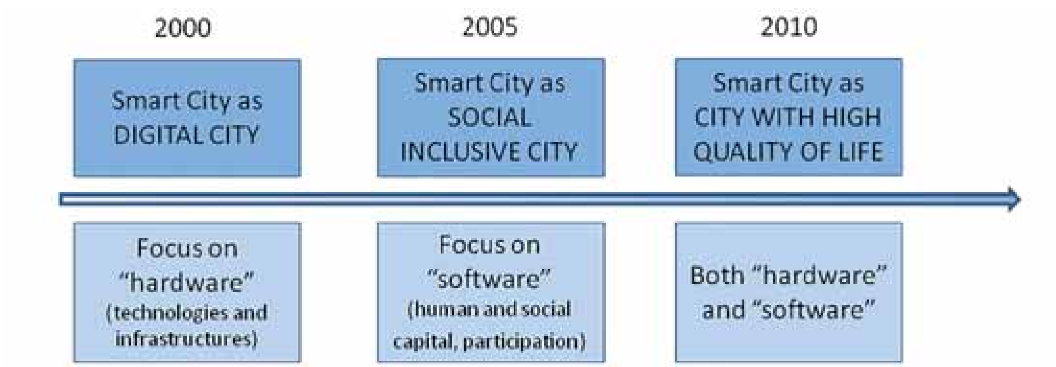

Fig. 5 Evolution of the Smart City concept

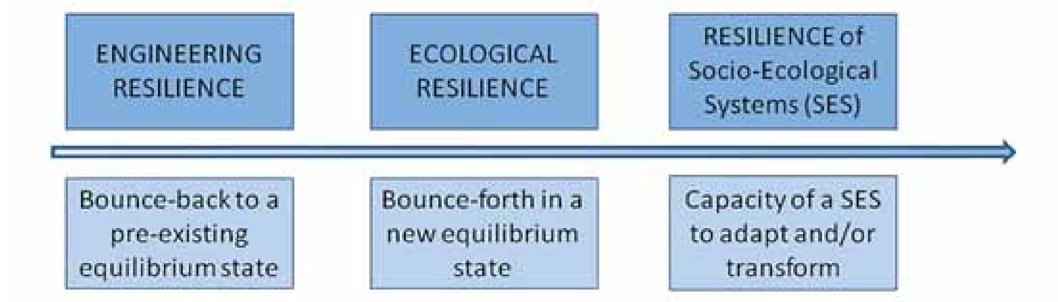

Fig. 6 Evolution of the Resilient City concept

Thus, both the concepts are currently interpreted as key concepts for improving urban performances, even though the Smart City concept puts large emphasis on the role of ICTs, while the Resilient City concept focuses on the inherent capabilities of cities to deal with the heterogeneous factors (from hazards to climate change, from environmental degradation to poverty) threatening cities' development. Moreover, both of them aim at providing strategies and measures acting on "hard" (infrastructures, technological systems, etc.) and "soft" components (capacities and behaviors of communities and institutions) of urban systems.

4 THE AIMS OF THE SMART AND RESILIENT CITY CONCEPTS

Based on the analysis of the definitions and of the evolution paths of the Smart and Resilient City concepts some commonalities between the two concepts can be outlined, even though, as clearly highlighted in the previous paragraph, each concept has its own peculiarities. To further investigate the relationships between the two concepts, the main goals of each concept have been deepened.

According to the vast scientific literature on these issues, both the Smart City and Resilient City are mainly addressed to improve sustainability and increase the quality of life, although each concept seem to pursue these objectives following different paths.

As regards sustainability, in the Smart City this goal is primarily pursued through a wide use of ICTs that, allowing a more efficient and effective management of networks (energy, transport, etc.), may led to a significant reduction in energy consumptions. In a broader sense, "a smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects" (ITU, 2014).

Nevertheless, it is worth noting that the large use of ICTs may also negatively affect sustainability, at least in respect to:

- environmental aspects, in that the production of ICTs involves an intensive use of raw materials that are assembled in not recyclable devices (Wagener, 2008) and, above all, the use of ICTs induces high-energy consumption (Viitanen and Kingston, 2014). As remarked by Wagener (2007), indeed, "large cities with a high concentration of knowledge workers, office buildings, and ICT are likely to find that ICT energy use is significantly higher than national averages" (Wagener, 2007). Nevertheless, "green IT is a new emerging field of study that brings together both environmental sustainability and information technology (IT) and explores the ways in which they connect with each other" (Lombardi, 2011);
- socio-economic aspects, in that the use of "ICTs would increase the risk to human health, including stress and conflict due to inequality" (Viitanen and Kingston, 2014) among individuals and/or institutions that have access to ICT and that, above all, are able to use them properly.

Thus, according to current literature, social and environmental sustainability represent a "major strategic component of smart cities" (Caragliu et al., 2009), even though relevant aspects, such as the issues related to the potential of green ICTs or to the social inclusion, should be further investigated.

According to Folke (2002), resilience and sustainability are tightly connected concepts, due to the need for creating and maintaining prosperous social, economic and ecological systems also in the face of uncertain events. Some scholars emphasize that resilience represents a "necessary approach to meet the challenge of sustainable development" (Chelleri et al., 2012) or a way of thinking for planning sustainable cities, capable to meet "the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Report, 1987).

Nevertheless, similarly to what has been highlighted for the smart city, some scholars point out some inconsistencies between resilience and sustainability (TURAS, 2012; Redman, 2014): in detail, while resilience puts large emphasis on uncertainty and discontinuities and is largely interpreted as the result of the dynamic interplay of persistence, adaptability and transformability (Davoudi, 2012), sustainability is often interpreted in a "fail-safe" approach as a concept aimed at "achieving stability, practicing effective management and the control of change and growth" (Ahern, 2011)

The increase of the quality of life is the other main goal of both Smart and Resilient City. In the Smart City, the widespread use of ICTs allows, for example, "to improve mobility on many levels, increasing spatial and a-spatial accessibilities to jobs, leisure, social opportunities and so on, thereby enabling the citizenry to increase their levels of life satisfaction" (Batty et al., 2012). Moreover, ICTs allow the reduction of energy consumptions and CO_2 emissions by allowing citizens to get a better air quality and a better environment.

The empowerment of citizens thanks to the use of ICT (Navarrete, 2012) represents a largely emphasized feature of the Smart City. It refers to a process of "social engagement" that creates a widespread sense of social cohesion, a significant awareness of the issues relevant to the community and allows people to propose and activate common objectives and actions (Zani, 2012). Thus, citizens' empowerment is a way to support decision-making processes based on a broad-base views of citizens and, therefore, to ensure development processes more participatory, collaborative and, in one, capable to effectively respond to the need of local communities.

Nevertheless, according to some scholars, "the paradox is that the same networked technologies that offer opportunities for empowerment can be used against civil rights for surveillance and censorship, or at worst, direct oppression" (Viitanen and Kingston, 2014).

Moreover, even though numerous scholars underline that the Smart City is addressed to increase "livability" (Toppeta, 2010; Chourabi et al., 2012; Smart City Council, 2014a), most of available definitions put "emphasis on business-led urban development" (Caragliu et al., 2009).

For example, the main aim of the study on European Smart Cities carried out by Giffinger et al. (2007) is to analyze the medium-sized European cities in order to find out their strengths and improve their competitiveness. The Smart City concept is, indeed, "principally open to any societal goals linked to it, but due to its focus on innovation systems, priority is given implicitly to competitiveness and economic growth" (Wolfram, 2012).

Also the Resilient City concept is addressed to increase the quality of life. A resilient city is, indeed, capable to absorb, adapt and/or change in the face of the main environmental challenges threatening its future, in order to preserve natural and man-made resources and, above all, to guarantee citizens' safety. It is worth reminding that, according to the five-stage model of human needs outlined by Maslow in 1943, safety is one of the basic needs that people have to fulfill, immediately after the biological and physiological ones. Therefore, to ensure the safety of people is a key objective for guaranteeing high levels of quality of life.

As it clearly arises from the above, the two investigated concepts, Smart City and Resilient City, show numerous commonalities, despite some differences. As regards the former, it has to be noticed that both of them result from a long and multidisciplinary evolution path capable to take into account the multiple and interrelated aspects of a complex urban systems, are addressed to pursue goals related to sustainability and quality of life and can be implemented through "hard" and "soft" measures.

Among the main differences, it is worth noting that while the spread of the Smart City concept has been strongly supported by large industries, the Resilient City concept has been mainly promoted by international organizations as well as by associations of cities and local governments.
Moreover, whereas the common ground among the definitions of Smart City can be found in the use of ICTs as a tool for empowering cities and citizens in the face of heterogeneous challenges, but above all as a key tool to fuel economic growth and competitiveness, the common ground of the definitions of Resilient City can be traced in the enforcement of the fundamental capacities of an urban system to deal with external pressures (from climate change to environmental degradation). Nevertheless, according to the more recent interpretations of the Smart City concepts, ICTs should be better addressed to solve long-term environmental challenges and to improve cities' resilience rather than primarily focus on consumer electronics. According to Heeks et al. (2013), indeed, "ICTs can help strengthen the physical preparedness of communities by helping those communities to optimize the location of physical defenses" and "can also strengthen institutions needed for the system to withstand the occurrence of climatic events".
Hence, the Smart City concept seems more and more to underlie a process, a multi-objective strategy of integrated urban and ICT development, capable to tackle problems of economic competitiveness but also of social equity and environmental performance (Wolfram, 2012). Such a process should allow cities to "become more livable and resilient and, hence, able to respond quicker to new challenges" (Kunzmann, 2014). Therefore, a better integration between the two often separated concepts and following strategies seem to be widely desirable and already pursued by some. Nevertheless, such integration has to be based on a robust scientific approach capable to provide methodological and operational tools for promoting cross-sectoral and multi-objective strategies capable to improve urban smartness and resilience, by providing citizens with a better urban environment capable to favor cohesion, sense of community and, meanwhile, safety and prosperity. Moreover, it is worth emphasizing that a multi-objective strategy addressed to build up a smarter and a more resilient city should be carefully tailored on the peculiarities of local contexts, in that each city has to define its own objectives and priorities, through a shared and participatory process (BSI, 2014).

5 BUILDING UP SMART AND RESILIENT CITIES: A CONCEPTUAL MODEL

According to the preliminary findings presented in the previous paragraph, it seems possible to state that, on the one hand, the Smart City concept is widely interpreted as a process capable to tackle urban problems related to economic competitiveness but more and more focused on issues related to social equity and environmental performances (Wolfram, 2012). On the other hand, the Resilient City is largely interpreted as a process addressed to empower cities and citizens to cope with external - environmental, social, economic - pressures. Hence, due to the relevant synergies between the two concepts, some authors emphasize the increasing area of overlapping among them, highlighting that resilience is more and more frequently included among the Smart Cities' objectives and that smart initiatives are often addressed to allow cities to "become more livable and resilient and, hence, able to respond quicker to new challenges" (Kunzmann, 2014). Moreover, some international organizations and networks as well as numerous cities are promoting integrated strategies for building up smarter and more resilient cities, as a key step for effectively counterbalance the challenge of climate change as well as for pursuing a better integration between mitigation and adaptation strategies (Klein et al., 2005).
For example, the American Planning Association (APA) has "created a Smart Cities and Sustainability Task Force, whose mission is to address advances in technology and innovation to cultivate cities which are smarter, more resilient and sustainable" (McMahon, 2014); the Asian Cities Climate Change Resilience Network (ACCCRN), funded by the Rockefeller Foundation, is striving for "developing smarter, resilient cities in India" (ACCCRN, 2015).

Nevertheless, as mentioned above, an effective theoretical framework – which is crucial for developing operational tools capable to support integrated and multi-objective strategies – is still missing. To fill this gap, the study focuses on the characteristics of Smart and Resilient cities and provides some hints for guiding a process aiming at improving cities' smartness and resilience in the face of climate change. In detail, based on the available scientific literature, first of all the characteristics common to both the Smart and the Resilient city concepts have been selected; then, grounding on previous studies focused on the Resilient City (Bahadur et al., 2010; Martin-Breem and Marty Anderies, 2011; Galderisi, 2013) and on the Smart City (Sinkiene et al., 2014; BSI, 2014) the most important ones for each concept have been identified. In the following (tab. 3 and 4) all the selected characteristics have been listed and briefly explained.

RESILIENT CITY CONCEPT	CHARACTERISTIC	SMART CITY CONCEPT
The "capacity to maintain a system in its current stability domain" (Berkes et al., 2002)	Adaptability	The capacity to adapt to unforeseen situations (Ratti & Townsend, 2011)
"It's the ability to constantly assess, take in new information, reassess and adjust your understanding of the most critical and relevant strengths and weaknesses and other factors" (Rockefeller F., 2014)	Awareness	It is related to the capacity of knowing and understand the urban potentialities (Giffinger et al., 2007)
It refers to the existence of multiple opportunities and incentives for a broad participation of stakeholders, as in public-private partnerships (Godschalk, 2003).	Collaboration	It is related to coordination and is defined as a step of the city technology harmonization, characterized by synergies and interactions between elements, resource and actors (BSI, 2014)
It represents the achievement of higher level of functioning by adapting to new circumstances and learning from the disaster experience (Maguire & Hagan, 2007)	Creativity	It is related to the creative capital that co-determines, fosters and reinforces trends of skilled migration (Florida, 2003; Caragliu and Nijkamp, 2008)
Diversity of species performing critical functions, diversity of knowledge, institutions and human opportunity and diversity of economic supports all have the potential to contribute to sustainability and adaptive opportunity (Berkes et al., 2002)	Diversity	It can be referred to the social and ethnic plurality (Giffinger et al., 2007) or to the diversity of specific elements, e.g. transportation modes (Caragliu et al., 2009).
"Fundamental property for service system and entails that performance are realized with modest resource consumption" (Fiksel, 2003)	Efficiency	It is related to the capacity of systems and infrastructures to optimize their performances (Aoun, 2013; Kramers et al., 2014).
It is a key aspect of adaptive capacity when unexpected events occur (Godshalk, 2003) and it is the capacity of a system to cope with an impact without being permanently altered (Tasan-Kok, 2013)	Flexibility	It is the ability to change, specifically referred to labor market and human capital (Giffinger et al., 2007)

RESILIENT CITY CONCEPT	CHARACTERISTIC	SMART CITY CONCEPT
"Innovation is seen as novel ways of doing things, or how new things can be made useful, and refers to incremental or radical changes in ideas, practices, and products; including novel ways of organizing society, changing its rules and institutions" (Ernstson et al., 2010)	Innovation	Changes made to something established, or a new introduction as new methods, ideas, or products, to achieve desirable outcomes that result in small but significant improvement (BSI, 2014)
Dynamic systems require to constantly revise existing knowledge to enable the management of the system and the adaptation to change (Stockholm Resilient Centre, 2014)	Learning	The human ability to gain knowledge or skill through ICT (Coe et al., 2001) or as the collection of data and their elaboration (Wolfram, 2012)
The ability to create networks of non-identical elements, or actors, called "nodes" that are connected by diverse interactions or links (Chuvarayan et al., 2006)	Networking	The capacity to connect computers and devices through communications channels that facilitate communications among users, allowing them to share resources and services (BSI, 2014)
The capacity to "build trust and relationships needed to improve legitimacy of knowledge and authority during decision making processes", as well as "create a shared understanding and uncover perspectives that may not be acquired through more traditional scientific processes" (Rockefeller F., 2014)	Participation	The capacity to involve civil society organizations, stakeholders, communities and citizens in policy-making and public debate (BSI, 2014)

Tab. 3 Common characteristics of Resilient City and Smart City

It is worth underlining that most of the literature related to the resilience of socio-ecological systems focuses on the concept of self-organization, by interpreting this concept as a key feature of a resilient system (Walker et al., 2004; Chuvarajan et al., 2006; Folke et al., 2006). However, according to numerous scholars, self-organization has been here intended as an inherent characteristic of complex systems, such as the urban systems. It "can be defined", indeed, "as the spontaneous emergence of global structure out of local interactions. Spontaneous means that no internal or external agent is in control of the process (…). This makes the resulting organization intrinsically robust and resistant to damage and perturbations" (Heylighen, 2008). According to such interpretation, self-organization has not been included among the selected characteristics. Nevertheless, self-organizing mechanisms that will arise as a consequence of the internal and external changes of the systems should be adequately understood and monitored.

Then, to better understand how these characteristics act and interact for improving the response capacities of complex urban systems in the face of climate change, a further step is required. Climate change is indeed a challenging threat that requires long term as well as short-medium term strategies. Thus, on the one hand, long-term strategies capable to reduce GHG emissions and energy consumptions, by promoting cities' transition from current energy consuming development patterns towards low-carbon patterns, are required; on the other hand, short-medium term adaptation strategies, aimed at reducing the vulnerability of urban systems to the heterogeneous impacts of climate-related phenomena, ranging from sudden (e.g. flash floods, heat waves, etc.) to slow (e.g. droughts) phenomena and to improve cities capacities to better cope with more and more "beyond the expected" or even "unexpected" phenomena, have to be developed.

CHARACTERISTIC	CONCEPT	DEFINITION
Connectivity	Resilient City	It is related to "the density of the links within the network, i.e., the number of links divided by the maximum possible number of links" and to the "reachability, or the extent to which all the nodes in the network are accessible to each other" (Janssen et al., 2006)
Knowledge	Resilient City	The capacity to elaborate knowledge and learn from management mistakes, protecting a system from the failure due to subsequent management actions based on incomplete knowledge and understanding (Berkes, 2004)
Memory	Resilient City	"The ability of a system to preserve knowledge and information" (Folke et al., 2005)
Modularity	Resilient City	"It is the degree to which a system's components may be separated and recombined" (Elmqvist, 2013)
Persistence	Resilient City	System's ability to withstand an impact, preserving its own characteristics and structure, except for a temporary departure from the ordinary functioning conditions (Folke et al., 2010)
Redundancy	Resilient City	Spare or superfluous "elements, systems, or other units (..) capable of satisfying functional requirements in the event of disruption, degradation, or loss of functionality" (Bruneau et al., 2003; Walker and Salt, 2006; Schultz et al., 2012; Tyler & Moench, 2012).
Resistance	Resilient City	The degree to which systems are displaced (or disturbed) by a given physical force or pressure (Carpenter et al., 2001)
Resourcefulness	Resilient City	"The capacity to (…) mobilize resources when conditions exist that threaten to disrupt some element, system, or other unit of analysis" including "the ability to apply material and human resources to meet established priorities and achieve goals" (Bruneau et al., 2003)
Robustness	Resilient City	The "ability of elements, systems, and other units of analysis to withstand a given level of stress or demand without suffering degradation or loss of function" (Bruneau et al., 2003).
Transformability	Resilient City	"Capacity of people to create a fundamentally new social-ecological system when ecological, political, social or economic conditions make the existing system untenable" (Walker et al., 2004)
Anticipation	Smart City	Capacity to conceive future predictable scenarios. Indeed, a smart city can provide "tools to exploit various sources of information about human behavior to aid in the allocation of resources—land, water, transportation, and so on—as the city evolves" (Naphade et al., 2011)
Monitoring	Smart City	"The capacity to monitor all critical infrastructures is crucial for a smart city in order to better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens" (Hall, 2000)
Reliability	Smart City	Degree to which a measure repeatedly and consistently produces the same result (BSI, 2014)

Tab. 4 The most important characteristics of Smart City and Resilient City

It is worth stressing that, in respect to the different time spans (short-medium-long term) that characterize the response of a complex urban system in the face of climate change, the selected characteristics play different roles. Therefore, in order to highlight their roles and linkages in the different phases, the selected characteristics have been framed into a conceptual model (Fig. 7).

So far numerous and heterogeneous models on Smart and Resilient City have been developed; these models can be distinguished at least into three different categories:

- "theoretical" models that, based on scientific theories, are addressed to understand and represent cities' dynamics and development;
- "operational" models, which provide a vision for urban development and outline a path for achieving it;
- "hybrid" models, combining a solid theoretical background with some operational elements.

The Smart City literature is largely focused on "operational" models, defining intervention sectors for projects implementation (Lekamge and Marasinghe, 2013), despite the lack of a "solid theoretical framework for smart cities" (Harrison et al., 2011).

In the Resilient City literature, some "theoretical" models, addressed to investigate the main characteristics of a resilient city (Tyler and Moench, 2012; Davoudi, 2013; Galderisi, 2013), as well as some "operational" models aimed at supporting municipalities in developing strategies for disaster risk reduction (Mehrotra et al., 2009; Prasad et al., 2010) or for climate adaptation (e.g., Climate-Adapt Platform, 2014) have been carried out. Unfortunately, most of the two groups of models seem to travel separately, in that the operational models do not mirror the hints provided by the theoretical ones; only recently some "hybrid" models, based on a robust theoretical framework and providing some operational tools for improving urban resilience, have been developed (Tyler et al., 2014).

Hence, the conceptual model for building up smart and resilient cities in the face of climate related challenges represents one of the first attempts to develop an "hybrid" model, framing smart and resilient cities' characteristics along the different temporal stages that characterize the response of a complex urban system in the face of climate change (fig.7).

The model is structured as a cyclical process, based on the learning capacity of urban systems and characterized by the "dynamic interplay of persistence, adaptability and transformability" (Folke et al., 2010). The capacity of "continual learning" is considered as crucial both for the Smart and the Resilient City concept (Cutter et al., 2008; Sinkiene, 2014). According to Davoudi et al. (2013), it allows urban systems to resist "disturbances (being persistent and robust)", to absorb "disturbances (…) (being flexible and adaptable)" and to move "towards a more desirable trajectory (being innovative and transformative)". Hence, it may allow urban systems to improve their capacity both to "bounce-back" in the face of climate-related impacts or to "bounce forward", including the idea of anticipation and improvement of their essential structures and functions through long-term strategies (IPCC, 2012). Moreover, the most recent approaches to the resilience concept provide an interpretation of the latter as the "dynamic interplay of persistence, adaptability and transformability across multiple scales" (Folke et al., 2010): such a dynamic interplay allows a resilient system to extend its focus beyond resistance to shocks, including adaptive responses as well as long-term transformation in the face of future or unforeseen threats (Galderisi, 2014).

Therefore, learning capacity, persistence, adaptability and transformability have been classified as the key properties of a smart and resilient city or, better, as the main goals to which strategies and measures have to be addressed for improving cities' response in the face of climate change. The cyclical structure of the process is characterized by three different stages (strategies' definition, implementation and management) developing over time and connected through a feedback loop: such a structure emphasizes that a smart and resilient urban system does not represent a "fixed state" (Davoudi, 2012), but it results from a dynamic and continuous process. Learning capacity is at the base of the process and allows the system to start, revise or change the strategies addressed to achieve the key properties of a smart and resilient city. Despite the dynamic interplay of these characteristics over time and across space, it is worth noting that each of them gains relevance in a different time span: in the short term, strategies are generally addressed to improve cities' capacities to withstand the expected (or the most likely) climate-related impacts, by increasing system's persistence; in the medium term, strategies are addressed to enhance cities' capacity to cope with unexpected impacts, by improving system's adaptability; then, long term strategies, by improving cities' transformability, should drive urban transition towards novel development pattern, capable to reduce energy footprint of cities and, in so doing, to prevent future climate-related impacts.

Within the model, all the selected characteristics, according to their meanings and relevance, have been hierarchized and related to one or more of the identified key properties, which are the learning capacity, the persistence, the adaptability and the transformability. Such key properties can be improved by other subordinate characteristics that can be related to more than one key properties, such as the efficiency that is common to the persistence and the adaptability. In detail, learning capacity can be improved through strategies and actions addressed to enhance: networking capacity that allows to connect people and devices for exchanging data and information; monitoring capacity, which allows to constantly detect the conditions of an urban system; knowledge that allows to elaborate information about events and processes; memory, which allows to learn from past events in order to figure out possible future scenarios; collaboration, which favors interactions and synergies between different stakeholders; participation, which allows to involve people in the decision-making processes. Moreover, learning capacity is intended crucial for developing people and institutions' awareness about climate-related issues, to improve the capacity to anticipate likely future events, which can threaten urban systems, and, mainly grounding on monitoring and knowledge, to guarantee an effective management of the urban system along the time.

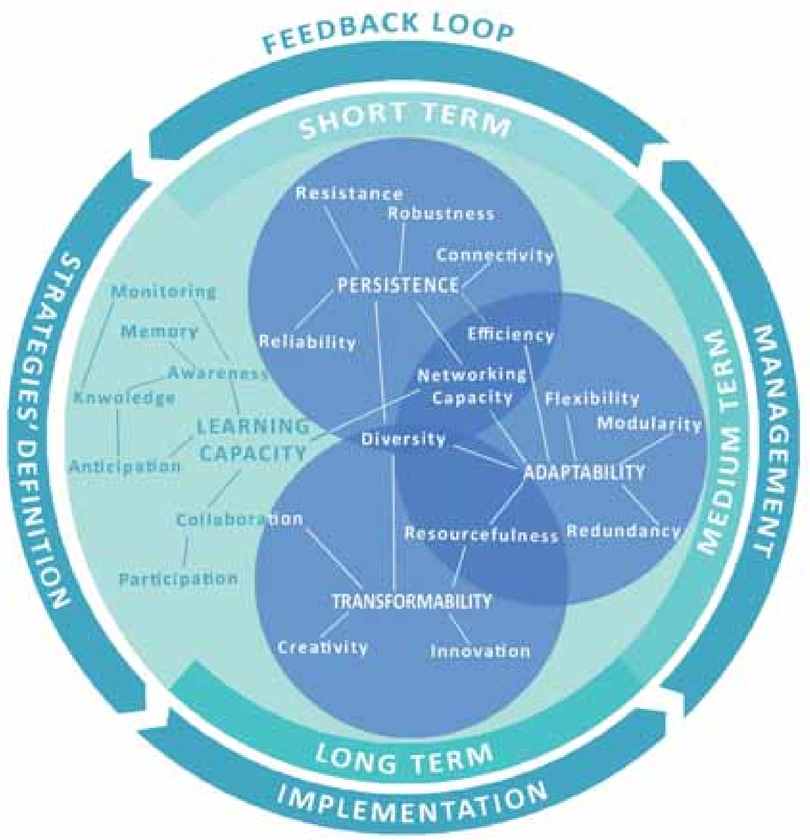

Fig. 7 The conceptual model: roles of and linkages among the capacities of a Smart and Resilient Urban System in the face of climate change.

Finally, as emphasized above, learning capacity provides inputs for enhancing persistence, adaptability and transformation of the system in the face of climate change: these properties, which come to the fore in different temporal stages, provide in turn information that, being continuously processed, can be used as an input to further increase the learning capacity (feedback loop).

Persistence, generally referred to the ability of an urban system to maintain the characteristics and structures in the face of a threatening factor, can be improved through strategies and actions addressed to enhance: robustness, which is the ability of elements and systems to withstand a given impact without suffering degradation or loss of function (Bruneau et al., 2003); resistance that allows the urban system to not be displaced (or disturbed) by a given pressure (Carpenter et al., 2001); reliability, which is the certainty of a result (BSI, 2014); efficiency, that is the capacity to optimize the performance with modest resource consumptions (Fiksel, 2003; Aoun, 2013; Kramers et al., 2014); diversity, related to the plurality of functions and of knowledge (Berkes et al., 2002); connectivity, related to the density of links within a network and to the extent to which all the nodes of the network are accessible to each other (Janssen et al., 2006); networking capacity, which refers to the ability to create networks of non-identical elements or actors, connected by diverse interactions or links (Chuvarayan et al., 2006).

In an integrated smart and resilient system, the networking capacity regards also the capacity to connect computers and devices, since the information exchange increases the urban system persistence, supporting for example the real time mobilization of resources and services where they are needed.

The networking capacity is crucial also for the adaptability because it allows the creation of diverse network configurations.

Adaptability, generally related to the capacity of an urban system to adapt itself to unforeseen situations (Ratti and Townsend, 2011), can be improved through strategies and actions addressed to enhance: flexibility that, in opposition to hierarchical organizations, allows a system to be changed or adjusted to meet particular or changing needs; diversity that, recognized as crucial in case of impacts of adverse events, allows a system to better cope with uncertainty and surprise; a diverse economy ensures, for example that there is overall economic viability if one economic activity fails (Berkes et al. 2002); resourcefulness that refers to the availability of ecological, economic, social and cultural capital, allows the system to better cope with external pressures; modularity, which allows to recombine the elements of a system, supporting the transition towards different configurations; redundancy, which allows the system to count on superfluous/substitutable elements for adapting adaptable in the face of pressures; efficiency, that allows to reach optimal performances in the adapted configuration.

Finally, transformability that represents the capacity to create a fundamentally new system when ecological, political, social or economic conditions make the existing one untenable (Walker et al., 2004), can be improved through strategies and actions addressed to enhance: innovation in all elements and sectors of urban systems, from the physical to immaterial aspects, comprising the introduction of new methods, ideas, products or processes to achieve desirable outcomes (BSI, 2014); creativity, which generally results from research and experimentation that provide spurs for innovating cities in face of complex and unpredictable events; collaboration that allows to exchange new information and inputs and fosters creativity; resourcefulness, which refers to the ability to mobilize and use the available resources supporting the transition of the system towards new configurations; diversity, that allows elements to be separated and connected in new configurations.

As mentioned above, so far very few studies have attempted to combine a robust theoretical framework with operational tools.

The conceptual model - framing smart and resilient cities' characteristics along the different temporal stages that characterize the dynamic process for improving cities' capacity to deal with climate change and its impacts - provides a robust theoretical background for building up smart and resilient cities in the face of climate change.

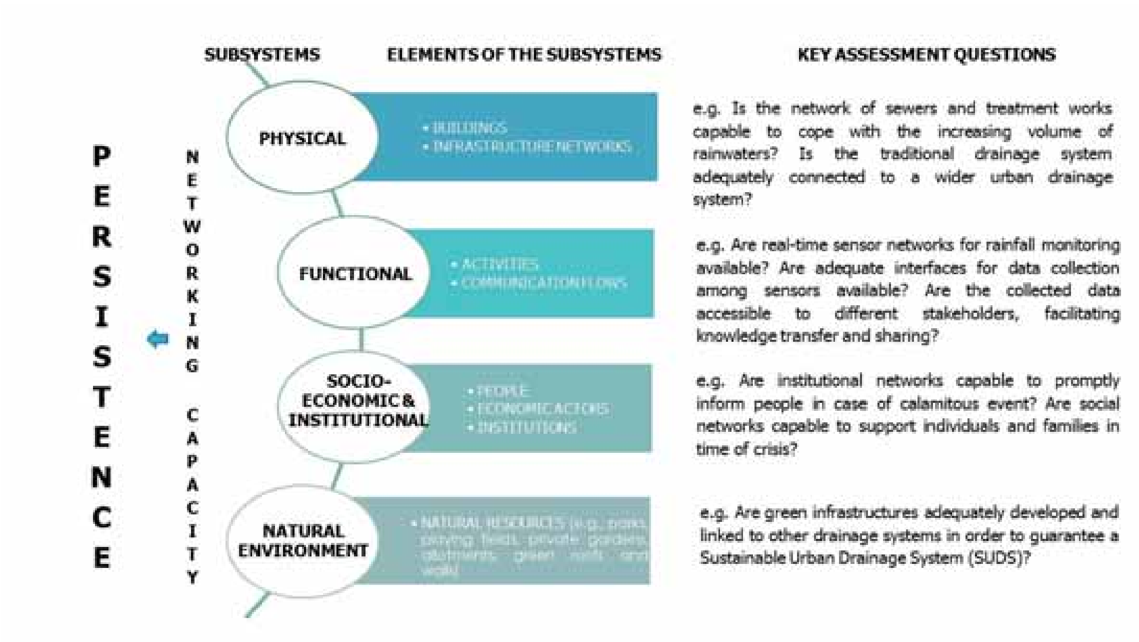

Fig. 8 Towards a guiding tool for evaluating the characteristics of a Smart and Resilient Urban System: an example related to the "networking capacity".

Nevertheless, an effective tool capable to guide planners and decision-makers in carrying out long, medium and short-term strategies addressed to pursue the key properties of a smart and resilient urban system in the face of climate change is still far to be achieved.

To bridge this gap, the next phase of the research work will be addressed to further develop the methodological path for guiding planners and decision makers in the assessment – with reference to the heterogeneous climate drivers and in respect to the different subsystems which constitute an urban system, physical, functional, socio-economic and institutional, natural environment (Papa et al., 2009) – of the different selected characteristics as well as in finding out the most appropriate strategies for enhancing them and monitoring their effectiveness.

An example may clarify what is meant here. According to the conceptual model, the persistence of the urban system in the face of intense rainfalls can be enhanced, by acting on different characteristics (robustness, reliability, connectivity, networking capacity, etc.). Hence, in the figure 8, an example of the methodological path for guiding planners and decision makers through the evaluation of the networking capacity of the different subsystems of an urban system, by using key assessment questions has been provided.

6 CONCLUSIONS

This study represents a first step of a wider research work addressed to develop conceptual and operational tools for improving cities' response in the face of the heterogeneous challenges posed by the climate-related phenomena. In detail, this contribution focuses on the metaphors of "smart" and "resilient" cities that, according to current scientific literature, seem to play a leading role in enhancing cities' capacities to cope with climate change. Based on the in-depth analysis of the current scientific literature in the field of both Smart City and Resilient City, this study has been firstly addressed to identify the main characteristics of a smart and resilient urban system. It has to be underlined that while in the resilience research field a large set of studies and researches have been focused on the characteristics of a resilient system, the Smart City literature does not provide in-depth studies on the characteristics of a smart urban system. However, some useful hints in this direction arise from the studies carried out by companies involved in the development of the Smart City standards (e.g., BIS, 2014) and from research works addressed to investigate Smart City performances (e.g., Coe, 2001; Giffinger et al., 2007; Lekamge and Marasinghe, 2013).

Then, the collected characteristics have been selected and framed into a conceptual model aimed at supporting the development of multi-objective strategies capable to improve the response capacities of complex urban systems in the face of climate change. The model is structured as a cyclical process, based on the learning capacity of urban systems and characterized by the "dynamic interplay of persistence, adaptability and transformability" (Folke et al., 2010); it outlines the temporal and operational phases that characterize the response of a complex urban system in the face of climate change, underlining roles and linkages of the different characteristics along this process, according to the different time spans (short-medium-long term). In detail, the model highlights that some characteristics (transformability) are crucial for supporting long-term strategies capable to reverse current urban development patterns in order to reduce GHG emissions and energy consumptions; others (persistence/adaptability) are relevant to short-medium term strategies aimed at enhancing cities' capacities to withstand or adapt to the heterogeneous climate-related impacts; others (such as learning) are at the base of the process, allowing the system to start, revise or change the strategies addressed to achieve the key properties of a smart and resilient city.

Although the conceptual model provides planners and decision-makers with a robust theoretical background for building up smart and resilient cities, it represents only a preliminary step for the development of an operational tool capable to guide them in carrying out multi-objective strategies addressed to enhance the response capacities of complex urban systems in the face of climate change.

To bridge this gap, the next step of this research work will be addressed to further develop the methodological path for guiding planners and decision-makers in evaluating – with reference to the heterogeneous climate drivers and in respect to the different subsystems which constitute an urban system – the characteristics of a smart and resilient urban system, as well as in finding out adequate strategies for enhancing them and monitoring their effectiveness.

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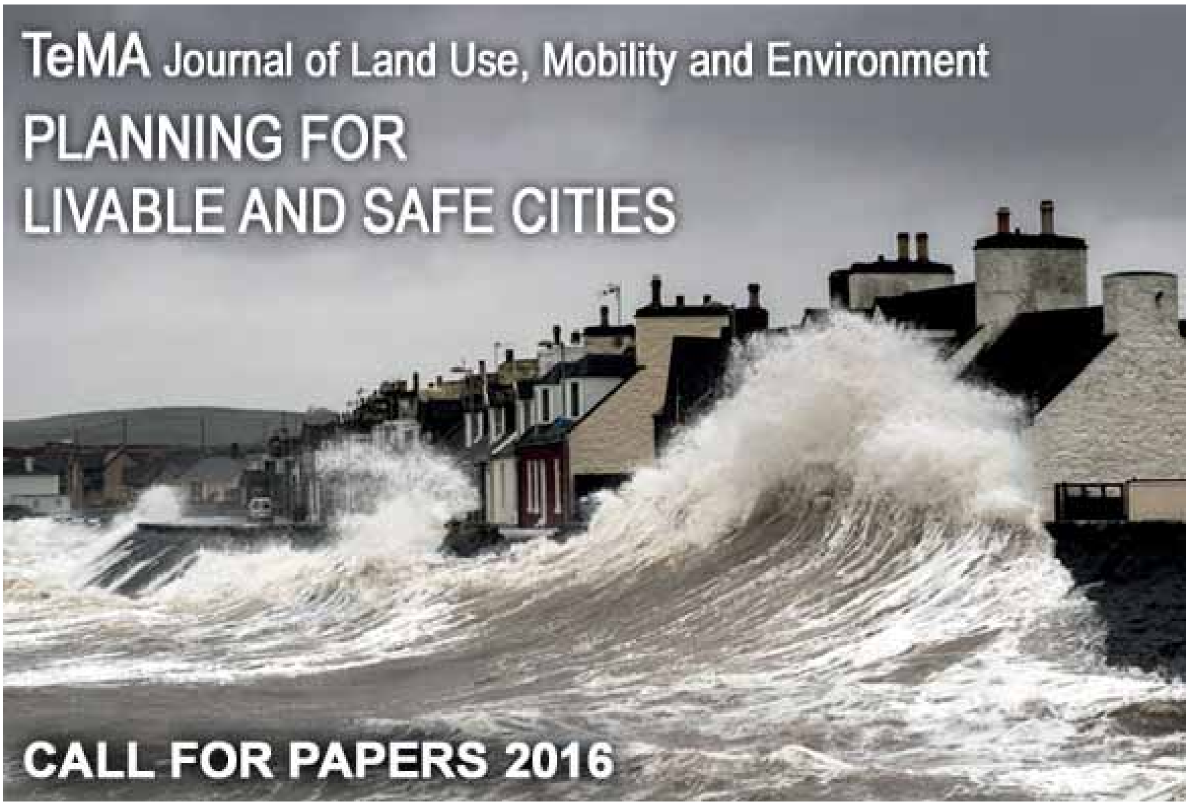

In the forthcoming decades, cities will face a range of social, economic and environmental challenges that might produce, over time, big lifestyle changes and influence cities way of living. Thus, the three issues of the 9th volume of the TeMA Journal will promote the debate on the possible strategies to increase the ability of urban areas to effectively adapt to these challenges and, at the same time, improve the quality of life of their citizens.

Specific attention will be devoted to the development and pervasiveness of new communication technologies as a tool to design innovative techniques of governance and management of the urban development, which are appropriate to the increasing complexity of urban systems and able to promote a wider participation in the decision making processes as well as guide the implementation of the foreseen strategies and the monitoring of the urban systems' development.

TeMA vol.9 n.2 (2016)
Planning for livable and safe cities: Energy, pollution and the degradation of the urban environment

DEADLINE 10TH MAY 2016

In detail, the second issue of the Journal in 2016 will mainly focus on:
Energy, pollution and the degradation of the urban environment

Contributions focusing on strategies and measures aimed at reducing the main sources of pollution/energy consumption/degradation of the urban environment while improving the quality of life in cities are invited. In particular, contributions dealing with residential energy consumption, transport energy consumption and noise pollution are especially welcome.

TeMA vol.9 n.3 (2016)
Planning for livable and safe cities: Socio-economic changes in advanced societies

DEADLINE 10TH SEPTEMBER 2016

In detail, the third issue of the Journal in 2016 will mainly focus on:
Socio-economic changes in advanced societies

Contributions dealing with strategies and measures aimed at reducing the impacts of socio-economic dynamics on cities life and organization by redefining the physical and functional form of the urban environment are invited. In particular, contributions dealing with population aging, globalization and migration flows are especially welcome.

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IMPLEMENTING EUROPEAN CLIMATE ADAPTATION POLICY

HOW LOCAL POLICYMAKERS REACT TO EUROPEAN POLICY

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ABSTRACT

EU policy and projects have an increasing influence on policymaking for climate adaptation. This is especially evident in the development of new climate adaptation policies in transnational city networks. Until now, climate adaptation literature has paid little attention to the influence that these EU networks have on the adaptive capacity in cities. This paper uses two Dutch cities as an empirical base to evaluate the influence of two EU climate adaptation projects on both the experience of local public officials and the adaptive capacity in the respective cities.
The main conclusion is that EU climate adaptation projects do not automatically lead to an increased adaptive capacity in the cities involved. This is due to the political opportunistic use of EU funding, which hampers the implementation of climate adaptation policies. Furthermore, these EU projects draw attention away from local network building focused on the development and implementation of climate adaptation policies. These factors have a negative cumulative impact on the performance of these transnational policy networks at the adaptive capacity level in the cities involved.
Therefore, in order to strengthen the adaptive capacity in today's European cities, a context-specific, integrative approach in urban planning is needed at all spatial levels. Hence, policy entrepreneurs should aim to create linkage between the issues in the transnational city network and the concerns in local politics and local networks.

KEYWORDS:
climate adaptation, EU, transnational city networks, Netherlands, adaptive capacity

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实施欧洲气候适应性政策

地方政策制定者如何响应欧洲政策

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摘要

欧盟政策与项目对于气候适应性决策的影响越来越大。这在跨国城市网络气候适应新政策的制定过程中最为明显。截至目前，关于这些欧盟网络对于城市适应能力的影响，气候适应性文献仍关注甚少。本文将荷兰的两座城市作为实证基础，评估两个欧盟气候适应性项目对于两个城市当地政府官员的经验和适应能力分别产生的影响。
主要结论是：欧盟气候适应性项目并不能自动提高有关城市的适应能力。这是由于在政治上投机使用欧盟所提供的经费，阻碍了气候适应性政策的实施。此外，这些欧盟项目使人们把注意力从当地专注于气候适应性政策制定与实施的网络建设上转移开来。这些因素对于有关城市跨国政策网络的适应能力水平造成负面的累积影响。
因此，为了增强今天欧洲城市的适应能力，各级空间都需要在城市规划中采用情景特定的综合方法。因此，政策制定者应努力创建关联，联结起跨国城市网络中的事项与当地政治及网络中的关注点。

关键词
气候适应、欧盟、跨国城市网络、荷兰，适应能力

1 INTRODUCTION

Climate adaptation in cities is a new and major urban challenge for the 21st century (Hunt & Watkiss, 2007; Kamal-Chaoui & Robert, 2007). The Netherlands are particularly vulnerable to climate change because they are located in a delta area. Rising sea levels and changing precipitation patterns, as expected by the IPCC (2014), threaten Dutch cities (PBL, 2011). Like many other European countries (Biesbroek et al., 2009), the Netherlands adopted a National Adaptation Strategy, entitled 'Maak ruimte voor klimaat!' (Make space for climate!) (VROM, 2007), as well as a Delta-programme (2008).

However, when compared with other European countries, the involvement of the Dutch central government in climate adaptation is relatively low (Biesbroek et al., 2011). The Netherlands are a decentralised unitary state in which local authorities are responsible for implementing national adaptation policies in their cities.

But, in most Dutch cities, climate adaptation in urban planning is (still) not evident. Usually, only fragmented projects are realized, such as funding green roofs or disconnecting rainwater from the sewer system (VROM, 2010). Policy entrepreneurs (Huitema and Meijerink, 2010) in urban planning have a key role in initiating and facilitating the adaptive capacity for cities (Adger et al., 2007; Blanco et al., 2009; De Bruin et al., 2009) because they have a more long-term policy perspective, which is necessary for responding to long-term climate change. However, lack of awareness and diverging perceptions about the risks of climate change limit the adaptive capacity (Adger et al., 2009; Hartmann & Spit, 2014).

The European Union has recognised the importance of climate adaptation for its Member States (CEC, 2007, 2009). A Green Paper on climate change adaptation (CEC, 2007) outlined the main impacts of climate change in Europe and formulated an adaptation strategy.

It included adaptation in all the EU's activities as well the development of an adaptation research programme at the EU level and the involvement of other stakeholders.

The related White Paper (CEC, 2009) stressed the coordinating role of European institutions in (trans-border) national climate adaptation (Dumollard & Leseur, 2011). The latest framework focused on the following key areas:

- Building a stronger knowledge base;
- Taking climate change impacts into consideration in key EU policies;
- Financing climate change policy measures;
- Supporting wider international efforts toward adaptation.

In addition to this framework, the European Commission has launched several EU projects to promote climate adaptation. Two examples of recently completed projects with Dutch case studies are GRaBS (Green and Blue Space adaptation for urban areas and eco-towns) and the INTERREG IVB project, or 'FUTURE CITIES'.

The objectives of these two projects are comparable; both are city networks for climate adaptation. GRaBS (www.grabs-eu.org) focused on building transnational policy networks through knowledge exchange and the transfer of best practices in order to achieve policy change by integrating climate change adaptation in regional and urban planning, notably green and blue infrastructures (Holstein & Schwaberger, 2011).

FUTURE CITIES aimed to build urban networks between city regions in northwest Europe that are facing climate change. It focused on the strategic components of green structures, water systems and energy efficiency in order to achieve synergic outcomes in existing urban structures (www.future-cities.eu).

Academic literature has paid little attention to the influence of such transnational projects on local climate adaptation policies. The debate on responses to climate change focused for a long time on mitigation (Galderisi, 2014). The recent scholarly debate on resilience brings attention to climate adaption (Colucci 2012). Adaptation encompasses measures that adjust natural or human systems in response to expected climate change induced effects (Galderisi et al. 2012).

Besides, the implementation of such climate adaptation has often been studied in terms of the performance of *national* (spatial) policies on a regional and local scale (Papa, 2012; De Lange et al., 1997; Mastop, 1997).

This paper focuses instead on the performance of *EU* climate adaptation *projects* at a local level. It has been ascertained in previous research that the local level is crucial for climate adaptation (i.e. resilience) (Pinto, 2014). So, it discusses the tension between the micro and macro level of climate adaptation.

We investigate if the cooperation in EU transnational city networks may create new opportunities for policy entrepreneurs in cities to promote climate change policy through knowledge exchange and access to EU funding. In other words, do European projects work as a strategy to implement climate adaptation on a local level? Thereby, the assumption if transnational city networks are indeed necessary for implementing climate adaptation is not questioned.

There are good arguments for such city networks for climate adaptation. First of all, climate adaptation is a topic that requires mutual learning, because it is a relatively new topic for local policymakers. Also, such networks can provide a basis for disseminating experiences and ideas across them.

This is important for the implementation of a transnational policy that requires implementation on the local level. However, this paper does not focus on the analysis of the content of the policy, but rather the process: how are the European objectives pursued in the projects.

So this is about the implementation of transnational objectives on the local level. The EU FUTURE CITIES and GRaBS projects have been in progress for several years.

Therefore, if the EU projects have had a significant effect on enhancing the adaptive capacity of the (Dutch) cities involved, it should be recognizable by now. However, our analysis suggests that EU climate adaptation projects do not, in fact, automatically lead to an increased adaptive capacity in the project areas.

These transnational policy networks have intrinsic limitations; additionally, there are interfering factors that affect the performance of these networks.

We expect these project examples to be similar to policy developments elsewhere in Europe. Researching the performance and effects of such projects on the local adaptive capacity can provide deeper insight into the transnational governance processes.

For the purpose of this paper, the case study areas are as follows: the Amsterdam Nieuw-West Borough was selected for its involvement in the EU GRaBS network; and the municipality of Nijmegen was selected for its collaboration together with the cities of Arnhem and Tiel in the FUTURE CITIES network. The central questions of this paper are:

- To what extent can EU climate adaptation projects increase the adaptive capacity of (Dutch) cities?
- What other interfering factors affect the results?
- What lessons can be learned for other European cities?

We used a reflexive approach to evaluate the performance of these EU projects at the adaptive capacity level of the cities involved. This implies that we not only evaluate whether the formal policy goals have been achieved, but also include interfering factors and the claims, concerns, and issues identified by local policymakers (Huitema et al., 2011).

From 2011 to 2012 we conducted in-depth interviews with seven Dutch local public officials to elicit their perceptions of the effectiveness of the EU climate adaptation projects.

On average, the interviews lasted one and a half hours. They were later recorded and transcribed in full. These interviews were treated as general findings because they reflect the overall sentiment in similar municipal contexts. In the first section of this paper, in order to place the two case studies in context, we first outline climate adaptation governance theory and policy theory as our theoretical framework. This section identifies the critical factors that would increase the adaptive capacity in cities.

These factors provide a backdrop for the next two sections: our empirical analysis of and evidence for the EU GRaBS project in the Amsterdam Nieuw-West Borough and the EU FUTURE CITIES project in the city of Nijmegen. We discuss the results and conclusions in the final section and indicate how they will contribute to the broader international debate on transnational policy networks.

2 CLIMATE ADAPTATION GOVERNANCE, POLICY NETWORKS AND POLICY CHANGE

2.1 THE GOVERNANCE OF CLIMATE ADAPTATION

Climate adaptation encompasses all measures that reduce vulnerability to the impact of climate change (Adger et al., 2007). Such measures include altering the exposure of the urban elements to the effects of climate change or increasing the resilience of social and ecological systems in cities. The adaptive capacity is the ability of individuals, groups or organisations to implement such adaptation measures (Adger et al., 2005, p. 78). To achieve climate adaptation, a broad range of actors (heterogeneity of actors) needs to collaborate, ranging from local government, to housing associations, property developers and residents (Carter, 2011; Füssel, 2007). In addition to local government, many other stakeholders control crucial resources, such as land, money, real estate and local knowledge and they need to be coordinated (integrative policies). Local government must therefore negotiate with these stakeholders and engage them in climate adaptation processes (Runhaar et al., 2009). Successful adaptation depends on the distribution of the adaptive capacity across all stakeholders (Adger et al., 2005; Adger, 2010).

The stakeholders' action toward climate adaptation requires integrated adjustments in behaviour as well as in resources and technologies (Adger et al., 2007). For this reason, isolated or sectoral solutions are not sufficient for successful climate adaptation. Integrative policies are needed to precipitate adaptation (Adger et al., 2005; Biesbroek et al., 2011; Füssel, 2007). Isolated or sectoral solutions can be most efficient in itself (Witte & Spit 2014). Furthermore, climate adaptation needs to be tailored to the specifics of every local situation (location specific measures and context specific processes) (see Adger et al., 2005; Nelson et al., 2007). Urban planning is most well-suited for the job, as it combines a long-term perspective with the ambition to integrate all types of policy with spatial effects.

The implementation of climate adaptation on a local level is a complex process. It seeks to combine many different stakeholders and policy networks and to align a large diversity of normative views (March & Olsen, 1976; van Buuren et al., 2007). Mees and Driessen (2011) used case studies in various countries (London, Rotterdam and Toronto) to illustrate that institutional fragmentation and compartmentalisation are barriers to the implementation of climate adaptation (policy fragmentation). Furthermore, awareness (Uittenbroek 2014) and coherence of the possible impacts of current extreme weather events and long-term climate change (temporal scaling) play a crucial role in implementation processes, because it leads to a sense of urgency (sens of urgency) (Hartmann & Spit 2014). Differences between climate developments and policy processes (climate change is long-term, many policy issues are short-term) are another important barrier to climate adaptation (conflicting timescales). The consequence is a lack of political priorities, ultimately leading to a low priority designation for climate adaptation (political will) (Biesbroek et al., 2011; Lorenzoni et al., 2007).

To summarise, the critical success factors for climate adaptation governance are the heterogeneity of the actors involved, integrative policies, and context- and location-specific processes and adaptation measures. The critical fail factors are policy fragmentation, a lack of sense of urgency, conflicting time scales and political will in decision-making. All these factors can interfere with the performance of the EU projects at the adaptive capacity level in the cities involved. This leads to a key question: Can climate adaptation be achieved via transnational city networks aimed at enhancing the cities' adaptive capacity?

2.2. POLICY NETWORKS AND POLICY CHANGE

Disasters and other shock events are the most important triggers to policy change (Birkland, 1998; Hartmann & Needham, 2012). However, most policy changes occur slowly because, according to Lindblom's incrementalism (1959), policies emerge as (political) compromises. Making small steps but keeping a clear vision of the ultimate goal may prove to be a better strategy for policymakers than dramatic policy change without societal or political acceptance (Mintrom & Norman, 2009). This incremental approach is a common strategy in spatial planning (Hartmann, 2012; Hartmann & Spit, 2012).

Thus, most public policy is characterised by continuity or incremental change, as is demonstrated in an advocacy coalition framework (Sabatier & Jenkins-Smith, 1993). These coalitions or policy networks (Koppenjan & Klijn, 2004) share policy core beliefs, norms and values. Consequently, the policy of the network is more resistant to change. Klijn and Koppenjan (2000: 19) define policy networks as 'a (more or less) stable pattern of social relations between interdependent actors, which take shape around policy problems and/or policy programmes.' Policy networks, which are very closed, are largely insensitive to the multiple contexts around them and are not open to policy change, whereas adaptive policy networks are sensitive and adaptive to their environment and can generate policy change (Teisman et al., 2009).

Policy changes can be triggered by policy entrepreneurs (Huitema & Meierink, 2010). Policy entrepreneurs are individuals or small groups inside or outside a governmental organisation who enable policy change. Generally, they possess four broad competences: maintaining social sensitivity; defining problems by highlighting the shortcomings of current policies; drawing greater support by building teams and making use of their broad professional networks; and working with coalitions to promote policy change. If they are involved in pilot projects, they can influence risk perceptions leading to policy change and build momentum for that change. Such change can be most successful when policymakers operate as 'boundary spanners' in policy networks and across separate policy domains (Mintrom & Norman, 2009; Teisman et al., 2009).

We might expect in our case studies that policymakers will operate as policy entrepreneurs, achieving policy change through effective use of the networks. Because cities suffer increasingly from limited financial means, and because climate adaptation has a relatively low political priority, a strategy to search for links with existing or planned initiatives could strengthen the adaptive capacity in cities (Carter, 2011). In other words, fostering goal intertwinement between various policy networks might bind actors together, creating opportunities to share costs so that new solutions can emerge (Koppenjan & Klijn, 2004).

The EU has promoted transnational policy networks. These networks are characterised by a high dependence on the policy sector, depoliticised policymaking, the dependence of supranational agencies on other agencies to deliver a service, and the pursuit of aggregating interests (CEC, 2007; 2009). However, transnational policy networks may also affect the cities' room to manoeuvre (Rhodes, 2000). This can be a hindrance to context- and location-specific climate adaptation. In addition, depoliticised policymaking can restrict local political support (Biesbroek et al., 2011). European cities are increasingly involved in transnational policy networks (Heinelt & Niederhafner, 2008; Kokx & Van Kempen, 2010). They cooperate transnationally in order to develop common policies and gain access to EU project funding. In such networks, cities act autonomously and voluntarily. The networks are a form of polycentric, horizontal, and non-hierarchical self-governance; decisions within the network are directly implemented by its members. Members of the networks can be local governments, scientific institutions, businesses, NGOs and individuals (Keiner & Kim, 2007). In the case of the EU, transnational city networks enhance its governing capacity to implement its policies without requiring it to engage with the nation states. Policy entrepreneurs that mediate between the transnational city network and local policy networks have the potential to achieve the most successful policy change and political support.

However, transnational city networks are increasingly focused on only one policy field (Kern & Bulkeley, 2009). This can be a hindrance to an integrative approach to climate adaptation because it promotes the maintenance of entrenched sectoral policy communities (Keiner & Kim, 2007), whereas effective climate adaptation requires both integrated solutions and heterogeneity of governance networks (Adger, 2010; Adger et al., 2005; Biesbroek et al., 2010; Füssel, 2007). To summarise, the success factors of these transnational policy or city networks are the learning and linking of these networks with heterogeneous local networks and local politics. The fail factors are depoliticised policymaking, a lack of discretion, a sectoral focus, and the neglect of the local context. Together, these success and fail factors provide a backdrop for our analysis of the performance of EU climate adaptation projects at the adaptive capacity level of the selected Dutch cities.

3. THE PROJECT GRABS

Municipalities, provinces, universities and non-profit organisations from eight different countries collaborated in the EU project GRaBS (2008–2011). This project aimed at exchanging knowledge and experiences to provide decision makers, politicians, communities and planners across Europe better information on urban adaptation challenges and appropriate measures to accommodate climate change impacts (Holstein and Schwaberger, 2011). We will discuss the case study of Amsterdam's Nieuw-West Borough. The neighbourhood, numbering about 138,000 inhabitants (2011), is characterized by its many ethnic minorities, its below-average personal income levels, and its own elected council and Executive Board.
The four main objectives of GRaBS were:

- To raise awareness and increase the expertise of professionals in spatial planning to adapt to projected climate scenarios;
- To develop adaptation action plans to coordinate the delivery of urban greening and adaptation strategies;
- To develop a risk and vulnerability assessment tool to help strategic planners with climate change adaptation responses;
- To improve stakeholders and community understanding and involvement in planning, based on positive community involvement techniques.

3.1. MOTIVATION TO PARTICIPATE IN GRABS

Engagement in transnational policy networks reflects a political sense of urgency to achieve climate adaptation (Biesbroek et al., 2011). According to the GRaBS local public manager in Amsterdam, the most important reason for partners to participate in GRaBS was that it provided the best opportunity to become collectively involved again. However, climate adaptation appeared to not be an important political issue at the local level (Biesbroek et al., 2011), as a senior environmental civil servant in Amsterdam illustrated: 'Of course, the borough has environmental and sustainability priorities, but when we decided to start the project, climate adaptation policy was definitely not a spearhead within these policies.' (Local Public Manager, Amsterdam).
Moreover, public officials in Amsterdam saw it merely as an opportunity to create a link with protecting green spaces. Consequently, climate adaptation was not the driving force behind participation in the project, but it was used as a means to link to other networks and to local public officials' own strategies. This illustrates an opportunistic motivation to get involved in these transnational city networks.

3.2 INCREASED AWARENESS OF PROFESSIONALS

According to public officials involved in the Amsterdam case, GRaBS led to an increased internal awareness for urban planners and green design professionals because a direct link had been made between climate adaptation and the preservation of the green spaces. 'It could also have been another relation, but coincidentally this sentiment is very strong here and very many people, especially urban and green designers, are keen on it' (public official, Amsterdam).
Another public official (Amsterdam) stressed that climate adaption had offered new challenges to professionals in urban planning: 'It isn't that the task is radically different now, but it offers them new perspectives for doing things in spatial policies that they have done in the past' (public official, Amsterdam).
This illustrates the incremental change of climate adaptation policies (Lindblom, 1959) wherein knowledge from the transnational policy network can be an inspiration for other local policy makers (Dolowitz & Marsh, 2000).

3.3 CLIMATE ADAPTATION ACTION PLAN

During the second and third year of the project, the local focus was primarily on the development of the climate action plan. According to the public officials, urgent climate-related problems were not a trigger for developing this plan. Rather, it was a requirement of the GRaBS partnership, and therefore the initial focus was on pilot projects to implement existing knowledge: 'That was also our goal at the start of GRaBS: We must have some pilot projects. We are not developing new knowledge, but are applying existing knowledge. At a certain point in the process, the partners were all obliged to organise their projects and procedures in exactly the same way" (GRaBS manager, Amsterdam).

This quote illustrates the coercive character of the transnational city network (Dolowitz & Marsh, 2000; Rhodes, 2000) by virtue of the fact that it required similar procedures and deliverables (Kern and Bulkely, 2009) in order to aggregate interests (Rhodes, 2000). This case also reveals that different cities can have very different perceptions (March & Olsen, 1976) about the most effective way to increase their adaptive capacity. Therefore, cities in this transnational city network are less autonomous than one may expect (Keiner & Kim, 2007).

Furthermore, the aim of GRaBS was that the climate adaption plan would serve as one of the leading concepts in future urban planning in order to achieve policy change. Every spatial plan must now include a paragraph on climate and address climate adaptation policy. This promotes only a sectoral focus on climate adaptation, whereas real policy integration might offer more opportunities to increase the adaptive capacity (Adger et al., 2005; Biesbroek et al., 2011; Füssel, 2007). Additionally, according to the same official in Amsterdam, the climate adaptation plan offers no guarantee of effective climate adaptation in the future, as the adaptation plan, due to lack of real political will, may only be used as 'window dressing' (Biesbroek et al., 2011).

According to the manager of the urban design department (Amsterdam), the spatial project managers, in particular, are not very enthusiastic about climate-proof neighbourhoods because they immediately suspect that costs will run up. In general, policy makers involved in the transnational policy network achieve little or no professional support for climate adaptation in other policy domains. (Mintrom & Norman, 2009; Kern & Bulkeley, 2009). There is also the risk that a lack of urgency will lead to diminishing interest in climate adaptation in the future, as the GRaBS manager (Amsterdam) pointed out: 'I think this is a major risk. The project is coming to an end and there is a real risk that the momentum behind the project will diminish once it's finished. There is always the risk that interest will disappear completely, due to a lack of a sense of urgency in the borough' (GRaBS manager, Amsterdam).

So we see that the urgency of climate change was not the main trigger behind the development of the climate action plan, rather, it was drawn up to meet a formal requirement of the GRaBS project (Kern & Bulkeley, 2009; Keiner & Kim, 2007; Dolowitz & March, 2000; Rhodes, 2000). The public officials' initial aim to start with pilot projects, in order to build momentum for policy change (Mintrom & Norman, 2009; Huiteman & Meierink, 2010), vanished, and the climate adaptation plan did not guarantee that adaptation would take place in the future. This was due to a lack of intrinsic political motivation, which hampered real policy change towards climate adaptation (Briesbroek et al., 2011). However, the outcome could have been different if local policy entrepreneurs from the transnational policy network had operated as real boundary spanners between separate policy domains and local politics (Mintrom & Norman, 2009; Kern & Bulkeley, 2009). Unfortunately, the focus on the timely completion of (sectoral) requirements within the EU project limited this opportunity.

3.4 ASSESSMENT TOOL

One of the requirements of the GRaBS project was implementing a local risk and vulnerability assessment tool. The tool was based on a Geographical Information System (GIS). The main aim was to assess current vulnerability, with an additional assessment of relative spatial patterns of risk, in order to develop appropriate policies and guidelines to include in the local adaptation action plans. However, the public officials from Amsterdam who were involved described difficulties in using the tool. These difficulties arose from obtaining the correct input data from the various fragmented departments in the city authority. As a result, the usefulness of the assessment tool was questionable: 'GRaBS has made a toolbox. But, here and there I have my doubts about it. How useful is it? I don't think it has enough information to help us, especially us designers. I can't use it as a design tool' (manager of the urban design department from Amsterdam).

In the end, local public officials from Amsterdam used another existing tool, which was originally designed for environmental and water policies. Overall, the GRaBS project has not led to increased knowledge on climate effects: 'As far as the supposedly enormous increase in knowledge on climate effects at a borough level over the three years of the GRaBS project is concerned, to be honest, I don't believe this to be the case. However, if you want to be specific, then you have to address the issue of causality. It is therefore hard to assess the effectiveness of climate adaptation policy' (GRaBS manager, Amsterdam).

An accurate, context-specific (Adger et al., 2005; Nelson et al., 2007) assessment tool at a borough level is difficult to develop even in practice. Thus, the transnational policy network is seriously limited in developing context-specific knowledge (Dolowitz & Marsh, 2000). This hard evidence would be necessary to raise climate adaptation on the political agenda. In consequence, the effectiveness of the tool for increasing local adaptive capacity is restricted. When compared to the use of similar tools planning and policy making, they meet similar critics (Vonk et al. 2007). Van Stigt (et al. 2015) recommend to use a user perspective in order to overcome context specificity and create a demand for such knowledge.

3.5 STAKEHOLDER AND COMMUNITY INVOLVEMENT

One of the aims of the GRaBS project was to enhance adaptive capacity through network building (Adger et al., 2005; Füssel, 2007; Runhaar et al., 2009; Carter, 2011). According to the GRaBS manager from Amsterdam, this was their most important objective, namely, to develop a network of residents and stakeholders. During the first year of the project, greater attention was paid to the knowledge exchange between international partners on community participation. Therefore, resident participation was limited and not focused on increasing residents' adaptive capacity (Adger er al., 2007). Later in the project, residents were not involved at all: 'We took the decision internally not to organise a separate participation project for the climate adaptation plan, but we have included principles to structure residents' participation' (GRaBS manager, Amsterdam)

Furthermore, no coalition building process was organized involving other residents or other stakeholders, such as housing associations. According to the public officials from Amsterdam, the housing associations would not have been interested in becoming involved because of their fear of potential cost increases: 'Currently, a housing association is not really responsible for any investments with respect to climate adaptation. And this is the point: They get a little bit sick of all these extra quality requirements, because they translate them into an additional cost. In Amsterdam, we have a system of a basic quality and in the case of anything above this, they say: Okay, we'll do it, but any more, and you will have to pay for it' (public official, Amsterdam)

Although the public officials' initial aim was the involvement of residents and other stakeholders, the focus changed during the course of the project to knowledge exchange within the closed GRaBS transnational city network. As a result, no local networks were developed to achieve policy change (Mintrom & Norman, 2009; Kern & Bulkeley, 2009). This implies that the potential adaptive capacity, through the heterogeneity of the stakeholders involved and opportunities to search for goal intertwinement, was not used effectively.

3.6 POLITICAL ATTENTION

One of the agreements between the partners in the GRaBS project was that the local authorities approve the climate adaptation plan. However, public officials from Amsterdam thought that the GRaBS project did not lead to greater political support for climate adaptation, even though the Climate Adaptation Action Plan was formally approved by the Borough Executive Board.

Ultimately, the policy makers in the transnational network did not pay much attention to increasing political support. Because formal political decisions about climate adaptation have not led to serious political action (Adger et al., 2005), the overall performance of the project was rather limited. Reasons for the lack of political interest included higher policy priorities for local politicians, such as tackling social deprivation, and the current lack of urgent climate problems. According to one official from Amsterdam, politicians are afraid that any investment in climate adaptation would give the wrong signal to other priorities in the borough (which they perceive to be urgent). Furthermore, local politicians often do not link low-income residents with vulnerability to climate change (Adger et al., 2007). Politicians' fear of additional financial claims also contributes to the lack of policy innovation in climate adaptation. One policy official from Amsterdam thought that climate adaptation should not even be that dependent on political support:

'I don't think you should rely on politics for this. It needs to get internalised in the regular organisation. This is why our approach is not to position it as a separate item on the agenda and to take action accordingly, but to integrate it in existing projects (…) Perhaps it's more effective not to talk about it all the time, but to simply get on with it' (policy official, Amsterdam).

In the past, the lack of financial resources has triggered public officials and politicians to opt for EU funding. However, this project has illustrated that EU funding is no guarantee that politicians will put climate adaptation higher on their agendas.

To summarise, the findings in this case study reveal that this transnational policy network did not enhance the local adaptive capacity. Fail factors were the sectoral approach, the lack of discretion reflected in common procedures and deliverables, the intrinsic limitations of developing context-specific knowledge, depoliticised policymaking, and the lack of attention to building up broad local professional networks and local coalitions to share resources and achieve policy change.

4 THE PROJECT FUTURE CITIES

In the 'FUTURE CITIES' project (2008–2012), twelve European partners from local authorities, water boards, planning companies, and project developers collaborated on green structures, water systems and energy efficiency. The city of Nijmegen in the Netherlands was one of the partners that contributed a case study. The project had four main objectives:

- Development of common evaluation methods for climate-adapted towns and cities – leading to an assessment check for climate-proof cities;
- Establishment of action plans for current structures so that the participating regions can adapt their strategies in a concrete manner;
- Implementation of combined construction solutions in pilot projects;
- Raising awareness among decision-makers and other influential groups about pro-active ways of tackling adaptation to climate change impacts (www.future-cities.eu).

4.1 MOTIVATION BEHIND PARTICIPATION IN FUTURE CITIES

The Nijmegen local authority stated that its reason for participating in FUTURE CITIES was to obtain additional financial resources: 'We only participate in those European projects for the money, just as everyone else does' (senior public environmental official, Nijmegen).

In addition, public officials from Nijmegen saw the FUTURE CITIES project as a chance to implement the city's water management policy along with a greening plan for the inner-city (Groene Allure Binnenstad), which already had political commitment: 'FUTURE CITIES didn't generate the greening programme. There was already commitment for it, and that's how we were able to introduce it in FUTURE CITIES (…) What is clear in a European project, is that everyone needs to support it. The Executive Committee and Management need

to support it in some way, because it will also cost the city a lot of money. Half of the budget has to be co-financed, but actually you should do much more' (public official, Nijmegen).
Hence, rather than the improvement of climate adaptation policies, it was the access to additional financial resources for their own programmes that motivated Nijmegen officials to get involved in the new EU project.

4.2 ASSESSMENT TOOL

One of the requirements of the FUTURE CITIES project was that partners should create a climate adaptation model or tool ('klimaatadaptatiecompas') for developing appropriate measures. The tool would demonstrate the effects of climate change on the city, the risks associated with those effects, opportunities, vulnerability and green and blue climate adaptation measures. However, just as in Amsterdam, the partners discovered: 'the difficulty is often that these measures can be linked to a street or a small project, but less easily to a larger entity, such as the district or neighbourhood level, because here things are so hard to bring together' (public official, Nijmegen).
Ultimately, it would be unrealistic to try to develop a common climate model, because the local context demands very specific information (Adger et al., 2005; Nelson et al., 2007). Add to that the scepticism of the involved parties and the usefulness of the model became very limited:
'We participate in the model for FUTURE CITIES, but I don't have much faith in it. In the end, most of the information comes from us (…) Actually, you have to do this at your own level. A tool is useful to guide you a little bit, but nothing more' (public official, Nijmegen).
In other words, although Nijmegen cooperated in the development of an assessment tool, stakeholders questioned its effectiveness. Just as in the GRaBS project, this illustrates the serious limitations in developing context-specific knowledge for transnational policy networks (Dolowitz & Marsh, 2000).

4.3 IMPLEMENTATION OF COMBINED MEASURES

Nijmegen public officials pointed out that their inner-city greening programme was used as a pilot project in the FUTURE CITIES programme. This was combined with their programme to disconnect roofs and paved surfaces from the sewer system. Both programmes started several years earlier than the FUTURE CITIES project. Therefore, no new policies were developed. Instead, public officials linked climate adaptation with the existing greening and water management policies on a project-by-project basis (VROM, 2010). This implies that participating in the transnational city network did not lead to new policy development for climate adaptation at the local level.

4.4 RAISING THE AWARENESS OF DECISION-MAKERS AND STAKEHOLDERS

Climate adaptation is not yet an important issue on the political agenda, due to former climate policy priorities, such as climate mitigation:
'The political agenda sets its own priorities. Despite the fact that they formally participate in EU projects, there are no aspects that the Executive Committee is immediately positive about. They consider sustainability as being of paramount importance. It is even part of the Coalition Agreement (…) But, all the years the local alderman has been in office, he has focused specifically on a related subject, namely climate mitigation' (senior policy officer, Nijmegen).
This implies that local climate policies are difficult to move in a new direction (Lindblom, 1959; Sabatier & Jenkins-Smith, 1993). Furthermore, according to the public officials from Nijmegen, substantial local budget cutbacks (50% of the previous budget) for implementing the greening the inner-city programme will make it difficult to implement green measures. Under these conditions, local politicians often prevent officials from developing new policies. This has led to climate adaptation policy being used merely as window dressing, only referring to existing policies (the greening and the disconnection programme) without taking it any further on

the policy agenda. This illustrates the politicians' opportunistic use of EU funding to implement regular policies, rather than using it to develop new climate adaptation policies.

In addition, public officials from Nijmegen perceive compartmentalisation within the municipal organisation an important barrier for the implementation of climate-proof elements in urban planning (Mees & Driessen, 2011): 'Our project leaders (in the urban planning department) work alone during the initiation phase. And this is the phase when it's decided if a project is going to be profitable or not. Then, plan economists are put to work. They only calculate initial costs, namely land development costs. They do not look at maintenance, nor at any initial or potential opportunities. These are not in the picture (…) Then, we suddenly sit down together and all think about it, but in the meantime some things have already been decided, which we are not allowed to change anymore' (public officer, Nijmegen).

This indicates that climate adaptation is not really integrated in urban planning, despite the fact that many authors stress the importance of this to facilitate the adaptive capacity (Adger et al., 2007; Blanco et al., 2009; De Bruin et al., 2009). For instance, goal intertwinement, which fosters synergic effects and shared costs, needs some sort of integration into urban planning processes (Koppenjan & Klijn, 2004). In addition, according to the public officials, the housing associations' commitment to climate adaptation differs depending on their willingness to be innovative and to invest. Housing associations and real estate developers perceive a green environment in particular as a sales tool in which, more particularly, the local authority invests and developers profit. As a public official observed: 'It sells well, and those real estate developers run off with the profits' (public officer, Nijmegen).

Finally, the transnational policy network FUTURES CITIES has not substantially enhanced the local adaptive capacity. Factors that contributed to this disappointing result were the limitations of this EU project to develop context-specific knowledge and the local focus on implementing only existing policies within the transnational policy network framework. Furthermore, policy entrepreneurs in this EU project invested little effort in involving other professional networks and stakeholders (Mintrom & Norman, 2009; Koppenjan & Klijn, 2004). Such involvement would have enhanced the adaptive capacity by sharing resources and could have overcome policy fragmentation. Other detracting factors were the dominance of climate mitigation policies and the political ban on making new policies.

5 SYNOPSIS

Our main question studied to what extent the EU climate adaptation projects could contribute to increasing the adaptive capacity of the participating cities with transnational policy networks. To answer this question, we applied a reflexive approach (Huitema et al., 2011) to evaluate the performance of two EU projects, namely the GRaBS project in the Amsterdam Nieuw-West Borough and the FUTURE CITIES project in the city of Nijmegen. The findings and synopses of the two case studies lead to three conclusions.

First, our main conclusion is that EU climate adaptation projects do not necessarily lead to an increased adaptive capacity on the local level. Evidence of this can be found in the way politicians use these types of projects to finance their regular policymaking. This attitude severely damages the effectiveness of the projects' empirical goals. Our findings reveal the way EU projects are filtered down in regular policymaking in Dutch municipalities and how the actual goal of improving climate adaptation gets watered down. This opportunistic political behaviour is a key detracting factor leading to the rather disappointing results of these EU projects in enhancing the local adaptive capacity.

Second, the EU project requirements for delivering common policy instruments can function as a straitjacket (Rhodes, 2000). They hinder the development of context- and location-specific climate adaptation measures and processes (Adger et al., 2005; Nelson et al., 2007). The common instruments can even be counterproductive. Their usefulness at the local or neighbourhood level is highly doubtful (see also Dolowitz & Marsh, 2000).

Third, the internal focus on timely deliverables draws attention away from local network building. Therefore, it is doubtful if the internal sectoral focus of the closed transnational policy networks will be effective in the longer term, due to a lack of attention to building up long-term stable local coalitions between politicians, the private sector and civil society (Mintrom & Norman, 2009; Kern & Bulkeley, 2009; Keiner & Kim, 2007; Koppenjan & Klijn, 2004). It is clear that all these factors are interrelated and have a negative cumulative impact on the performance of these transnational policy networks at the adaptive capacity level in the cities involved.

Table 1 gives an overview of the findings in the two case studies.

MAIN CHARACTERISTICS	GRABS	FUTURE CITIES
Time-span of the EU project	3 years (2008-2011)	4 years (2008-2012)
Network members	Local and provincial governments, universities, non-profit planning and development companies	Local governments, water boards, for profit companies in planning and real-estate
Scope	Green and blue infrastructure in existing and new mixed-use urban development	Green structures, water systems, energy efficiency in existing urban structures
Motivation to participate	Nieuw-West Borough, Amsterdam: Continuity of cooperation with former partners Strategy to link climate adaptation with protecting the green structure	Local authority of Nijmegen: Continuity of EU funding Strategy to implement own existing policy programmes
EU projects' aims	Results	Results
Raising awareness/increasing expertise of professionals and decision makers	+ Urban and green designers – Spatial project managers – Politicians: lack of sense of urgency; other policy priorities; lack of budget Result: Policy fragmentation Lack of political support	– Spatial project managers – Politicians: lack of sense of urgency; window dressing; other policy priorities; ban on making new policies; lack of budget Result: Policy fragmentation Lack of political support
Developing a climate adaptation tool	– Not useful as design tool at the city district level – No increased knowledge about local climate effects Result: Inadequate context-specific climate adaptation tool	– Not useful as climate adaptation tool at the district or neighbourhood level Result: Inadequate context-specific climate adaptation tool
Development of climate adaptation action plans	Requirement of EU project – No guarantee for actual climate adaptation action Result: Instrument for window dressing	-

Implementation of combined measures	-	Linking climate adaptation with existing greening and water management policies Result: No policy innovation
Stakeholder and community involvement	+ Most important own aim during the start of the project – In practice, no broad local network developed owing to the focus on common deliverables and knowledge exchange within the project Result: No heterogeneity of local adaptive capacity	– No sharing of investment or profit Result: No heterogeneity of local adaptive capacity
Overall performance on the local adaptive capacity	Limited	Limited

Three-point scale for the contribution of the EU project to the local adaptive capacity: – (minus) negative contribution; +/–: neutral (no negative or positive contribution); + (plus) positive contribution.

Tab.1 Comparison of climate adaptation projects

6 CONCLUSIONS

Where does this leave European environmental policy? This paper addresses a dilemma of European policymaking: issues such as climate adaptation, as well as flood risk management (Hartmann, 2011), territorial cohesion (Hartmann & Hengstermann, 2014) and European corridors (Witte, 2014) require a common European approach, but the measures need to be implemented on the local level. There is a need for European frameworks for these issues, however, their location-specific contexts require a greater scope for discretion in their implementation on the local level (Reinhardt, 2008). Unfortunately, this scope for discretion and freedom at the local level allows opportunistic behaviour for stakeholders.

The above analysis reveals the constraints and limitations of implementation at the local level for EU funded projects. An important lesson learned is that in order to strengthen the adaptive capacity in today's European cities, a context-specific, integrative approach in urban planning is needed at all spatial levels. In this way, policy entrepreneurs can make a linkage between the issues in the transnational city network and the concerns in local politics and local networks. Therefore, realising a genuine, joint working capacity within and between institutions and the community involved in integrative urban planning strategies on all spatial levels is an urgent challenge that must be addressed in order to foster effective climate adaptation policies and to share costs (Hartmann & Spit 2014). This also implies that in urban governance research and practice (EU, national, local), much more attention should be paid to important process conditions and contextual factors for long-term capacity building in order to enhance adaptive capacity in cities. The opportunistic behaviour or local policymakers hinders the effective and efficient implementation of European policies. However, this claims not necessarily for more strict central policymaking (Wegener, 2012) or more rigorous reporting. Effectiveness and efficiency are not the only criteria for policymaking in Europe – the democratic legitimacy or fairness are other criteria (Hartmann & Spit 2015). This also means that in the future, transnational policy network projects are an option for pursuing climate adaptation, but the steps in policy change that they achieve might be very confined, due to the above stated reasons. This paper does not suggest changes in the approach of the European Union to implement policies via projects like GRaBS or FUTURE CITIES. It rather provides insights in its implementation and sets an agenda for further research: namely further research is needed on the matching and mismatching between intrinsic motivations of local policymakers and transnational policy objectives. In particular with a long-term issue such as climate adaptation, it is essential that future European projects respond to those motivations (in place of suppressing them). We must also accept that policy change for climate adaptation in cities still implies incremental change, due to the very specific local circumstances and conditions.

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IMAGE SOURCES

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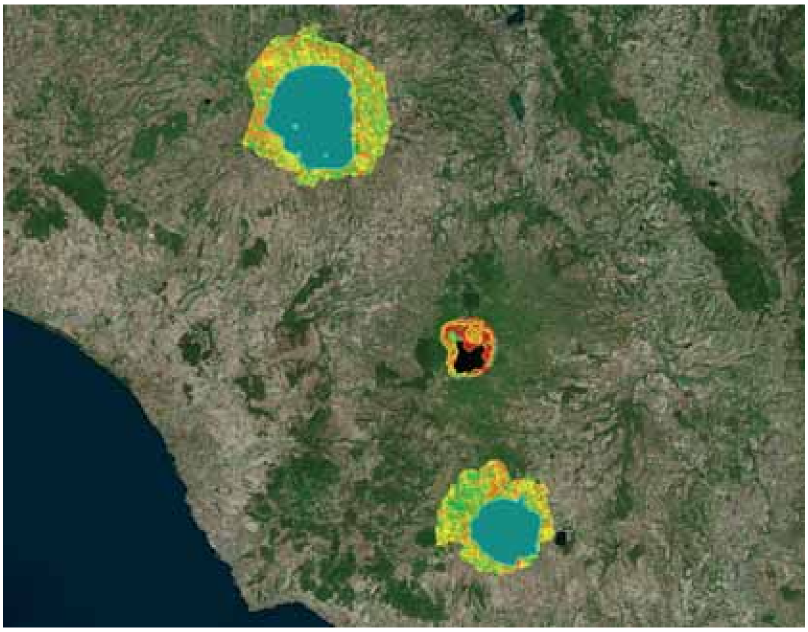

INTERACTIVITY OF WEBGIS FOR THE SIMULATION OF LAND DEVELOPMENT

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ABSTRACT

In the definition of scenarios as key components underlying the decisions on city's and territory's transformation processes stands the comprehension of the interactions between multiple aspects that influence that dynamics.
The spatial data knowledge and the development of new ICT solutions which can guide the planner towards strategic, reliable and shared decisions are essential.
It is proposed a methodology in which to specialize the special approach established in previous projects developed by extending and implementing GIS technology Geographic Information System towards online interoperability.
The control of the effects of changes in land use in environmental quality, particularly in the water resources management, can thus become operational in the network through the application of innovative tools able to meet the new challenges of urban regeneration.

KEYWORDS:
GIS, WEBGIS, simulations, land use planning

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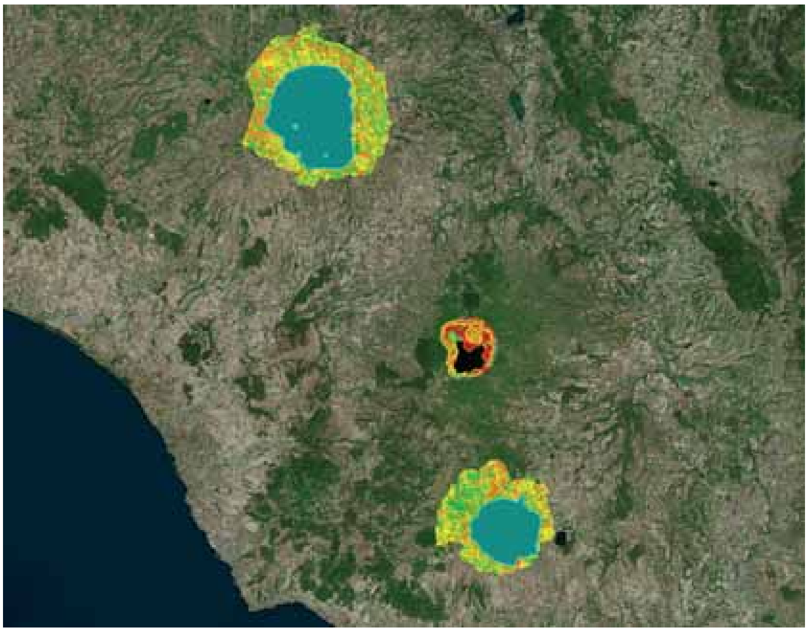

土地开发模拟中WEBGIS的交互性

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摘要

在对城市与土地转化过程进行决策时，有一些情境是支撑决策的关键组成部分． 在对这些情境解释时，需要理解对这一动态形成影响的多个方面之间的互动．空间数据知识与新信息通信技术解决方案的制定至关重要，它们可以指导规划者做出具有战略性，可靠性与共享性的决策．
这提出了一个方法，能够将在以往项目中业已形成的特别方法专门化，这些项目的开发是通过延伸并落实 GIS 技术地理信息系统的在线互操作性而实现的．通过应用能够应对城市重建新挑战的创新工具，控制用地变化对环境质量造成的影响尤其是水资源管理 在网络中将具有可操作性．

关键词

模拟，土地使用规划

1 INTRODUCTION

Between 2009 and 2050, the world population is expected to increase by 2.3 billion, from 6.8 to 9.1 billion.
At the same time, urban populations are projected to increase. Thus, the urban areas of the world are expected to absorb all of the population growth over the next four decades; today around half of the people living on earth are living in urban areas and by 2050 that proportion will be 70%. Furthermore, most of the population growth expected in urban areas will be concentrated in the cities and towns and their surroundings.
The new contemporary landscapes, need special attention to the design of open spaces, of voids, of marginal or disposed areas, of interstitial spaces, of the so called SLOAP, the "Space Left Over After Planning", for urban peri-urban and regional regeneration.
Following an inter-scalar approach will allow coordinated and consistent actions from the local scale of the architectural dimension to the wide-scale of land planning.
In this perspective, it is clear the relevance of care and management processes of natural and man-made territory to counter those phenomena of degradation, abandonment or even damage of land resources and landscape.
In urban areas, for example, the phenomenon of the flow of surface water (run-off) is now considered a major source of degradation of rivers and lakes.
In the urban environment the waterproofed surface of paved areas and buildings, promoting the reduction of the time of concentration fosters the rapid run-off to the receiving bodies.
The receiving bodies gather then, from storm water, untreated waste water and water full of nutrients, sediment and solid material variously polluting.
The purification of rainwater filtered slowly through the soil, as happens in natural environments such as forests, grasslands and wetlands is prevented in urban areas from sealing terrain.
The influx of large volumes of water that occurs at prolonged or intense rainfall events, determines morphological and hydrological significant consequences on the receiving bodies related to the sudden increase of flow and velocity of runoff and erosion.
The sudden increase of the flow and the speed flow rates causes harm to fish and other aquatic life, or can make useless the body of water for which is designated (drinking water, bathing water, irrigation water).
The need for effective control and management of the flow of water of the urban areas and especially of the large metropolitan areas is evident.
Issues related to greater environmental sustainability of built areas and the conservation of soil as non-renewable resource push towards finding solutions to strategic planning for future scenarios of management and regeneration.
The European Innovation Partnership on Water - EIP Water in short - is an initiative within the EU 2020 Innovation Union. The EIP Water facilitates the development of innovative solutions to address major European and global water challenges and has identified five thematic priorities: water reuse and recycling; water and waste water treatment, including recovery of resources; water and energy integration; flood and drought risk management; and the role of ecosystem services in the provision of water related services in both urban and rural areas.
The answer to these immanent needs is the construction of appropriate ICT tools to address the greatly accelerated urban dynamics and to drive the reduction of pollution linked to the urban water cycle.
For this purpose, it is essential to know the characteristics of the present context and therefore the availability of geographic information. A Geographic Information System (GIS) can be defined as the set of technologies that can perform any operation on geographic information, from acquisition and compilation through visualization, to querying, modeling analysis, sharing and archiving. (Longley et al., 1999, 2010). As claimed by the geographer Michael F. Goodchild, the GIScience has as its challenge to find useful and

effective ways to capture and represent the infinite complexity of the geographical domain in the limited space and in the binary alphabet of a computer. Alongside this there is the challenge of characterizing what is inevitably left out, and the evaluation of its impact on the results of GIS operations.
With the Legislative Decree no. 152/99 and subsequent amendments, the legislature for the first time deals with the problem of impacts related to storm water (Article 39, paragraph 1).
The decree refers to Regions the regulation of cases where the runoff water, first rain and washing of the external areas are conveyed, collected and purified, in relation to their activities, if there is risk of pollution by hazardous substances or otherwise substances that may adversely affect the achievement of the objectives of quality of water bodies (Article 39, paragraph 3).
The issues object of this research are widely shared at European level and are in line with the principles of the Joint Programming Initiative of the European Community in the field of new challenges "Water challenges for a changing word".

2 STUDY AREA

As paradigmatic case studies were chosen the neighborhoods of Acilia and Infernetto in an area in the south of the city of Rome, whose surface waters are drained from the channel Palocco. Acilia Infernetto and are two of the peri-urban neighborhoods of Rome that have clear problems related to urban expansion, which began in the 50s, and related to the soils sealing. The Palocco Channel, located between the districts of Acilia and Infernetto, falls into that category of canals / ditches whose bed, a time of natural origin, was deputy to the drainage of surface water from a purely natural environment or, at most, semi - natural in the case of the presence of areas intended for farming and grazing.
Today this channel is being profoundly altered with a waterproofed riverbed that is required to perform its hydrological function in a highly urbanized environment.
Currently the Palocco Channel, which extends for a length of about 10.500 kilometers, drains the water coming from the districts of Acilia and Casal Palocco - Infernetto (approximately 100,000 residents) before crossing the Presidential Estate Castelporziano protected area and thus reaching the Tirrenian sea.
The main problems ascribable to this waterway are linked to hydrological instability, the transport of pollutants from diffuse sources of pollution and the high social and economic costs that its management put in place.
The mitigation of these problems, in addition to the increasing risk due to intense rainfall events becoming more frequent, it is now necessary to comply with Directive 2000/60/EC. The full and correct implementation of the Directive 2000/60 / EC, WFD (Water Framework Directive), which incorporates the Directive 91/271 / EEC on Urban Wastewater and the Directive 91/676 / EEC on nitrates from agricultural sources constitutes a indispensable condition for the attainment of the "good ecological status" required by 2015.
The management of surface water, is currently the only tool that can limit the system crisis.
For the natural and semi - natural protected area of Castelporziano and Infernetto, the experience gained so far leads to believe GLEAMS (Groundwater Leaching Effects of Agricultural Management Systems; Knisel, 1993) at the field scale and SWAT (Soil and Water Assessment Tool) to the basin scale, the most appropriate management models, which have had even more of an experimental evidence already experienced in the Lazio Region. GLEAMS and SWAT models (in their respective scales) simulate the mobilization of nutrients and pesticides, caused by the rains, in runoff, soil erosion and leaching.
These models are suitable for planning issues precisely because they focus on land use. Depending on land use are then simulated these environmental processes and, for this reason, although physical models, are classified in the category of managerial models.
The simulations allow the impacts' analysis of land management activities and the evaluation of environmental management decisions' performance.

3 OBJECTIVES, MATERIALS AND METHOD

The primary objective is to provide a practical contribution to the construction of the future landscape focusing on quality, well-being and environmental sustainability of the contemporary city and above all of marginal areas to contribute to the optimization of planning and urban regeneration.

Two realized projects are examined in the following to allow the detection of the computer tools able to achieve the set targets towards the definition of a proper environmental sustainability in urban and territorial transformations and in the identification of possible options for action.

The basis of the technological structure is founded on a cognitive analysis of the various aspects that are combined to make the environmental panorama complex such as the characteristics of river beds, banks and the consequent risks both in the soil conservation, in the defense of the landscape values and in the protection of natural resources.

These considerations underlie the analysis and evaluation of territorial systems and rural landscapes, examined in their environmental context and within the framework of natural and anthropogenic faced risks and socioeconomic variables from which are affected.

The acquired result concerns the design of GIS (Geographic Information Systems) for the synthesis between the urban planning needs and nature conservation and for the assessment of vulnerability and environmental risk of the examined areas.

The thematic decomposition into homogeneous layers simplifies the interpretation of both the environmental situation and the stratigraphy of skills and different existing rules leaving those who view the task of interpreting the relationships that exist in reality.

The first example concerns the Urban Planning GIS of a City of more than 65.000 residents in the Lazio Region, the second example concerns the Project created in the collaboration between one SME and some Research Institutions in the further developed of the technology utilized in the first case study.

3.1 URBAN PLANNING GIS

The GIS - Geographic Information System of the City of Viterbo was designed to provide map information, information on planning instruments and for the research of technical practices.

The GIS, allows to manage a large amount of data and is set up as the main reference for all the information and acts of planning. Therefore, the GIS makes available to all citizens, constantly updated data and allows to see the basic cartography to navigate on the interactive maps.

The integrated applications in the GIS allow access to legislation and to the factsheets for each object of interest (metadata) enabling, where necessary, to download forms and official documents.

The GIS - Geographic Information System makes environmental and territorial information available to a wide audience by exploiting the municipal information assets and appears as a chance to boost entrepreneurship and create jobs and new markets.

Transparency on the work of the institutions and the use of public resources becomes therefore possible and the heritage of the information is accessible and located in the territory.

The plurality of geographic data structured in the GIS (Fig. 1) come also from external geodatabase as the one of the National Cartographic Portal, or of the Lazio Region and of the Province of Viterbo as well as from the municipal offices and from Google Maps and Bing (Microsoft). The input data of the Urban Planning GIS cover many themes, from the Master Plan (Piano Regolatore Generale PRG) to higher-level constraints (hydrogeological plan PAI, hydrogeological constraint), cadastral information, road network, sewage system, green network..., all information that contribute to assemble land management and planning essential knowledge heritage.

Fig. 1 Geodatabase scheme

For the construction of the GIS was necessary to proceed to the re-projection of the cartographic bases of the PRG on the ED50 Zone 33 N projection to overlay the planning instrument both on technical maps and on aerial photos.

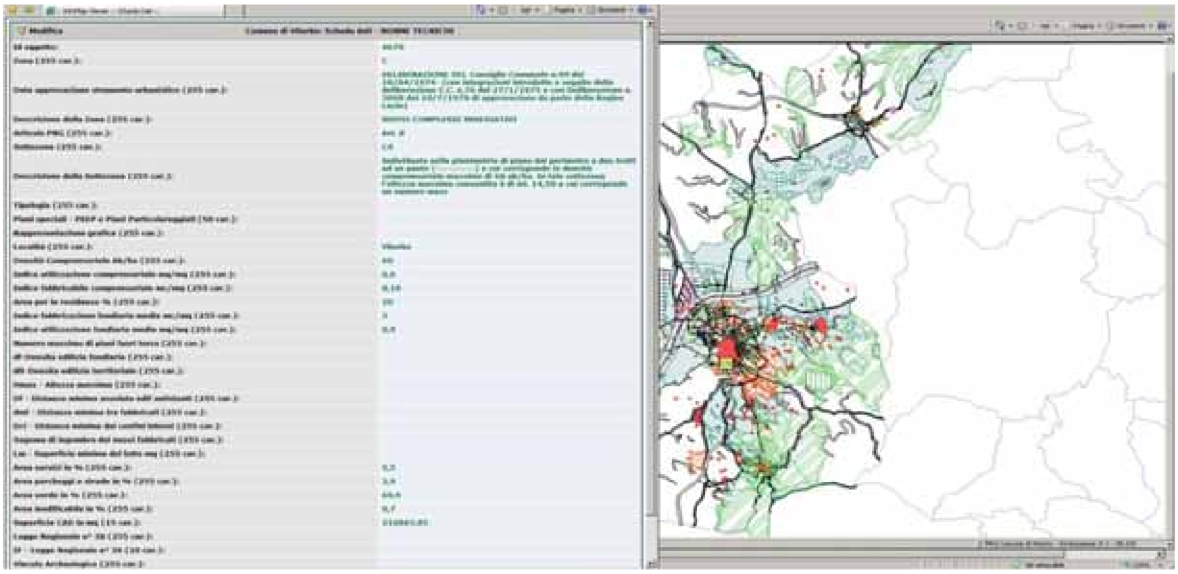

Fig. 2 Example of Web GIS with the information content

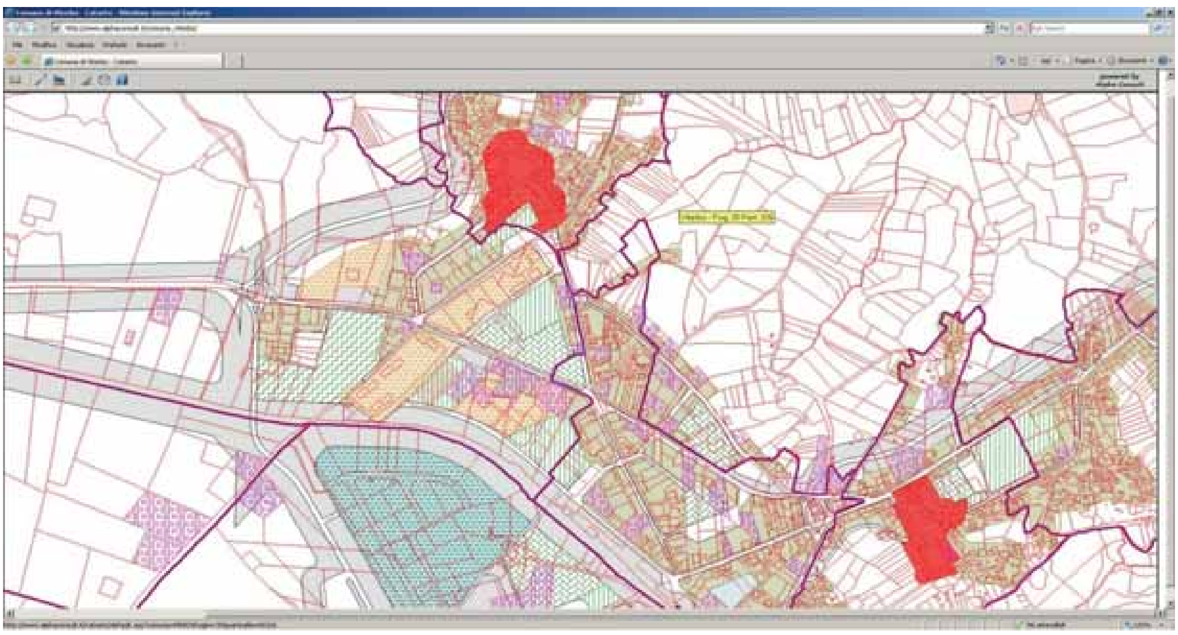

Fig. 3 Example of Web GIS with the PRG and Cadastre overlay

3.2 PROJECT FILAS CO-RESEARCH PST-CSA

The project PST-CSA Strategic Territorial Planning for a Correct Environmental Sustainability comes from the collaboration of a group composed of five research institutes coordinated by the SME Alpha Consult Ltd.
The Project Partners are therefore those listed in the following table (Tab.1).

The project aimed at testing methods of analysis to determine a sustainable planning criteria for environmental systems sensitive to anthropogenic activities which are the volcanic lakes of the Lazio Region and the Pontine plain.
The project portal collects the work of Alpha Consult to realize the on-line Geographic Information System for the dissemination of the data produced by the Research Institutes for the project PST-CSA Strategic Territorial Planning for a Correct Environmental Sustainability.

The project aimed at putting online a web service made up of geographic database queries' tools that relies on the Geographic Information System.

The web service created for the project is provided with a user interface that allows the use of online modeling for interactive study of the impacts that changing land use has on the ecosystem of lakes and reservoirs with mechanical drainage.
Through this online service, the impact of diffuse sources of pollution (mainly nitrogen and phosphorus) on surface water bodies of the Lazio Region, in particular on the volcanic lakes and the drainage canals managed with mechanic drainage, can be analyze and simulate.
The following map shows the study area, comprising the catchment areas of the five volcanic lakes of the Lazio Region and the Pontine plain: Bolsena, Vico, Bracciano, Albano and Nemi.

ALPHA CONSULT	Alpha Consult Ltd.
	University of Tuscia - Department of Agriculture, Forests, Nature and Energy (DAFNE)
CRA-CMA	National Research Unit for Climatology and Meteorology applied to agriculture (CRA-CMA)
CRA-RPS	National Research Centre for the Study of the Relationships between Plant and Soil (CRA-RPS)
	University of Rome Sapienza Department of Architecture and Design (DIAP)

Tab.1 The Project Partners

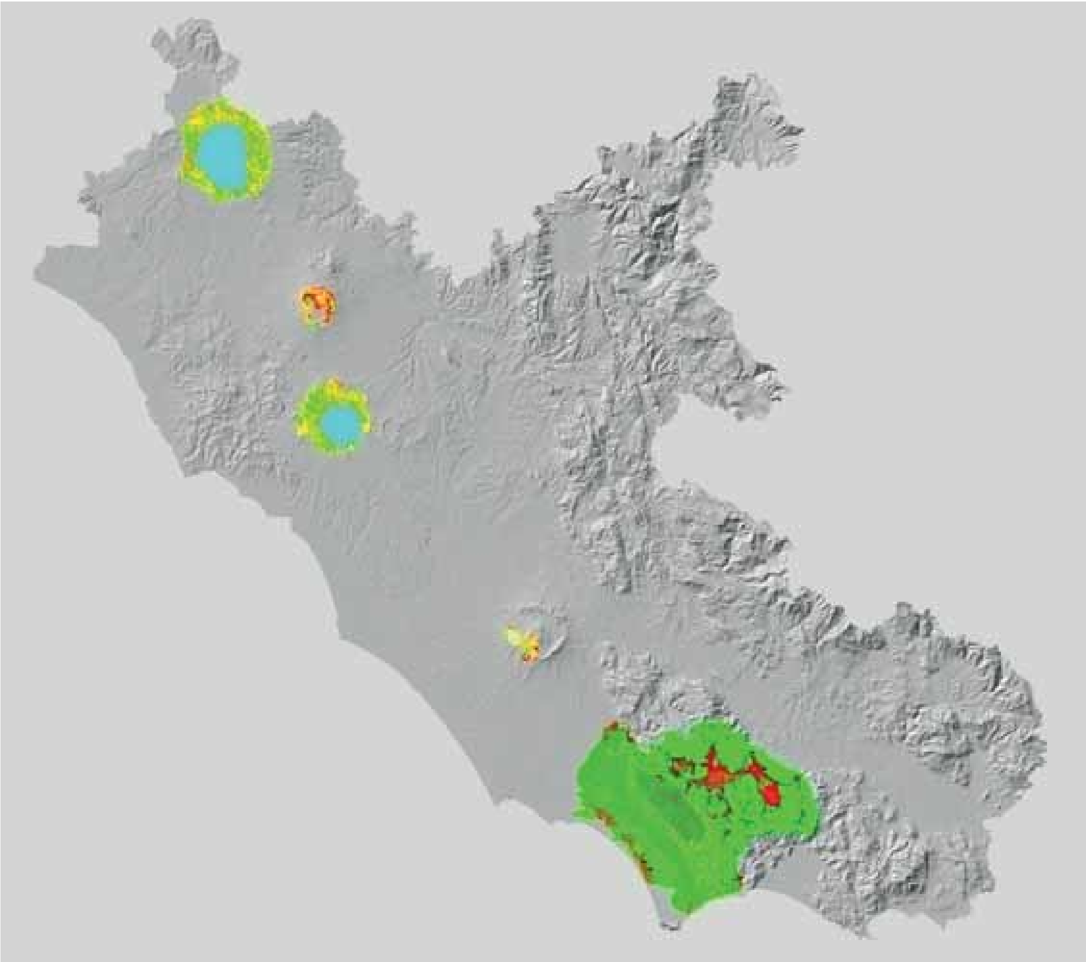

Fig. 4 The case studies: Bolsena, Vico, Bracciano, Albano, Nemi and the basins of the rivers Sisto, Rio Martino and Badino-Amaseno

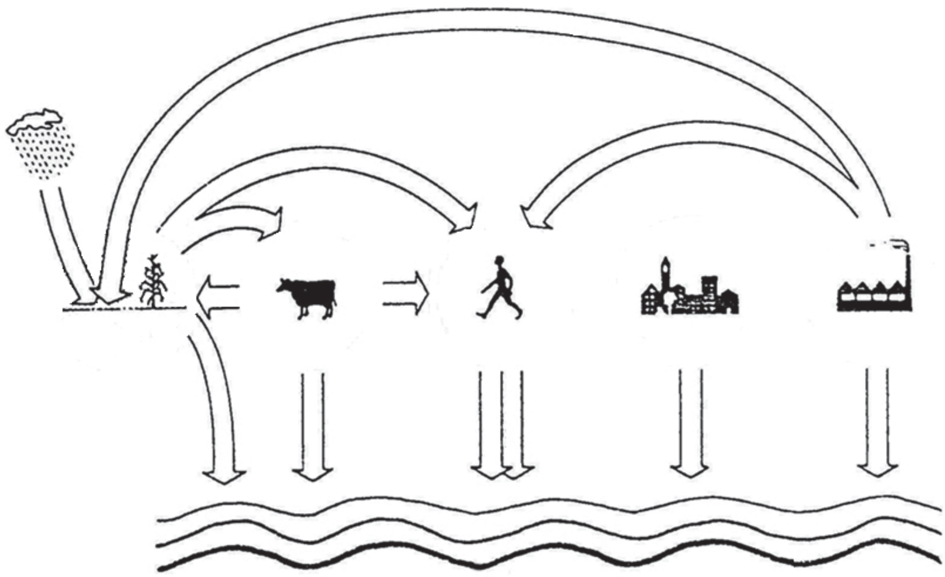

Fig. 5 The direct or indirect impacts on water bodies

The thematic geographical knowledge of the area, whose availability is one of the most challenging issue to be overcome in dealing with environmental topics, derived from years of study by the Alpha Consult and the Research Institutes, were organized in the GIS and poured in the Portal.

Specifically the main topics are those in the following table (Tab. 2.).

- Mapping of the CTR CTRN (scale 5.000 10.000 and 100.000);	- Hydro geological Map of the Lazio Region in 1:25.000
- Cartography IGM 1:25.000 and 100.000)	- Intersection between river basins and TCEV Maps (regionalization of rainfall map)
- Cadastral Cartography	- PRG: Local Government Master Plans
- Administrative boundaries	- Regional landscape Plan
- Aerial photos of 1996, 2000, 2005 and 2010 and from Google maps and Bing	- PAI Hydro-geological hazard plan of the Lazio Region River Basin and of the Tiber River Basin Authorities
- Agricultural soil map of the Lazio Region 250.000	- Ecosystem Services: Riding Trails, Gorges mapping and trails (taken from the planning documents of the Province of Viterbo: the project for the touristic development of the old roman roads such as: Via Cimina, Via Clodia and Via Amerina.
- Land Use maps: _Corine Land Cover 1991: European land use database in scale 1:100,000; _CUS 2005: land use maps by Region Lazio 25.000 _Detailed land use derived from direct ground soli surveys of the project areas with additional photo interpretation by the University of Viterbo "UNITUSCIA" (in progress)	- Archaeological map of the Province of Viterbo
- Watershed maps by the National Printing Office	- Project LIFE Rewetland: The REWETLAND project intends to set up a wide-scale Environmental Restoration Programme in the "Agro Pontino", an area with critical conditions of water pollution, mainly caused by an intensive agricultural activity, with the techniques of constructed wetlands
- Geological Map of the Lazio Region in the scale of 1:25.000	

Tab.2 The main topics

The dissemination of data is obtained extending GIS technology on the internet, providing a powerful tool to share related information available to multiple users simultaneously. In the realization of the project on this platform have been developed accessory functions in order to ensure that in addition to classic queries connected to the polygons on the GIS (to select, view and edit values) the user could also operate to repeat the simulations made by the GLEAMS model highlighting the results on the cartography.

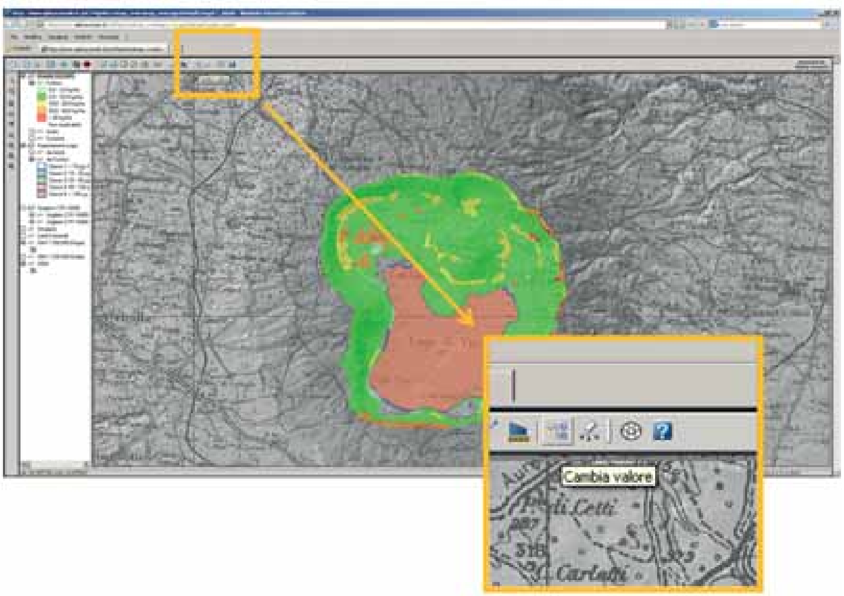

Fig. 6 Accessory functions to perform simulations

To make interactive simulations made with GLEAMS Model the selections made on the online mapping needed to be managed by a number of suitable features that produced the end result. The result is obtained as a given polygon, and as an aggregate of all the polygons in the river basin whereas taken together, provide the environmental quality of the lake.

The main difficulty has been to ensure that the user could perform a interactively simulation changing online the value of land use to view the results in the layer of the health of the lakes.

The legend of the land use map CUS 2005 was reduced to define the land use classes to be included in the model (Fig. 7). Land use classes used for modeling refer to:

- Ryegrass corn;
- Forest;
- wasteland;
- alfalfa or lucerne;
- hazelnut;
- Not applicable.
- Beside the simulation of the contribution of agriculture is assumed to consider the polygon "not applicable" in case the contribution to pollution of the polygon is led through a sewer system to a wastewater treatment plant (the drainage system around the lake).

Fig. 7 The reduced land use classes

The user may decide to change directly on the screen the type of land use of one or more polygons, by acting on the theme of the overlay. The system (geodatabase) identifies the selected polygons and change the value of contributions of environmental modeling parameters such as phosphorus or nitrogen.

These simulations are driven and based on predefined scenarios stored in the database that can be improved.The application allows you to view the data of the simulation based on the changed values, and then display the result of the state of health of the lake that these areas represented by polygons will provide the environment due to the changes made. That is not only to enable queries to the database but to be interactive in the use of GLEAMS model data, all without leaving the Web GIS cartographic consultation.

Thus, the portal gives access to structured data that have been placed on the Web Server and the interaction on the Web GIS determines the possibility of multiple users on a network to work on a common territorial board and simulate scenarios placed at the disposal of all. On the following image (Fig. 8) the results after changing values in the case of phosphorus.

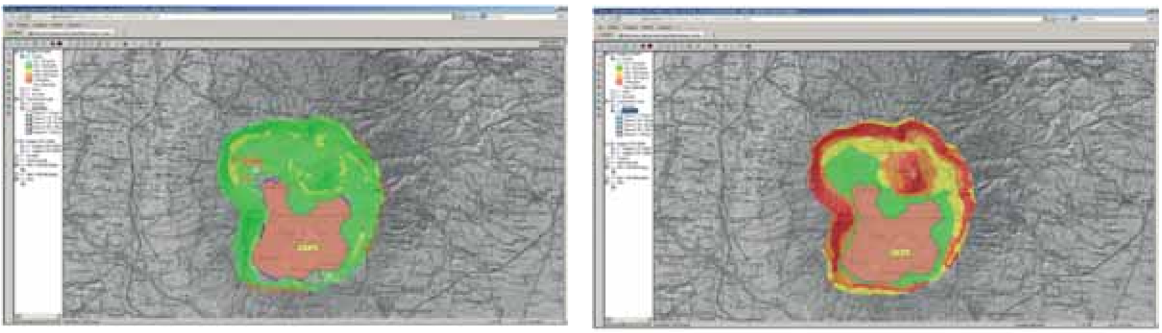

Fig. 8 Before and after the simulation

The work of the University of Tuscia produced GLEAMS model processing that have been conferred to the information system in excel format.

In order to accommodate the modeling data was necessary to perform the overlap between the basic themes (overlay) and then producing tables output in the geodatabase that describe the polygons overlay. The polygons of the overlay have been connected to modeling data processed in the SQL database.

The approach of the project PST-CSA is completely opened to the overlay of the topics considered essential for the application of the pollutants valuation models.

The value is properly given by taking into account the parameters of the polygon overlay whose waters arrive in the catchment area of the lake.

The special feature of the used method is therefore to have put on-line at the disposal of an evaluator who consults the system the layer resulting from the intersections of the types of all the issues that enter the GLEAMS model.

All themes have been traced back to a single informative level in which the polygons generated by the intersections of the various plans have the characteristic of having a single value in each thematic layer.

In this way, it is possible to graphically display the influence on the territory of a single theme but also the application of a weight due to modeling and see the results of the envelope of the information on another topic, in this case the lake's health.

This methodology allows to have discretized the modeling reality in individual thematic topological overlay where polygons represent the homogeneous characteristics of slope, land use etc.

This way you have a chance to go into detail and improve the system error more is deepening the knowledge of the specific theme.

In the case of the scale of the project was obtained an intersection of themes with a sufficient accuracy to be able to adequately represent the result of the transport of nutrients in the polygon that represents the receiving body, the lake.

The novelty of the process was to define the color changes and therefore the quality of the individual nutrient.

In this way it is possible to assess the issues of the contributions of modeling and which polygons contribute with nutrients in the lake.

This result was achieved and can be reformulated interactively online by the user by changing the values using the developed functions thanks to the simultaneous use of an on-line map server and a database server that offer a synergistic service for displaying modified modeling data.

The web GIS device then becomes a reality's interpretation tool through the use of established modeling and becomes a tool for the planner: no longer a GIS to produce risk's maps but a geodatabase on which to apply a spatial modeling to simulate alternative land use planning scenarios.
The large amount of data that a planner must keep under control now needs the help of the computer tool that extends the analytical capabilities of human mind. The planner has to set the rules of the system being able to assist in the development of modeling and being therefore capable of a critical reading of the results.
By merging the two professions of computer science and spatial planning comes the opportunity to give back to the land planner a tool to manage complex processes and to have the basis for a future environmental monitoring of what has been achieved refining results identified in modeling with field sensors.

4 CONCLUSIONS

The proposed methodology and the geographic information system (GIS) on line (WEBGIS) to be applied to the case study of the Palocco Channel will allow all governments of the region to take advantage of a methodology to perform simulations of scenarios related to territorial changes and the impact of those changes on the state of water resources.
This tool will help incisively in decision-making processes related to scheduling, planning and land management.
The main users of this tool are local governments to support the design, upgrading and management of urban and peri-urban areas; professionals and businesses for development opportunities; residents in urban and peri-urban areas as end users.
The strength of the project, in fact, is represented by the potential applications of transversal interest for local authorities, trade associations, professionals and for civil society.
The result is the provision of a flexible and upgradeable tool to support the preparation of planning instruments (for example urban planning implementation, structural plans, landscape plans, water conservancy plans, Provincial Coordinating plans, procedures for Environmental Impact Assessment, constraint plans, regional planning and landscape plans) and the study of the effects of projects to apply a careful management of water resources of rural and peri-urban areas.
The contribution in the realization of a number of tools to help the planner on handling a considerable amount of data will allow different future developments. Some of the most important future developments apply to the ability to use digital information for the territorial development, the possibility to exploit local information assets for job creation and to encourage the development of other private applications on the public data made. The new features developed specifically for the portal allow then to perform simulations on the network. These simulations are designed to aid the planner to create different planning scenarios and to show the changes that planning involves in the water quality of the lakes.
The display update is automatic and allows to extract different data scenarios, which are essential for the planner. According to Professor Bernardo Secchi: "The definition of scenarios in recent years seems to have become an essential component of the decisions on the transformation processes of the city and the territory. The fast change and the multiplicity of actors involved need to project the hypothesis of the project within the future to assess the likely impacts, reliability, sharing" (Secchi, 2000).
The proposed methodology and the online geographic information system (SIT/ GIS &WEBGIS) will allow all governments of the region to carry out simulations of a change of scenario for changes in land use and its impact on the state of water resources. Such a cognitive tool to support the decision-maker might affect , in the early stages, decision with respect to spatial planning, where now the parameters to keep in mind and the data to take into account apply to a plurality of issues to be addressed simultaneously that are outside

the range of a single expert especially in large scale, the one of the basins and then to the regional and interregional scale (district).

A similar approach is represented by the ESPON European Spatial Planning Observation Network TIA Territorial Impact Assessment where are directly analyzed the territorial impacts of EU policies.

As suggested in the ESPON network, maps are a useful and easy way to make complex information accessible to a wide audience. This kind of tools based on the multi-scalar territorial analysis concept are therefore fundamentally useful in territorial analyses, in support of successful policy.

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CYCLE SUSTAINABILITY

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ABSTRACT

One of the main problems that affects modern cities is connected to transport/mobility. Urban transport is currently based on car use; the transition to the use of more sustainable means of transport is happening slowly. Bicycles used as main way of transport, combined with walking, it's a successful solution for many towns to really bring traffic and congestion down. For their high density and their short time travels, towns are the best places (in comparison to long time travels as merchandise transport) to reduce the green houses gasses emitted promoting walking, cycling and public transport. For this reason the European Union is directly founding different projects that boost urban cycling. Many examples presented in this paper where collected by an European project. This project sectioned best practices and excellences in cycling as the so called cycle cities: Amsterdam, Copenhagen, Seville,...cities that have recognized the importance of cycling as a solution to traffic congestion. But how is it possible to transfer these experiences to others realities?
The scope of this article is to show the sustainability of cycling according to socio-economic (social and economic sustainability) and environmental terms (environmental sustainability).
For this reason is proposed a CBA (Cost and Benefits Analysis) methodology specific to evidence the advantages of investments in cycling made by public authorities or private companies both, to promote and realize ecological infrastructures.

KEYWORDS:
cycling, transport, cost and benefit analysis

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自行车出行的可持续性

摘要

影响现代城市的一个主要问题就是交通运输/流动性.城市交通现在是以使用汽车为基础，但向更可持续交通方式的转变进展缓慢. 对很多城镇来说，将自行车作为主要交通方式，并与步行相结合，是真正降低交通流量和拥堵的成功解决方案. (与货物运输行程的长时间相比)因密度高，行程时间短，城镇成为用推动步行，自行车出行和公共交通来降低温室气体排放的最佳场所. 正因如此，欧盟正直接资助能推动城市自行车出行的不同项目. 本文列举了一个欧洲项目所收集的许多例子. 这个项目对自行车出行的最佳实践和优点以及所谓的自行车城市进行了划分，这些城市包括阿姆斯特丹，哥本哈根，塞维利亚等已经认识到自行车作为一种交通拥堵解决方案的重要性的城市. 但这些经验能否转移到其他现实中呢？
本文的作用是从社会经济(即社会和经济可持续性)和环境(即环境可持续性)角度来展示自行车出行的可持续性.
因此，本文用成本效益分析（CBA）方法，来证明政府当局或私营企业为促进和实现生态基础设施而对自行车出行进行投资所具有的优势.

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关键词
自行车出行，可持续性，交通

1 CYCLING AND TOWNS

Towns are modern society main actors. Here are concentrated the majority of habitants, commerce and trades. Inside European towns live more than 70% of the population and it is generated more than 80% of the European PIL, but the majority of these towns is not developed in a sustainable way. One of the main unsolved problems is related to mobility, that is more and more difficult and inefficient. Metropolis are rapidly growing – United Nations say that within the 2050, world population will reach 9 billion of people instead of 7 – and so there is an increasing number of people that need to move every day. "That travel is a derived demand and not an activity that people wish to undertake for its own sake" (Banister, 2008). Urban mobility is based on private car use which are usually alimented with carbon fuels. The gradual change through soft mobility ways of transport is slowing happening.

"Even though there is not yet a unique definition, we can argue that soft mobility (pedestrian, cycle and other not motorized displacements) is a zero impact mobility trying to be alternative to the cars use" (La Rocca, 2010). City as Warsaw, Marseille, Rome, Paris[1] suffer from chronical traffic congestion that costs 80 billion of euro every year. Traditional transport is not only an economical problem, but one of the main causes of climate changings. Towns also produce over 70% of global energy-related CO_2 emissions[2]. Cycling as preferential way of transport inside towns - combined with the creation of new pedestrian zones - is an efficient solution to reduce vehicular traffic. Towns for their high density are characterized by short transfers, so pedestrian, cycling and walking could really be considered as good way of transport to go to move every day. "The majority of nonwork trips are within walking or cycling distance and are therefore of interest to the physical activity, air quality, and transportation planning fields" (Saelens et al., 2003).

The document Europe 2020 - A European strategy for smart, sustainable and inclusive growth underlines the importance to develop sustainable and modern systems of transport inside Europe. For this reason many urban cycling projects were funded directly the European Union. Many examples presented in this article where collected thanks to one of these European projects[3], that selected best practices and excellences of cycle cities – as Amsterdam, Copenhagen, London, Seville, ... -. A cycle city is a town where cycling is promoted and supported in order to avoid traffic congestion. But how is it possible to transfer these good experiences to others realities?

Cost Benefit Analysis (CBA) is commonly considered as an ex-ante evaluation tool to address the decision for new infrastructures. "The CBA has become a widely used instrument for the appraisal and evaluation of large infrastructure projects in many countries" (Haezendonck, 2007; Mackie, 2010; May et al., 2008; Odgaard et al., 2005; Rotaris et al., 2010; Vickerman, 2000). But even if this analysis has already shown its benefits to support new travel infrastructures, as roads, railway lines, tunnels, it's still rarely used to address investments in cycling.

In this paper the authors[4] want to demonstrate the convenience to adopt this methodology for public and private investments in cycling. The analysis proposed considers costs and benefits related both to social or environmental aspects and it underlines the advantages that come from the realization and promotion of cycling thanks to public and private joint investments. Many examples and indications are later given to reach a perfect balance between this two form of investment. Obviously, main benefits are related to health and environmental aspects (air pollution, CO_2 production, land use, …). From conclusive CBA data it is

1 Top 10 most congested cities in Europe, The Telegraph, UK 2015.
2 Cities, towns & Renewable Energy, International Energy Agency, OECD/IEA 2009.
3 CycleCities project, INTERREG IVC Innovation & Environment - Regions of Europe sharing solutions, involved 8 partners.
4 Selena Candia has done an analysis about public investments in cycling thanks to an European project. The author developed the methodology proposed in this article after doing many researches on the existing best practices about cost-benefit analysis in public and private investments. Francesca Pirlone has done an analysis about private investment in Cycling in European Countries. The author enhanced the CBA methodology considering costs, general benefits and environmental impacts connected to public and private investments in infrastructures. This CBA methodology is a useful tool for local transport plans and policies.

evident the importance and the convenience to invest in cycling: bicycles are less expensive (1 Km of new car ways correspond to 110 Km of new bicycles lanes) and they are cleaner (zero emission) compared with other means of transport. Cycle cities are more liveable and a synonymous of quality.

2 COST-BENEFIT ANALYSIS FOR PRIVATE AND PUBLIC INVESTMENT IN CYCLING

A world widely used systematic process for calculating and comparing gains (benefits) and costs of projects, decisions and policies is the Cost Benefit Analysis, this tool is used in order to determine if it is a sound investment (justification / feasibility) and to see how it compares with alternative projects (ranking / priority assignment). Since there is a long history of evaluation of major transport projects such as motorways, railways, etc. CBA may also be proven a helpful tool to demonstrate the potential of cycling.

In particular to analyze investments in cycling it have been used a SCBA, Social Cost Benefit Analysis that can include soft factors besides hard effects reflected by real behavior and real economic value. "Social Cost Benefit Analyses (SCBA) are used in many western countries as evaluation tool for infrastructure projects ex ante" (Mouter et al., 2013). Making a SCBA gives insight to policymakers and the public into the costs and benefits of an infrastructure project or several alternatives. Not only the simple costs of building a road, bridge or rail track are included but also soft costs such as damage to nature, pollution and accidents are taken into account. The SCBA appeared in the literature in 2000 as a renewed version of the well-known CBA method as a result of the Dutch OEEI guideline[5].

"Despite all the theoretical studies performed on the types of information policy makers can process, the need for transparency and for an active multi-actor involvement in the evaluation and decision process has become politically essential and explains why SCBA became successful" (Haezendonck, 2007). The SCBA includes different assessment procedures and in particular it integrate some participation techniques to include stakeholders in the decision-making process. On the benefit side a SCBA calculates the benefits of a certain infrastructure project to society in terms of welfare. These benefits include travel time gains, better accessibility, safer traffic environment, agglomeration effects and so on.

"In the Academic spheres as well as in public policy the Societal Cost Benefit Analysis can count on some critics as well" (Beukers et al., 2012). Those critics mainly focus on the problems of quantifying softfactors due to an infrastructure project, such as effects on nature. However, translating the soft factors into money makes it possible to involve them into the analysis so that a decision is far better supported. In summary, a SCBA attempts to measure the positive or negative consequences of a project, which may include: effects on users or participants, effects on non-users or non-participants, externality effects and Option value or other social benefits.

To do a correct CB analysis – for public or private investments in cycling - is important to follow an accurate planning composed by different steps: problem analysis; formulation of alternative solutions; identification, quantification and monetization of effects; comparison between cost and benefit; sensitivity analysis and final decision. This CBA planning is reported in figure 1. The adoption of cycling can have significant impact in mitigating a variety of the costs associated both with the usage of public and private transportation methods. Indicatively cycling can play an important role in saving time and money. A new bicycle could cost around 150€, for a new car are necessary 20.000€. Bicycles don't have any maintenance costs, cars' maintenance costs are really high: fixed cost as the insurance and operational costs as fuel, parking, highway costs.

[5] OEEI Onderzoeksprogramma Economische Effecten Infrastructuur - Research Programme on the Economic Impacts of Infrastructure – Netherlands.

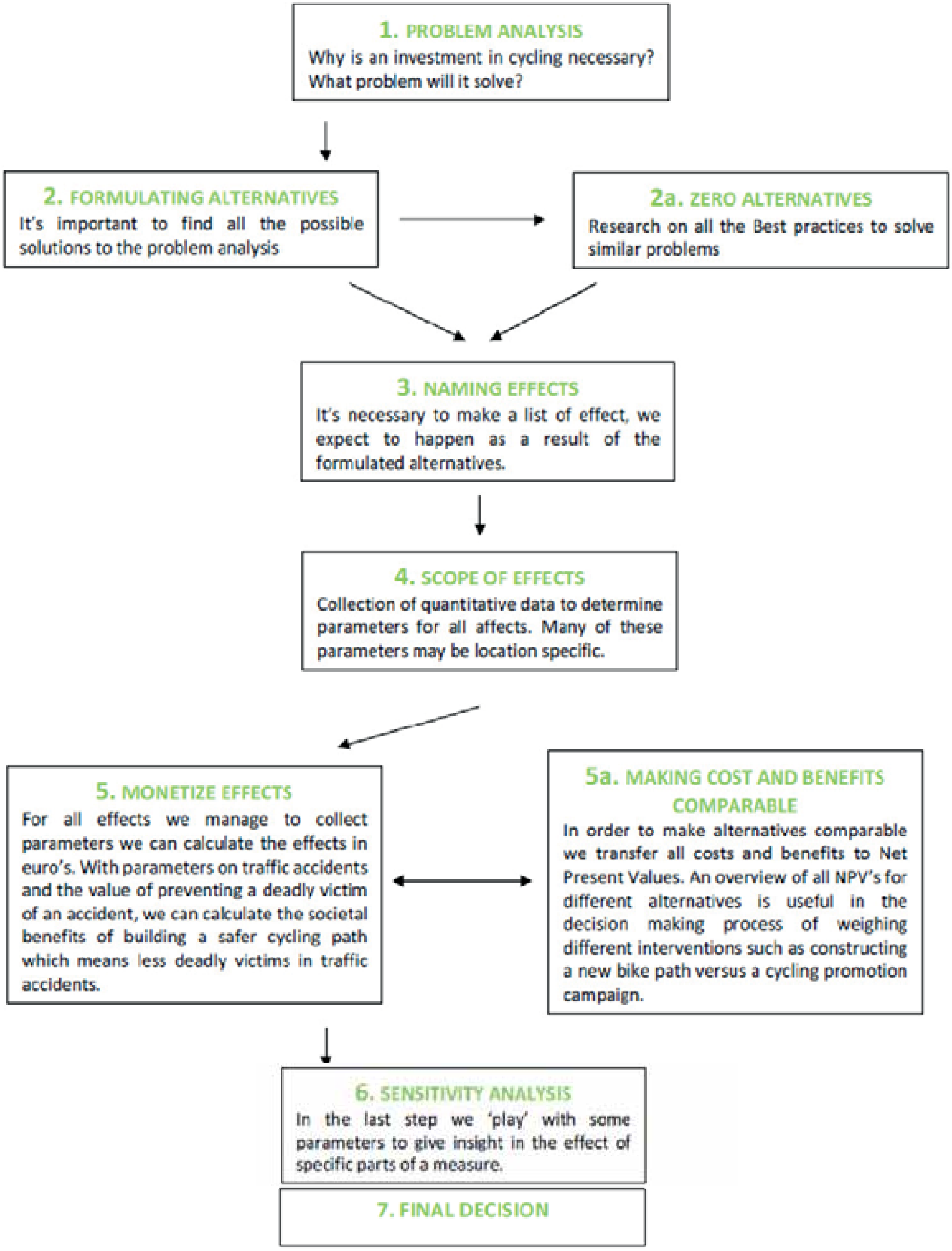

Fig.1 CBA analysis procedure

The operational costs for a small car are estimated around 8.500€ - considering 15.000 km/year -. To this amount a car owner have to had 1.800 € of fixed costs. The city of Hamburg with the project We are the traffic (see figure 2) showed that cycling instead of car driving in ten years could make you save more than37.000€. All these costs related to cycling are not comparable with the costs needed to build new roads, tunnels, railways, (see figure 3).

Traffic and congestion are the main causes that could really extended the costs prolonging everyday trips. Inside Mexico City center to do 20 kilometers it could take more than four hours, this is really a contradiction because it's possible to cover the same distance in less time on foot.

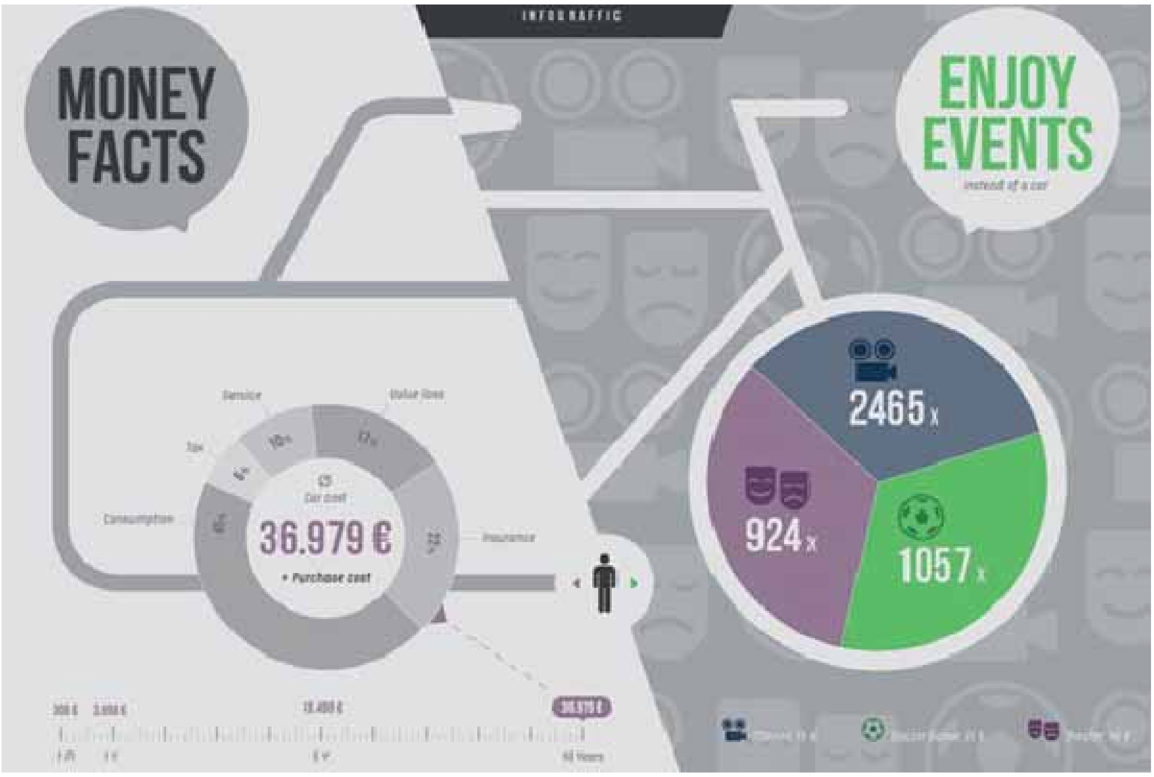

Fig. 2 We are the traffic cycling campaign in Hamburg

1 KM OF…….	IS EQUIVALENT TO N°Km OF BIKEWAY
Rail	29 Km
Road	110 Km
Bus Way	138 Km
Road with tunnels	324 Km
Underground rail	533 Km

Fig.3 Comparison between cycle infrastructure cost and the infrastructure cost of the other mean of transport

Traffic congestion costs Europe about 1% of Gross Domestic Product (GDP) every year. Different cities have already adopted drastic measures: in Sigapore each day could enter a pre-determined number of cars, many Italian towns have a car-free center,… Cycling should be treated as a complement to public transportation rather than a competitor. To this end measures that facilitate the integration of both methods of transportation can have an important role. A successful policy in this case would have significant impact on the effectiveness and efficiency of both methods of transportation. Short trips would become faster, while the ability to use public transportation would allow for the bicycle to be used for more distant destinations, thus increasing its flexibility. This complementarity would elevate the profile of both transportation methods and make them more attractive to a larger part of the population, especially the youngest segments.
To do a correct CBA is also important to know which are the drivers or the inhibitors that can facilitate or prevent investments in cycling (see figure 4). First of all is necessary a solid collaboration between national and local Authorities and private companies. Public administration have to give the right example. Which could mean financially invest in cycling infrastructure themselves, but it could also be by providing a Master plan on how cycling should get a more important position in a city's infrastructure.

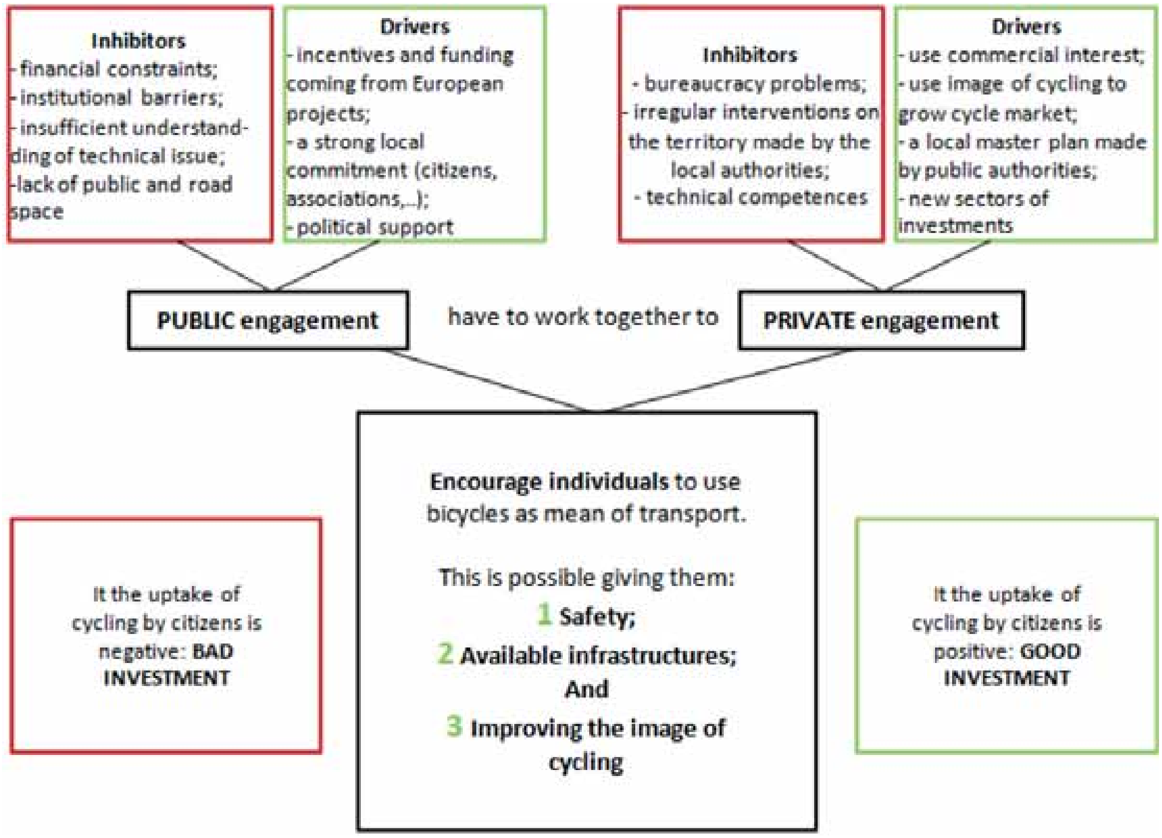

Fig. 4 Drivers or inhibitors that can facilitate or prevent investments in cycling

It's also important to set out a national/local approach to prioritize future investments in capital and revenue spend on cycling, and challenges policy makers to ensure that programs are in place to influence, enable and encourage individuals, families and communities to take part in physical activity and adopt active travel choices. An important driver or inhibitor is connected to the portion of population that will shift towards cycling. Generally if a low uptake is expected, then the cost will probably outweigh the benefits, and thus the investment might not be undertaken.

3 CYCLING COSTS

In Italy there aren't many cycle cities. Public Authorities and administrations are not always aware about cycling's benefits or cycling is not seen as a priority. There is the necessity to spread the reasons that make bicycles important to reduce traffic congestion and pollution for short travels, contributing also to people health. Cycling costs are related to cycling infrastructures/activities. In this paper these costs have been studied. These are the costs associated with the initial construction of an infrastructure and there are expenses that occur only once. They can range from relatively low (e.g. the installation of signs and traffic management equipment) to intermediate (e.g. construction of bike lanes on the existing road network) to high (e.g. construction of bicycle tracks and off-road paths). Other costs are related to maintenance and operational expenses.

Firstly are here reported the infrastructure costs. To understand these costs it's important to have a general description about the type of infrastructure[6]. Infrastructure costs has been divided into four main categories: Travel infrastructure for cycling (A); Bike parking and end of trip facilities (B); Integration of bicycling with public transport (C); Bike sharing system (D).

6 Type of infrastructures starting from The national Cycle Manual edited by National Transport Authority of Ireland 2014.

The first category, travel infrastructures for cycling, includes infrastructures upon which bicycles can travel and other measures (through infrastructures) that facilitate the flow of cycling traffic. Within this first sub category has been distinguished two kinds of travel infrastructures differentiated by the existence or not of a physical separation of the cycling path from the rest of the road used by other vehicles. Travel infrastructures without physical separation are called Mixed Traffic; they are paths where cycling traffic is mixed with motorized traffic, or where there is no physical obstacle for crossing over between normal street and cycling path. Examples of Mixed Traffic are: one road bicycle lanes; two-way travel on one-way streets; shared bus/bike lanes; bicycle boulevards; colored lanes; shared lane markings; advanced stop lines (see figure 5).

MIXED TRAFIC	EUROS	UNIT
Bicycle lane on bus lane	51,88	Per meter
Pavement marking	7,59	Per meter
Cycle logo (each)	38,91	Each

Fig.5 Costs of different types of infrastructure in Europe in 2014

Travel infrastructures with physical separation are called Separated Traffic, they are paths where cycling traffic is completely separated from motorized traffic. This implies a physical obstacle that cars cannot cross easily or at least without noticing it. Examples of Separated Traffic are: cycle tracks and off-street paths (see figure 6).

SEPARATED TRAFIC	EUROS	UNIT
Bicycle lane with major junctions	950,82	Per meter (wide 1,5m)
Bicycle lane with simple junctions	345,72	Per meter (wide 1,5m)
Raised white line	17,05	Per meter

Fig.6 Costs of different types of infrastructure in Europe in 2014

Other measures, that facilitate the flow of cycling traffic, are infrastructures where various types of lanes/tracks facilitate the usage of bicycles by citizens. However those routes are not the only measures that can have an impact on the usage of bicycles, their effectiveness and (as a result) the potential for a shift for citizens from motorized traffic to cycling. Indicative examples of this type of investments are: bicycle phases/traffic signals, traffic calming methodologies, way finding signage and techniques to shorten cyclists' routes. All this category includes traffic arrangements that facilitate cycling traffic especially in intersections and involves the construction of cut-through that provide cyclists with more direct ways than motor vehicles (see figure 7).

OTHER MEASURES	EUROS	UNIT
Traffic light	4.447,30	each
Bike route signage	127,46	each
Raised white line	17,05	Per meter
Traffic calming / managed area	345,72	

Fig.7 Costs of different types of infrastructure in Europe in 2014

The existence of the necessary lanes and routes examined in the previous pages is of significant importance when individuals consider using a bicycle for their trips (both work related commuting as well as leisure). They are not however the only factor. Of similar importance are the so called End-of-trip facilities. These are infrastructures that cyclists can use when they have reached their destination.

In this vein a categorization that can be made is the following: unsheltered, sheltered, guarded, bike parking; bike lookers; bike rentals; bike repairs; bike washer; showers and changing room.

On a per parking space basis, unprotected outdoor bicycle stands or racks are the cheapest to provide. The only significant cost is the cost of the stands themselves. A single inverted 'U' or post-and-ring stand, which accommodates two bicycles, costs roughly €100-€150 or €50-€75 per bicycle parking space (City of Ann Arbor, 2008). A canopy or shelter for weather protection for twenty bicycles could cost anywhere between €5,000 and €15,000 (€250 to €750 per bicycle), depending on the quality of the design and materials used (Bikeoff, 2008). Bicycle lockers are considerably more expensive. A single bicycle locker can cost from €1,000 to €2,500, depending on the model (see figure 8).

END OF TRIP FACILITIES	EUROS	UNIT
Unsheltered bike parking	100	Per bicycle
Sheltered bike parking	300	Per bicycle
Bike lockers	1500	Per bicycle

Fig.8 Costs of end of trip facilities, City of Ann Arbor Bike Parking for Your Business, 2008

Other infrastructure costs are related to the realization of a new bike sharing system. A bicycle sharing, or bike share scheme, is a service in which bicycles are made available for shared use to individuals on a very short term basis. Each bicycle cost is about €1,000, and the annual operating cost per bike was €1,860[7].

There are other costs related to cycling differently from the over mentioned cycling infrastructure costs. These expenses could be divided into two categories: promotion measures including information, formation and marketing also using new technologies (smartphone app, virtual maps,…) and organization managerial measures including financing.

After constructing any cycling infrastructure and releasing it for usage the maintenance costs have to be considered to prevent the continuous and gradual degradation. This degradation is a combined result due to the usage and other environmental factors. It's important to ensure and to maintain an acceptable level all physical and qualitative properties of an infrastructure making periodically repair. These periodic reparations involve different maintenance costs that are around 1700 €/(km*year)[8]. Some types of investment have also operational costs not only maintenance costs. These cost are related to the normal infrastructure operation. Examples of operational costs are: the salaries of personnel operating bike-sharing system, the energy consumption of lights and of traffic lights. Operational costs for traffic lights, street lights and the like are marginal compared to initial infrastructure investment and maintenance costs.

2.1 PUBLIC AND PRIVATE INVESTMENTS: EXAMPLES AND GUIDE LINES

The over mentioned cycling costs could be effort by Public Authorities, Private companies or private and public subjects in partnership. Private investments in cycling infrastructure are more and more substantial; in Europe and in the North of America exist cycle lanes or bike-sharing programs entirely financed by private investors. Here below are reported different examples to understand how public and private could work together. The Velocity 2025 (Manchester UK) Master Plan from the Transport for Greater Manchester

7 Bike Share Under Consideration, Alexandria Gazette Packet Retrieved May 14, 2011.

8 PSC, Realizzazione e manutenzione straordinaria piste ciclabili, Comune di Firenze 2010.

Fig.9 London Barclays Hire

Committee shows how public and private parties can cooperate in stimulating cycling. The Plan actively engages the private sector to invest in cycling infrastructure. The Barclays Cycle Hire (London, UK) is a good example of combination of public and private investment. Initiated by the municipal government the private investment involved is substantial: Barclays contributed 25 million pounds in exchange for being the name carrier of the prestigious project (see figure 9).

"In countries with a high popularity of cycling like the Netherlands or the Scandinavian countries, cyclists are a very important group of customers for retailers, especially in the city center" (Kastrup, 2013). Bad or missing parking facilities for bikes are an important barrier for people to take their bike for a shopping trip. This should be an incentive for retailers or developers of retail real estate to take care of enough parking facilities for bicycles around the shopping area or in front of shops. Private companies in general could stimulate cycling by investing in parking facilities for bicycles at their own location. Besides stimulating their own employees to take up their bicycle for commuting trips they can stimulate visitors to come by bike as well. "Investments in physical facilities at the workplace that offer better comfort to cycling commuters are called investments in a Bicycle-Oriented-Design" (Phyllis et al., 2010). Bad or missing facilities at the end of a commuting trip can be a major barrier towards cycling for commuters. So the other way around, investments of the employer in a bicycle-oriented-design could encourage the employees to take up their bicycle to work. Opening up bicycle shops therefore can be seen as private investments in cycling infrastructure, in the end even influencing peoples travel mode choice towards cycling. The opportunity of fixing defects like a flat tire in close proximity to a cyclists route makes it far more comfortable to cycle around the city. In Europe, local governments exploit still 27% of the existing bike sharing systems. "However, the future of bike-sharing is to private (or public-private) initiatives as new business models are emerging" (Parkes et al., 2013). The most efficient way to involve private investment is to give to private companies the possibility to show their logos and advertisements for free in public spaces in exchange of their investment in cycle infrastructures (at the bike sharing- stations as for London Barclays Cycle Hire example).

Local governments could involve private investors in several ways according to:

- the advertising model: a private company builds the infrastructure and provides the bike fleet for a bike sharing program in order to have the right advertisements on the streets (at the bike sharing-stations). Local governments mostly exploit the system;
- the sponsor model: another advertisement based business model to realize bike sharing programs. In this case, the local government is the initiator of the program but private companies do (most of) the investment. The program is often named after the sponsor, but exploited by the local government.

Sponsoring professional cycling teams by bicycle manufacturers, or other companies, can be seen as private investment in cycling as well. Reason for sponsoring a cycling team is simple: getting good publicity and eventually growing their market share. There are also private investments connected to health insurances. For employers promoting cycling towards their employees could be a very good economic investment.

The health and wellbeing program of the American bicycle company Quality Bike Products (QBP) shows that offering financial incentives towards employees to commute by bike, results in significant health effects and appurtenant financial benefits. The company offered their employees an account of €110 to buy QBP products and paid € 45.000 on commuter rewards to cycling commuters every year. The program resulted in a 4.4% reduction in health costs associated with a saving of €170.000 over three years.

But what Municipalities have to do to stimulate these private investment in cycling? (see figure 10)

- an active campaign on cycling can encourage private parties to start investing in cycling;
- giving the right example and making a Master Plan on how cycling should get a more important position as a city's infrastructure;
- think about different ways of financing public cycling infrastructure, using commercial interest of private companies (like the right to advertise in public space);
- keep on boosting cycling even if there are political changes in the Public Administration.

First of all, when private companies investments in cycling are requested, Public Authorities have to capture their attention supporting a significant campaign to promote cycling as a daily mean of transport. This could mean financially investing in cycling infrastructure themselves, but it could also be by providing a Master plan on how cycling should get a more important position in a city's infrastructure. Private companies will probably follow public efforts to improve the infrastructure.

When the cycling infrastructure is expanded by public effort, resulting in an increase of cyclists, private companies will follow by investing in parking facilities for instance because people will start to reach their location by bike. Commercial interests can be used to co-finance cycling infrastructure. Sponsoring a bike sharing system has two major benefits for private companies.

First of all it provides advertisement space in the public environment. Besides that, supporting a sustainable transport project is good for the image of a company, which is quite a driver in these times when consumers seem to value Corporate Social Responsibility. Moreover parking facilities at shopping centers or streets should be in the interest of retailers because cyclist are good customers.

4 CYCLING BENEFITS

"The benefits of such cycling are potentially extensive – reduced local noise and air pollution, decrease in emissions of greenhouse gases, improved safety, better fitness levels of the population, as well as changes which are more difficult to quantify such as greater sociability of the urban environment, increased freedoms for children to use the environment and an overall improvement in urban quality of life" (Tight, 2011).

The main socioeconomic benefit of cycling is on the health side. Frequent use of the bicycle for commuting as well as leisure activities is a very good way to have regular physical activity. This reduces symptoms of a sedentary lifestyle, increases fitness and improves overall health. The gains for society come in form of reduced healthcare costs, which can mitigate most of the investment costs if a significant modal shift is achieved. A Danish study proved that women bikers live 2/3 years more and men bikers 4/5. Moreover Tour de France participants live around 8 years more than other athletes (according to a study published on The International SportMed Journal).

Another important aspect is connected to environment, transportation choices contribute to global warming and affect the environment. Three quarters of the volume of CO_2 emissions from land transport operations are produced by road traffic. The greenhouse-gas emissions from air transport and international sea transport must also be taken into account. They are responsible for about 3% (air transport) and 4% (sea transport), respectively, of the CO_2 emissions in the EU-27. In other to measure the real benefits of cycling on the environmental, this research developed a specific methodology to determinate the environmental impacts related to transport systems. The assessment of environmental effects requires identification of:

- thematic areas of influence;
- parameters per thematic area;
- indicators per parameter or thematic area;
- indicators assessment.

<table>
<tr><th>Typology of cycling infrastructure</th><th colspan="2">Public investment in cycling</th><th>Private investment in cycling</th><th>Combination of public and private investment</th></tr>
<tr><td rowspan="12">Travel infrastructures</td><td rowspan="7">mixed trafic</td><td>On-road bicycle lanes. A stripe separating bicycles from other vehicles.These lanes occupay part of existing roadway</td><td rowspan="12">The "Velocity"2025 (Manchester UK) master plan from the Transport for Greater Manchester Committee shows how public and private parties can cooperate in stimulating cycling. The plan actively engages the private sector to invest in cycling infrastructure. The "Barclays Cycle Hire" (London, UK) is a good example of combination of public and private investment. Initiated by the municipal government the private investment involved is substantial: Barclays (an important bank in the UK) contributed 25 million pounds in exchange for being the name carrier of the prestigious project.</td><td rowspan="12">Mostly the local government is the initiator of the program but the investment is done by private companies in exchange for advertisement or for being name carrier of the project.
What Municipalities have to do to stimulate private investment in cycling?
- An active campaign on cycling can encourage private parties to start investing in cycling;
- Giving the right example and making a master plan on how cycling should get a more important position as a city's infrastructure;
- Think about different ways of financing public cycling infrastructure, using commercial interest of private companies (like the right to advertise in public space);
- Keep on boosting cycling even if there are political changes in the public administration.</td></tr>
<tr><td>Two way travel on one-way streets. In this case bycicle can travel in the opposite direction in one-way streets.</td></tr>
<tr><td>Shared bus/bike lanes. Bicycles are allowed to travel on bus lanes.</td></tr>
<tr><td>Bicycle Boulevards. These are signed bicycle routes usually on low-traffic streets.</td></tr>
<tr><td>Colored lanes. Bicicle lanes more visible thank to the use of color.</td></tr>
<tr><td>Shared lane markings. Lanes where both bicycles and cars can travel.</td></tr>
<tr><td>Advanced stop lines. It's a marked "box" where cyclist can wait when traffic lights are red.</td></tr>
<tr><td rowspan="2">separated traffic</td><td>Cycle tracks. There is a physical separation between motorized traffic and cyclist instead of a simple stripe.</td></tr>
<tr><td>Off street paths. These are also tracks that are completely separated from motor vehicle traffic. They are paved and usually pedestrian travel is not allowed on them.</td></tr>
<tr><td rowspan="3">other infrastructures</td><td>Traffic signals. Signals dedicated to cyclist.</td></tr>
<tr><td>Way finding signage. Sings to help cyclist to find directions for prominent estination.</td></tr>
<tr><td>Techniques to shorten cyclist' routes. This category includes traffic arrangements that facilitate cycling traffic especially in intersection.</td></tr>
</table>

Typology of cycling infrastructure	Public investment in cycling	Private investment in cycling	Combination of public and private investment
Bike parking and end of trip facilities	bike parking bicycle rentals bycicle repairs bycicle washer showers and change rooms	bike parking bicycle rentals bicycle repairs bicycle washer showers and change rooms	In this kind of investment the private is the predominant part. These end of trip facilities can create new jobs (bicycle rentals, repairs, washers…) or can be done by enterprises to get better the condition of their employees (showers, bike parking,…)
Integration of cycling with public transportation	Extensive network of parking spots for bicycles close to metro and railway station as well as central bus hub.	Private advertisment in interconnation hot spots.	This kind of investment is typically public, but integrating bicycles with other mean of transports, municipalities can save money for example investing less in busses.
Bike sharing	Bike sharing system and network. At multiple locations throughout a city there are bike-sharing station where people can grab a bike on as-needed basis.	In Europe, still 27% of the existing bike-sharing system is exploited by local governments. According to Parkers et al. The future of bike sharing is to private, or public-private initiatives.	Mostly the local government is the initiator of the program but the investment is done by private companies in exchange for advertisement.
Industry alliances		On the national but also on the European level, bike manufacturers unite themselves in industry networks.	More cyclists mean more bikes and more bikes are good for business. If cycling levels in Europe matched those of Denmark, we would sell 30 million more bikes per year. But even by doubling cycling in Europe, we could increase the market by 10 million bikes.
Professional cycling		Sponsoring professional cycling teams by bicycle manufacturers, or other companies, can be seen as private investment in cycling.	Reason for sponsoring a cycling team is simple: getting good publicity and eventually growing their market share. But why these investments are interesting in the light of investment in cycling in general is the chance of growing the total market for bicycles.
Health insurances' investments		Promoting cycling towards their clients could be an interesting investment for insurance companies.	This kind of investment is typically private, but also public administrations could benefit of it, moreover in Countries where the Health system is guaranteed by National governments.

Fig.10 Integration and synthesis of data analyzed about public and private investments

The first two steps of this methodology are important to identify all the possible environmental impacts caused by transport. This identification starts with an accurate research work on a lot of scientific documents. Step 2 involves quantification of as many as possible of the indicators emerged from previous research stage in order to establish a data basis of unit prices for cycling for each EU country. After the quantification of indicators is possible to compare and to assess all the different means of transport from an environmental point of view.

The five thematic areas of interest, identified by this research- direct or indirect responsible for climate changing - are: Energy use, Air quality-CO_2 production, Noise, Quality of urban space and Land use. For each thematic area, specific parameters and indicators have been identified. This is necessary to correctly asses the real impact of different mean of transport on each thematic area and to give a final evaluation.

The first thematic area is Energy use. The energy exploited by the transportation sector includes energy consumed in moving people and goods by road, rail, air,…. In the IEO2013 (International Energy Outlook) reference case, world energy consumption in the transportation sector increases by an average of 1.1 percent per year. Petroleum and other liquid fuels are the most important component of transportation sector energy use throughout the projection.

The second category is Air quality. Smog hanging over cities is the most familiar and obvious form of Air pollution. But there are different kinds (CO_2, PM_{10}, NO_x, SO_2,..) of pollution—some visible, some invisible—that contribute to global warming. Air pollution harms human health and the environment. In Europe, emissions of many air pollutants have decreased substantially over the past decades, resulting in improved air quality across the region. However, air pollutant concentrations are still too high and air quality problems persist. Environmental Noise pollution is the third thematic area and it relates to ambient sound levels beyond the comfort levels as caused by traffic, construction, industrial, as well as some recreational activities. It can aggravate serious direct as well as indirect health effects. Night-time effects can differ significantly from day time impacts. According to a European Union (EU) publication: about 40% of the population in EU countries is exposed to road traffic noise at levels exceeding 55 db(A); 20% is exposed to levels exceeding 65 dB(A) during the daytime and more than 30% is exposed to levels exceeding 55 dB(A) at night.

With the category Quality of urban spaces are gathered together two different sub-categories: Transport safety and Transport accessibility. The last impact considered is Land use that stands for the space (square meters) occupied by each mean of transport. Then measurable indicators have been found for each urban mean of transport according to the over mentioned thematic area (see figure 11). This process is very important to compare the final direct impact of each mean that derives from the total value obtain considering all the areas. The results obtained demonstrate that bicycles and pedestrians are the best way of transport in terms of almost all the thematic areas - energy use, greenhouse gasses, air quality, noise and land use –except for safety. The cause is the high mortality of cyclist in comparison to the other way of transport. But this negative result could be easily changed creating new cycle lanes, signals and educating both cyclist and car drivers.

This research had also analyses different existing methodologies to assess environmental impacts connected to each way of transport. Cycling is really good for the environment: bicycles don't produce pollution or noise and are a good solution to traffic congestion. Here below are reported two of this methodologies: the GEF and the Evaluating the environmental effects of transportation modes using an integrated methodology and an application.

The GEF developed a manual detailing specific methodologies for calculating the Green Houses Gases (GHG) impacts of energy efficiency, renewable energy, and clean energy technology projects.

			Mean of Trasport				
Environmental impacts	**Parameters**	**Indicators**	**tram**	**bus**	**car**	**bicycle**	**pedestrians**
5.2.1 Energy Use	Typology and quantitative of energy used by each mean of transport	%Fuel used	x	25 l fluel oil/ 100 Km 0,5 l / person 100 Km (avarage capacity 50 people)	7 l fluel/100 Km	x	x
		%Energy from different sources used	5 kwh/km 0,0025 Kwh / person Km (avarage capacity 2000	1 kwh/km 0,02 Kwh / person Km (avarage capacity 50 people)	0,2 kwh/Km	x	x
5.2.2 Green House Gasses	CO_2 introduce in the environment by each mean of transport	% CO_2	33g/person Km	75 g/person Km	237 g/Km	x	x
5.2.3 Air Quality	Analisys of the introduction of particulates, biological molecules, or other harmful materials into the Earth's atmosphere	% PM_{10} ,	x	0,75 g/Km	diesel 0,068 g/km petrol 0,0171 g/km	x	x
		% CO	x	4 g/Km	diesel 0,97 g/km petrol 1,55 g/km	x	x
		% NOx	x	12,5 g/Km	diesel 0,202 g/km petrol 0,07 g/km	x	x
5.2.4 Noise	Analysis of the disturbing or excessive noise that may harm the activity or balance of human or animal life.	n°dB day and intensity (max 55dB)	45 dB	80 dB	70 dB	35 dB	30 dB
		n°dB night and intensity (max 40dB)	45 dB	80dB	70 dB	35 dB	30 dB
5.2.5 Quality of Urban Spaces	Safety	% mortality	0,3 death each billion of km	0,4 death each billion of Km	3,1 death each billion of Km	44,6 death each billion of Km	54,2 death each billion of Km
	Funtionality/Accecibility	% of use in Europe	pubblic trasport 22%		53,00%	7,00%	13,00%
	Upkeen services	cost of upkeen services for infrastructures in a year	not found	8.500 €/(km*year)	8.500 €/(km*year)	1700 €/(km*year)	1300 €/(km*year)
5.2.6 Land Use	Modification of the environment couse to trasportation needs	n° square meters occupied for a km of mean of transport	3000 mq/km (doubble lane)	10000 mq/Km (doubble lane)	10000 mq/Km (doubble lane)	3000 mq/km (doubble lane)	2500 mq/Km (dobble sidewalk)
		n° square meters for services connected to each mean of transport	81 mq*1 tram	38 mq*1 bus	12,5 mq*1 car	0,83 mq* 1 bike	0,5 mq*1 pedestrian

Fig.11 For each thematic area this research produced measurable indicators

This new Manual provides the first methodology designed specifically for projects in the transportation sector. The GEF models are designed to develop ex-ante estimations of the GHG impacts of transport interventions (projects) as accurately as possible, without requiring data so exacting that it discourages investment in the sector.

The methodology provides uniformity in the calculations and assumptions used to estimate the GHG impact over a very diverse array of potential projects. These include projects that: improve the efficiency of transportation vehicles and fuels; improve public and non-motorized transportation modes; price and manage transport systems more efficiently; train drivers in eco-driving; package multiple strategies as comprehensive, integrated implementation packages.

Another methodology to understand transport's environmental impact is reported in a research[9] done by the Department of Industrial Engineering inside the Technical University of Istanbul. Measuring the environmental effects of transportation modes may be a complex process because of the different criteria which approach to the subject from different aspects. However, the criteria that contain uncertainties or cannot be given precisely are usually expressed in linguistic terms by decision makers.

The methodology proposed by the Department of Industrial Engineering of Istanbul, uses a mathematical procedure called fuzzy logic for determining the weights of each criteria. "The term fuzzy logic is used to describe an imprecise logical system, FL, in which the truth-values are fuzzy subsets of the unit interval with linguistic labels such as true, false, not true, very true, quite true, not very true and not very false, etc" (Zadeh, 1975). The Department of Industrial Engineering connects different ways of transport (road, railway, sea, air, multimodal) to different environmental categories: noise, emission reduction, effects on open land, undesirable view, safety, energy resources utilization, transportation capacity of the vehicle, infrastructure of the transportation network, seasonal affect.

Then to find the best way of transport (in environmental terms) this methodology uses the fuzzy logic to give a weight to the abovementioned categories. Then it put in relation this results with all the possible alternatives of mean of transport for a specific travel. To link criteria to alternatives the Department of

9 Evaluating the environmental effects of transportation modes using an integrated methodology and an application.

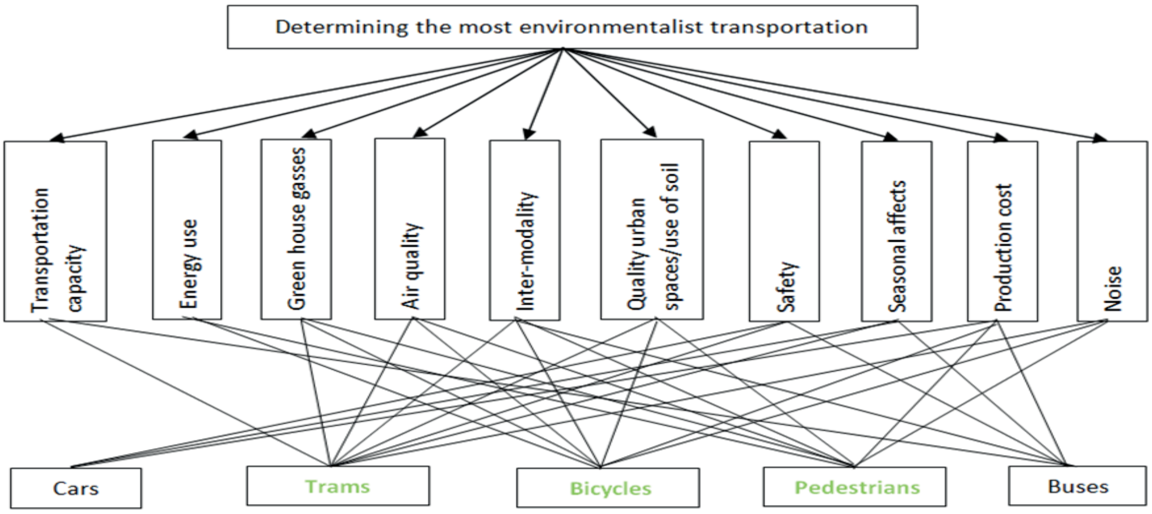

Fig. 12 Hierarchical structure of the criteria and alternatives to determinate the most environmentalist transportation at urban scale

Industrial Engineering's methodology uses a neural network. "The field of transport studies has seen an explosion of interest in neural networks in the 1990s.This can been seen as part of a general pattern of increased use of artificial intelligence techniques in transport" (Kirby and Parker, 1994). This paper adapts this methodology to an urban scale. The research adds new categories (according to the environmental thematic area reported in this chapter) to the Department of Industrial Engineering's methodology: Quality of urban spaces and Land use. From figure 12 is clear that the most environmentalist transportation at urban scale are cycling and walking.

5 CBA ASSESMENT AND CYCLING RECOMMENDATIONS

After reporting cycling costs and benefits, it's possible to precede with the CBA assessment. Cycling networks are generally good for the economy. Calculating all internal and external benefits of cycling together, based on 7,4% of use of the bicycle in Europe, and adding the turnover of related industries, ECF estimates the number to be well above € 200 billion annually, or more than € 400 for every person that lives in the EU. The evidence demonstrates that investments in cycling infrastructure make good economic sense as a cost-effective way to enhance shopping districts and communities, generate tourism and support business. This research reports two examples (one from Denmark and the other from the Netherlands) to assess investment in cycling. In the first study, unit prices are connected to expected effects; different parameters are considered as time, safety, health,…(see figure 13). Using data collected on those parameters it was possible to calculate average costs (benefits) per kilometer for cycling. However this approach is limited by the fact that for some cases no model exists that can perform such calculations. Cycling costs are separated into internal and external. The distinction is similar to the distinction between direct and indirect costs. Therefore, internal costs are the ones that affect the cyclist's decision process, because the directly affect him/her. On the contrary external costs are the ones creating externalities to third persons (for example a better quality of air to breath). It is assumed that these costs (benefits) do not enter the cyclists' decision process. The Danish study shows that the unit cost for each kilometer done by bike is 0.60, instead the cost for each kilometer done by car – driving at 50 km/h –is 3.74.

Bicycle kilometer is a Dutch web tool for making simple Cost Benefit Analyses for investment in cycling. Besides the comparison with car traffic, these Dutch figures also allow us to compare the bicycle with travelling by public transport.

EFFECT FOR THE ECONOMIC CBA	METHODOLOGY TO QUANTIFY TRAFFIC EFFECTS	DATA REQUIREMENT
Vehicle operating costs	Change in vehicle kilometer by mode, i.e. for different motorized vehicles, public transportation and bicycles.	Traffic counts and/or modeling
Time cost	Change in transport time by transport mode	Traffic counts and/or modeling
Accident cost	Change in the number of accidents with and without bicycles involved.	Accident registrations, traffic counts and/or modeling.
Pollution and externalities	Change in vehicle kilometers for each mode of transportation	Traffic counts and/or modeling.
Recreational Value	Change in cycle kilometers and cyclists' statements.	Interviews and traffic counts and/or modeling.
Health Benefits	Change in cycle kilometers.	Traffic counts and/or modeling.
Safety	Change in the number of accidents, cyclist statements and change in cycle kilometers.	Accident registrations, interviews and traffic counts and/or modeling
Discomfort	Change in cycle kilometers.	Traffic counts and/or modeling.
System Benefits	Change in cycle kilometers.	Traffic counts and/or modeling.

Fig. 13 Methodology to quantify traffic effects. Source, Economic evaluation of cycle projects – methodology and unit prices, 2009, COWI, City of Copenhagen

Behind this tool lies a rich database with key figures on time values, health effects, environmental effects, accidents and so on. When all these figures are translated into a per kilometer value, it is possible compare the costs and benefits of the bicycle to those of driving a car or travelling by public transport. According to this study riding a bicycle is €0,41 more beneficial to society than driving a car per kilometer. So every kilometer on a bike instead of a car has 0,41€ of benefits to society. The effect of lower congestion due to less car kilometers is the largest part of this. Health effects (life years) are relatively low in this case but it's important to notice that these values are applicable to the Dutch case where physical activity is already relatively high. The societal benefits of riding a bike instead of travelling by bus are even larger; every kilometer on a bike instead of in a bus brings €0,51 of societal benefits.

There are other tolls available on the web as The Health Economic Assessment Tool. The HEAT for cycling is a tool online designed by the World Health Organization. This tool provides quantitative information regarding the health benefits of active transportation (cycling and walking) establishing a methodology for an economic assessment of the health effects. According to this methodology, it results that ride a bike regularly (30 minutes a day) reduces of the 15% the risk of mortality.

This paper wants to show the triple sustainability of cycling: economical, environmental and social. From the CBA proposed it' s evident that investing in cycling, rather than in other way of transport, is fundamental for the sustainable development of towns (less pollution, noise, ...), to ameliorate the quality of life and it's less expensive than investing in cars or public transport. Benefits overpass Costs.

It is important to conclude reporting some recommendations for a good cycling policy:

- cycling policy needs continuous political leadership and coordination from the very top down;
- as the main socio-economic benefit of cycling is on the health side. Health departments should actively reach out to other departments for fully inclusive cycling policies. This also relates to the concept of health in all policies;
- the polluter pays principle is finding more and more political support. The European Commission stated in the White Paper on Transport (2011) the ambition to proceed to the full and mandatory internalization of external costs (including noise, local pollution and congestion);
- to use European funding to create a mixed partnership (public and private) to promote projects in cycling;
- to do Sustainable Mobility Plan that includes a CBA. This report shows that almost every CBA on cycling investment turns out to be very positive; the social costs outweigh the benefits by far;
- to consider cycling as an integral part of the total Mobility Plan of a city. Synergies with public transport are an important part of that;
- to work for a new green economy including bicycles considering that: cycling spend more than car drivers; cycling employees are more productive and deliver better quality; the cycle economy ensures economic and social gains.

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IMAGE SOURCES

Cover: Cycling in Amsterdam, Jorge Royan Phot
Fig. 1, fig. 3, fig. 4, fig. 10, fig. 11, fig. 12: elaborated by the authors
Fig. 2: Björn Lexius and Till Gläser image
Fig. 5: Regional Development Agency of Gorenjska BSC, Siebe Visser, Kees van Ommeren – Decisio, Pascal van den Noort – Velo Mondial, Slovenia, 2014
Fig. 6: National Transport Authority of Ireland, 2014
Fig. 7: National Transport Authority of Ireland, 2014
Fig. 8: Bike Parking for Your Business, City of Ann Arbor, 2008
Fig. 9: Mariordo (Mario Roberto Duran Ortiz) Photo
Fig. 13: City of Copenhagen, 2009

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Shots of one of SEM Project oral presentations during the “European Climate Change Adaptation Conference”, hosted in Copenhagen (12-14 May 2015).

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REVIEW PAGES

CITIES, ENERGY AND CLIMATE CHANGE

Starting from the relationship between urban planning and mobility management, TeMA has gradually expanded the view of the covered topics, always remaining in the groove of rigorous scientific in-depth analysis. During the last two years a particular attention has been paid on the Smart Cities theme and on the different meanings that come with it. The last section of the journal is formed by the Review Pages. They have different aims: to inform on the problems, trends and evolutionary processes; to investigate on the paths by highlighting the advanced relationships among apparently distant disciplinary fields; to explore the interaction's areas, experiences and potential applications; to underline interactions, disciplinary developments but also, if present, defeats and setbacks. Inside the journal the Review Pages have the task of stimulating as much as possible the circulation of ideas and the discovery of new points of view. For this reason the section is founded on a series of basic's references, required for the identification of new and more advanced interactions. These references are the research, the planning acts, the actions and the applications, analysed and investigated both for their ability to give a systematic response to questions concerning the urban and territorial planning, and for their attention to aspects such as the environmental sustainability and the innovation in the practices. For this purpose the Review Pages are formed by five sections (Web Resources; Books; Laws; Urban Practices; News and Events), each of which examines a specific aspect of the broader information storage of interest for TeMA.

01_WEB RESOURCES
The web report offers the readers web pages which are directly connected with the issue theme.

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02_BOOKS
The books review suggests brand new publications related with the theme of the journal number.

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03_LAWS
The law section proposes a critical synthesis of the normative aspect of the issue theme.

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04_URBAN PRACTICES
Urban practices describes the most innovative application in practice of the journal theme.

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05_NEWS & EVENTS
News and events section keeps the readers up-to-date on congresses, events and exhibition related to the journal theme.

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评述页

城市、能源与气候变化

TeMA从城市规划和流动性管理之间的关系入手，将涉及的论题逐步展开，并始终保持科学严谨的态度进行深入分析。在过去两年中，智能城市课题和随之而来的不同含义一直受到特别关注。学报的最后部分是评述页 这些评述页具有不同的目的：表明问题、趋势和演进过程；通过突出貌似不相关的学科领域之间的深度关系对途径进行调查；探索交互作用的领域、经验和潜在应用；强调交互作用、学科发展、同时还包括失败和挫折（如果存在的话）。评述页在学报中的任务是，尽可能地促进观点的不断传播并激发新视角。因此，该部分主要是一些基本参考文献，这些是鉴别新的和更加深入的交互作用所必需的。这些参考文献包括研究、规划法规、行动和应用，它们均已经过分析和探讨，能够对与城市和国土规划有关的问题作出有系统的响应，同时还对诸如环境可持续性和在实践中创新等方面有所注重。因此，评述页由五个部分组成（网络资源、书籍、法律、城市实务、新闻和事件），每个部分负责核查TeMA所关心的海量信息存储的一个具体方面。

01_WEB RESOURCES
The web report offers the readers web pages which are directly connected with the issue theme.

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02_BOOKS
The books review suggests brand new publications related with the theme of the journal number.

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03_LAWS
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01

CITIES, ENERGY AND CLIMATE CHANGE

REVIEW PAGES: WEB RESOURCES

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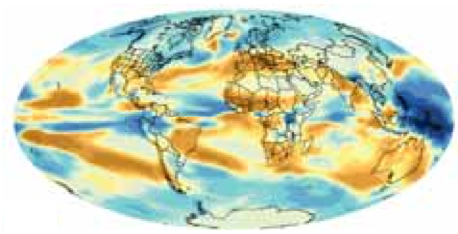

In this number

PLANNING FOR SUSTAINABILITY AND CLIMATE CHANGE

Over 50% of the world population lives in cities. More than two thirds of the world's largest cities are vulnerable to rising sea levels as a result of climate change. Millions of people are being exposed to the risk of extreme floods, storms, temperatures and winds. Moving to the causes of the mentioned phenomena, the GHGs emissions are widely recognized as the main contributors to climate change: carbon dioxide (CO_2) is the most important anthropogenic GHG and recent data confirm that consumption of fossil fuels accounts for the majority of global anthropogenic GHG emissions. Researchers and policy makers are devoting their attention to outline strategies for urban adaptation to climate change, both at European and local scale.
Two are the main typologies of strategies that at global, European and local level are currently put in place:

- mitigation measures, aimed at reducing GHG emissions;
- adaptation measures, aimed at adjusting natural or human systems in response to actual or expected climatic stimuli or their effects.

The two types of strategies also differ one from each other, both from a temporal and a spatial perspective. Mitigation measures are generally the result of international strategies, although applied at national or local levels, and are referred to a long-term perspective. Adaptation measures are strongly characterized as site-specific measures; they generally refer to the scale of the impacted system and are undertaken at local level, although based in some cases on a wider common platform at national or upper level (Galderisi, Ferrara 2012).
In this number three websites are presented; they are related to three theoretical and methodological approaches to urban adaptation to climate change, depending on the context. The first one addresses the significant extents of the city of Rotterdam, which is an international seaport city with a strong industry sector based on fossil fuels and raw materials but has great ambitions to realize 50% reduction of CO^2 emissions and to become 100% climate proof in order to maintain its international top position and to benefit optimally from the economic opportunities that are created in this context. The second website describes the Italian experience of BLUE UP project whose aim is to provide Bologna with a Local Adaptation Plan, to make the town more resilient in the face of climate change. In the end, the SymbioCity website offers the Sweden conceptual framework for support to climate change challenges in low and middle income countries.

ROTTERDAM CLIMATE INITIATIVE
http://www.rotterdamclimateinitiative.nl/

The Rotterdam approach to climate change is unique in the world. The Rotterdam Climate Initiative (RCI) is a partnership between the Port of Rotterdam, the companies of the industrial port district, the municipality and the environmental protection agency Rijnmond, with the goal of reducing CO^2 emissions by 50% by 2025, as compared to the level in 1990, and to address the issue of climate change through mitigation and adaptation policies in combination with economic growth in the Rotterdam Region. It was launched in November 2006 by an advisory body of the Mayor and Aldermen of Rotterdam as part of the international Clinton Climate Initiative. One year after the collective initiators joined their forces to participate in an international climate programme for metropoles. Since the end of 2013, Rotterdam has had its own adaptation strategy which has set out the course that the city wishes to take to prepare for climate change. The focus of attention in the RCI is on energy conservation, sustainable energy and capture, reuse and storage of CO_2. Through knowledge development, innovation and sustainable area development, Rotterdam furthermore responds to the challenge of changing water levels as a result of climate change. Moreover, the international network of stakeholders helps new companies motivated in reducing CO_2 emissions and adapting to climate change to set up their business in a global market.
RCI website is a rich source of information for those who are interested in the comprehensive climate file. It is organized into seven sections: Publications, Press releases, Contact, About us, Projects, Clips and News.
The section *Publications* lists all of the publications in English published by the RCI from 2008 to 2014. In this section users have free access to interesting reports, programmes, brochures and flyers which provide answers to questions about the effects of global climate change for Rotterdam or about how can inhabitants of Rotterdam contribute to keep their city safe and habitable, now and in the future. Furthermore in compliance with the idea to support the free global exchange of knowledge all the publications can be easily accessed on line and downloaded.
Press release section contains all of the press releases published by the RCI as well as the press releases of the RCI adaptation programme, Rotterdam Climate Proof (RCP). In the section *About us* users can find short information about the RCI board and its relations with the Rotterdam municipality departments, the government bodies and the NGOs and knowledge institutes. Also some information on the mission and the ambition of the network are given.
The section *Project* is mostly dedicated to an in-depth analysis of the new or currently underway works which help Rotterdam urban region to achieve his climate proof objectives. They are new or renovated adaptive urban spaces which benefit the city environment such as a tidal park; a full-scale water square; floating constructions; green roofs; multi-functional rowing courses; waterway corridors; underground water storages; playgrounds doubling as water storage; dynamic traffic management practices; green façades. In this section users can find also guidelines, researches, reports, videos, apps and games to adapt to climate changes by achieving maximum benefit for residents and businesses. The topics are not only energy saving, sustainable energy, electric mobility but also the capture, reuse, transport and underground storage of carbon dioxide (CSS). The section *Clips* offers a large variety of video products and interviews for sharing knowledge about methods used by cities to manage climate risks such as extreme rainfall, flood risks and high temperatures. Watching these videos users can learn from extreme incidents or can gather information about adaptation measures and instruments for decision making. In the end, the section *News* collects the latest announces about current events, ongoing projects and the new steps forward in the field of mitigation and adaptation to climate change.

BLUEAP | BOLOGNA ADAPTATION PLAN FOR A RESILIENT CITY

https:// http://www.blueap.eu/

BLUE AP (Bologna Local Urban Environment Adaptation Plan for a Resilient City) is a LIFE + Project (LIFE11 ENV/IT/119) for the implementation of the Plan of Adaptation to Climate Change for the city of Bologna.

The project kicked off on October 1, 2012 and is going to end on September 30, 2015.

The Municipality of Bologna is the coordinator of the project which involves three other partners: a non-profit organization, Kyoto Club; Ambiente Italia that is an expert European center for urban and environmental policies; ARPA Emilia Romagna which is the Regional Government's Agency for Environmental Protection and Prevention.

The project is aimed to provide some concrete measures which can be implemented at the local level in order to make the city less vulnerable and able to positively react in case of floods, droughts and other consequences of climate change.

Bologna will be a pilot-city addressing in Italy the challenge of climate change which is nowadays considered a priority at European and national level.

The creation of a Local Climate Profile and the involvement of relevant stakeholders as well of citizens have been paramount for the development of the projects. Once BLUEAP is completed, within the site users will find guidelines useful for the redaction of similar Adaptation Plans as a model framework which could be adopted by other medium size Italian cities.

The goal of the website is to create specific information on adaptation issue, which has been attracting a growing interest in recent years. In order to encourage the widest possible dissemination of the project contents and materials, the BLUE AP website is simple and user-friendly.

It consists of six sections: *News, About, Project, Scientific board, Documents, Calendar, Forum* and *Contact*.

The *News* section provides to users the most interesting informative articles published in media dealing not only with climate change, adaptation and resilience but also with water management, drought, heat islands, and greening initiatives; only a small summary is published and original sources or individual authors are indicated at the bottom of each article.

Moreover, in this section also technical articles and press releases reporting the activities carried out by the BLUEAP Scientific Board are collected.

In the section *About* the most relevant information on the project partners are given. They include also contacts. The section *Projects* contains the description of the six pilot actions planned by the BLUEAP project and aimed to build resilient communities and to raise awareness about the risks associated with climate change. In the section *Documents* users can access and download the results and the products created within the project: informative brochure; dissemination and communication plan; Local Climate Profile analysis; best practices in the field of adaptation to climate change; local strategies; adaptation plan; questionnaire for visitors to the site and surveys.

In order to effectively reach on time bodies and organizations concerned with the project goals and topics of the project, direct communication with the identified target audience is crucial. For this reason, BLUEAP is also present on the new communication channels such as Facebook, Twitter and Linkedin.

Furthermore, at the bottom of every section of the website users have the opportunity to subscribe for the newsletter.

SYMBIOCITY | SUSTAINABILITY BY SWEDEN

www.symbiocity.org

SymbioCity is a Swedish government initiative on the issue of sustainable urban development. Founded in 2008, the primary goal of the program is to export the knowledge of Sweden experience on sustainable cities. The Swedish Association of Local Authorities and Regions (SALAR) and its subsidiary SKL International has been commissioned by Sida to foster and develop the Symbio City Approach between 2010 and 2013. According to the holistic and integrated approach of SymbioCity, environmental and economic gains result from unlocking synergies between urban systems, integrating different technologies and functions of the city. For example, waste can be transformed into energy, waste water can turn into fuel, and excessive heat from an industrial area can warm up a household. A sectoral approach should be replaced by a multi-disciplinary approach in order to succeed in solving combined problems. The conceptual framework collects the Swedish methodology and experiences, with a focus on the practices of local government. It is scalable framework and it can be adaptable to any climate.

In the homepage of Symbiocity website users can find a slideshow gallery that combines short texts with images in order to communicate the concept of the initiative. On the right of the slideshow gallery there are fast links to the main sections of the website. Moreover, there are small overviews, organized into a grid, aimed at promoting the approach and at showing some successful cases of industrial districts transformed into sustainable urban environments, e.g. the case of Western Harbour in Malmo or the district of Gårdsten in Gothenburg. At the end of the homepage the latest news about SymbioCity are presented.

The website is organized into four main sections each of them have a bar menu. The section *DISCOVER* collects information about the methodology which can be applied from single blocks to entire urban areas. The seven building blocks in which SymbioCity works are: Architecture; Energy; Landscape Planning; Traffic & Transport; Waste Management; Urban Functions, Industry and Buildings; Water Supply and Sanitation. In this section some experiences and cases are listed. The *DEVELOP* section shows the six steps to achieve the holistic partnerships that will drive to transition to sustainability. Furthermore, this section offers a toolbox to help users to reach sustainable development. In the toolbox users can find useful instruments, for example organizational diagrams for planning and review work; SWOT analysis for identifying and weighing up the negative and positive qualities of an urban territory; some set of indicators for tracking progress in planning and development. At the bottom of this section there is the opportunity to launch a game in which sustainable scenarios, depending on differing conditions and cultures, are shown. Information about tailor made visiting programs, access days or specific training programs can be found in *GET GOING* section. Finally the *NETWORK* section shows a list of companies affiliated to Symbiocity which can be filtered by business area and geographic position. The list of companies is kept continuously up to date. At the bottom of the section users can find also contacts and address of the organization.

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IMAGE SOURCES

The images are from: www.climatemonitor.it; www.rotterdamclimateinitiative.nl; www.blueap.eu; www.symbiocity.org.

02

CITIES, ENERGY AND CLIMATE CHANGE

REVIEW PAGES: BOOKS

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In this number

ENERGY CONSUMPTION AND CLIMATE CHANGE IN URBAN AREAS

Cities are undergoing a renaissance, with a huge growth in urban population. In 1900, about 13 per cent of the global population was urban, but by 2000 this proportion was 47 per cent, and the 50 per cent threshold was reached in 2007 when 3.3 billion people lived in urban areas. By 2050, nearly 70 per cent (6 billion) of the global population (9 billion) will be living in urban areas. This enormous urban growth are causing congestion, traffic, polluting air, noise and energy consumption, also due to the high density of urban activities. The combination of environmental effects clearly measurable and the energy price crisis produced by the explosion of global demand, reveals strongly the urgency to afford the problem in a multi-sectorial and systemic perspective (Gargiulo et al., 2012).

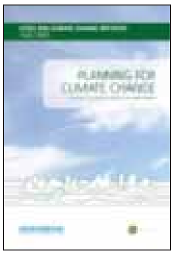
Besides population, in the cities are concentrate disproportionate parts of the economy, resource consumption and the decision making power in most countries. Nearly 75 per cent of the global economic production takes place in urban areas. Cities are responsible for 67 per cent of the total global energy consumption and more than 70 per cent of greenhouse gas emissions and these trends significantly intensify the severity of some of the two great challenges of our time: climate change and energy security (UN Habitat, 2011).

It is not cities, or urbanization per se , that contribute to greenhouse gas emissions, but rather the way in which people move around the city, sprawling urban development, the amount of energy people use at home and to heat buildings that make cities the great consumers of energy and polluters that they are.

In particular, urban density and spatial organization are crucial elements that influence energy consumption, especially in transportation and building systems (World Bank, 2010).

So changes to the built environment both to adapt to climate change and to limit emissions require long lead times, which heightens the urgency of implementing land-use zoning, spatial, building and transportation policies now (OECD, 2010).

According to these brief considerations, this section proposes three documents that help to better understand the issue of this number: the first document Planning for climate change is a guide for city planners and other professionals to help the urban communities in low and middle-income countries; in the second document City Resilience Framework is collected and analyzed a set of indicators that useful to describe the fundamental attributes of a resilient city; in the third document Transport, Climate Change and the City seeks to develop achievable and low transport CO_2 emission futures in a range of international case studies.



Title: Planning for climate change
Author/editor: John Ingram and Colleen Hamilton
Publisher: UN-Habitat
Download: http://www.unhabitat.org
Publication year: 2014
ISBN code: 978-92-1-132400-6

This guide published by the UN agency UN-HABITAT for a Better Urban Future. It describes a strategic values-based approach for urban planners was developed for city planners and other professionals to better understand, assess and take action on climate change at the local level. While climate change is a global issue, this guide is specifically intended for urban communities in low and middle-income countries where the challenges are unique and the stakes of planning for climate change are particularly high. The primary audience for this guide is city planners working in cities in low and middle-income countries who have a basic knowledge of climate change and the desire to address it.

An another group that can use this guide are the elected representatives, non-government professionals, civil society groups, donor agencies and private sector organizations who individually and collectively affect how cities manage climate change risks, impacts and vulnerabilities.

To help the diversity of users, their differing capacities, available resources, experience, and the range of political contexts that they will find themselves in, this guide presents a broad range of tools and information.

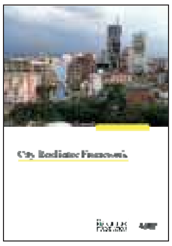
This guide's planning process is organized around a four-module strategic planning approach that incorporates innovative decision-making tools with a participatory, community-based methodology. It can be used to support city climate change planning processes and as a stand-alone capacity building resource and training tool. To help integrate climate change planning into current planning and urban development initiatives, and make it easier for urban planners to take action on climate change, this guide is organized around a four step strategic planning approach that incorporates innovative decision-making tools with a participatory, local values-based methodology.

Each module asks a specific planning question and requires guide users to go through a corresponding set of individual steps, which are supported by 42 different planning tools. The planning tools are provided in a companion document, Planning for Climate Change: A strategic values-based approach for urban planners toolkit.

This guide takes the approach that climate change planning can, and should, augment and be integrated and mainstreamed with existing city plans, planning processes and development activities across all sectors. climate change is simply another piece of information that should be considered during every planning process, or when existing plans are modified and updated.

fundamentally, good city planning practices are, by their nature, also climate smart planning practices. This is because most climate change planning actions are consistent with planners' responsibilities, including:

- Minimizing risk and improving land development activities that occur in or near flood, slope or coastal hazard areas;
- Improving infrastructure for storm water management, solid and liquid waste management, access to safe drinking water, and the movement of goods and people;
- Protecting ecosystems and environmentally sensitive areas in and around towns and cities;
- Improving disaster risk reduction, including the improvement of response capacities for disasters (particularly weather and climate-related events);
- Supporting local economic development to reduce poverty and improve quality of life.



Title: City Resilience Framework
Author/editor: Jo da Silva, Braulio Morera
Publisher: The Rockefeller Foundation and ARUP
Download: http://publications.arup.com/Publications/C/City_Resilience_Framework.aspx
Publication year: 2014
ISBN code: n.d.

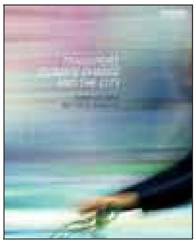
The City Resilience Framework provides a lens through which the complexity of cities and the numerous factors that contribute to a city's resilience can be understood.
In addition, cities need to ensure that their development strategies and investment decisions enhance, rather than undermine, the city's resilience. This analysis comprises a set of twelve key indicators that describe the fundamental attributes of a resilient city.
A resilient city is a city where there is or are: Minimal human vulnerability; Diverse livelihoods and employment facilitated; Adequate safeguards to human life and health; Collective identity and mutual support; Social stability and security; Availability of financial resources and contingency funds; Reduced physical exposure and vulnerability; Continuity of critical services; Reliable communications and mobility; Effective leadership and management; Empowered stakeholders; Integrated development planning. The twelve indicators fall into four categories:

- the health and wellbeing of individuals (people);
- infrastructure and environment (place);
- economy and society (organization);
- leadership and strategy (knowledge).

They represent the fundamental elements of a resilient city. They are what enable people to survive and thrive and businesses to prosper despite adverse circumstances.
For each category, it is reported a best case which represents a resilient city, and a worst case which equates to breakdown or collapse.
The indicators are complemented by qualities that distinguish a resilient city from one that is simply livable, sustainable or prosperous.
This guide incorporates a strategic planning approach with the belief that all planning is more effective if it's strategic. This is because no matter the type of planning, all of it is ultimately about making the best long-term decision possible. To plan for climate change adaptation using a more strategic approach will not only help communities decide what to do, but also how to do it and when to do it, making decision-making more transparent and objective.
This climate change planning process is not linear. Although it follows a step-by-step process, it is designed to let cities revisit steps as new information becomes available, new stakeholders become involved, or other circumstances change.
This guide is designed to allow users to enter the strategic planning process at different steps or modules. It is anticipated that guide users and their cities will:

- Be at different stages of climate change planning;
- Be using the guide for different purposes;
- Have different planning structures and processes;
- Have different resources and capacities.

Primary audience for City Resilience Framework is municipal governments. But, the framework, indicators and variables are also intended to support dialogue between other stakeholders who contribute to building more resilient cities globally.



Title: Transport, Climate Change and the City
Author/editor: Robin Hickman and David Banister
Publisher: Routledge
Download: n.d.
Publication year: 2014
ISBN code: 978-0-415-66002-0

Cities have become the centers of humanity and in the last 10 years, in particular, much discussion has focused on sustainability, reducing greenhouse gas (GHG) and carbon dioxide (CO_2) emissions. Within this, there are aspirations towards sustainable travel. This book takes this difficult context as its starting point, developing its approach from an exciting body of work in scenario analysis and futures thinking. It draws on the conceptual origins from Thomas More's (1516) Utopia, and others such as Herman Kahn and Pierre Wack. Futures analysis has developed into a wide literature field: scenarios have been well used in many domains, notably in business and corporate strategy, and also in energy futures and, to an extent, in transport and city planning. The authors view scenarios from the tradition of Herman Kahn, encompassing a wide range of external and internal factors, such as changed environmental, economic and cultural factors, into composite images of different potential future lifestyles forming a structured view of the future and framework for analysis. This is different to much of the common parlance in transport planning, where scenarios are conflated with option analysis, considering marginal changes, such as route alignments or changes in frequency of service. They use scenario analysis to explore much more fundamental possibilities for changed travel behaviors.

The authors propose the analysis the climate change transport problems and the differents solutions in five different urban areas of the world:

- Ambitions towards sustainable mobility (City of London);
- Affluent rurality and car dependence (City of Oxford);
- Breaking the projected (City of Delhi);
- Building a new world (City of Jinan);
- Urban dispersal and high motorisation (City of Auckland).

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03

CITIES, ENERGY AND CLIMATE CHANGE

REVIEW PAGES: LAWS

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In this issue

EUROPEAN AND ITALIAN STRATEGY ON ENERGY AND CLIMATE CHANGE

The gradual increase of the average global temperature, which today is 0.8°C higher than that registered in the pre-industrial period, is only one of the many effects of climate change; in Europe, the temperature has been rising faster, as shown by data that indicates a difference of 1.3°C with the pre-industrial levels (EEA 2012). Furthermore, together with global warming, other alarming consequences of climate change, related to the greater frequency of extreme weather events such as heat waves or heavier rainfall, are challenging the EU territory which therefore must focus its attention on this issue, considering it a priority for the sustainable development of our society.

In line with the goal of facing the impacts of climate change, the European Union has been promoting mitigation and adaptation efforts based on a policy framework for climate and energy with ambitious and pioneering efficiency targets. Indeed, as long as global warming represents a dangerous risk for our planet, it is crucial to impose a number of actions aimed at reducing greenhouse gas emissions, as well as at increasing the shares of renewable energy, in order to encourage the transition towards a more sustainable energy system and to limit further changes in the earth's climate.

Both at national and international level, the efforts to promote a more sustainable development have been increasing in the last decade and, not surprisingly, Europe is at present a global leader in addressing this challenge. However, the largest emitters of carbon dioxide are China (29%) and the United States (16%), while Europe is just in third position, with the 11% of global emissions. Although the concern for air pollution and energy security has pushed China to invest in renewable energy, its CO_2 emissions do not seem to slow down, on the contrary, in 2012 US emissions have decreased by 4% (EEA 2012).

In 2008 the European Commission has adopted its first policy for climate and energy (EU 30/2008), defining two key targets: a reduction of at least 20% in greenhouse gases by 2020 and a 20% share of renewable energies in EU energy consumption by 2020. These ambitious measures have been updated with the approval of a new policy framework, at the beginning of 2014 (EC 15/2014), which includes new key achievements to be attained by 2030. This document will be described in this number of the journal, together with the EU strategy on adaptation to climate change (EC 216/2013), which sets out a number of measures to improve the resilience of the EU territory. In conclusion, the Italian strategy on adaptation to climate change (MATTM 2014) will be investigated in order to identify the group of actions the Italian government intends to implement to face the impact of climate change at national, regional and local scale.

COM(2014) 15 – A POLICY FRAMEWORK FOR CLIMATE AND ENERGY IN THE PERIOD FROM 2020 TO 2030

Many steps forward have been made since the EU has established the 20/20/20 targets in 2008. However, now the time has come for the European Union to evaluate what has been done and, even more important, what needs to be done by 2030 in order "to drive progress towards a low-carbon economy which ensures competitive and affordable energy for all consumers, creates new opportunities for growth and jobs and provides greater security of energy supplies and reduced import dependence for the Union as a whole" (EC 15/2014). With these goals, in 2014, the EU has adopted a new policy framework for climate and energy, defining two new energy targets for 2030:

- a reduction of greenhouse gas emission (GHG) of 40% in 2030 compared to 1990;
- a share of renewable energy of at least 27% by 2030.

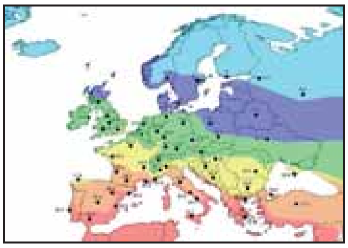
In addition to these two targets, the policy framework identifies a number of different aspects to be considered. For example, improving energy efficiency represents a crucial element for mitigating the impacts of climate change; even tough the objective of 20% by 2020 seems still far at the moment, the Commission has calculated that the GHG emissions reduction target of 40% would require an increased level of energy savings of approximately 25% in 2030.

Furthermore, the EU considers high levels of competition in the internal energy market a further priority for the achievement of energy policy goals: "it will provide the key tools to contain energy prices for business and households. A fully integrated and competitive energy market could result in cost savings of between €40-70 billion up to 2030 as compared to today" (EC 15/2014). The achievements just described are promoting by the EU so as to preserve the flexibility for Member States to set national goals that, however, must be consistent with the European governance framework; in fact, in order to guarantee the respect of energy targets established at European level, Member States should adopt national plans that include precise domestic objectives for "the delivery of a competitive, secure and sustainable energy system" (EC 15/2014). A three steps process will support the drawing up of such plans, which should be implemented well before 2020:

- The Commission will define the content of national plans in detail;
- Member States will draw up the plans based on the Commission guidance and on the consultation with neighboring countries;
- The Commission will evaluate the plans in order to verify if the national goals are adequate for the achievement of the Union's energy targets.

Nevertheless, the EU considers these plans necessary but not sufficient to ensure that the policy framework for climate and energy is fulfilled; for this reason, the Commission will monitor progress over time by measuring a number of key indicators, that should asses the respect of the energy objectives with a more accurate and scientific approach.

In conclusion, the new 2030 climate and energy policy framework, in line with the 20/20/20 targets, promotes the reduction of GHG emissions, the increase of the share of renewable energy, higher competition in the Member States' energy market and the definition of an European governance process based on national plans with the common goal of encourage the sustainable development of our planet and mitigate the impacts of climate change.



COM(2013) 216 – AN EUROPEAN STRATEGY ON ADAPTATION TO CLIMATE CHANGE

Climate change has become a matter of global concern since its impacts have negatively affected territories from an environmental, social and economic perspective. The rise in the number of extreme weather events – e.g. heat waves, heavier precipitation and flooding – is likely to increase the magnitude of disasters, leading to significant economic losses, public health problems and deaths (EC 216/2013). In Europe, despite some territories are more vulnerable than others, just think to the coastal areas or the Artic regions, no country can consider itself safe from the risks related to climate change. For this reason it is necessary to implement adaptation measures to limit the consequences of global warming regardless of the positive results that might be achieved by mitigation actions.

In line with this awareness, the EU has approved the strategy on adaptation whose goal is "to contribute to a more climate-resilient Europe. This means enhancing the preparedness and capacity to respond to the impacts of climate change at local, regional, national and EU levels, developing a coherent approach and improving coordination" (EC 216/2013).

Eight actions can be envisaged to implement the strategy:

- The Commission will provide instructions to foster all Member States to adopt adaptation strategies;
- The Commission will financially support adaptation activities through the LIFE funding (2013-2020);
- Adaptation in cities will be introduced in the Covenant of Mayors framework;
- The knowledge gap will be refined in order to better investigate different aspects related to adaptation actions, such as their real costs and benefits, or the most appropriate methodology for monitoring and evaluating them;
- A more effective interaction between the Climate-ADAPT platform – launched in 2012 to facilitate the spread of data on adaptation strategies implemented in the different EU States – and other national and local adaptation portals will be supported in order to strengthen the role of Climate-ADAPT;
- The Commission will ease the integration of adaptation measures under the Common Agricultural Policy, the Cohesion Policy and the Common Fisheries Policy;
- The construction of more resilient infrastructures will be encouraged;
- The Commission will foster insurance and other financial products for resilience in investment and business decisions.

As well as for the EU policy framework for energy and climate described above, the EU strategy on adaptation to climate change includes the development of indicators for monitoring and evaluating the effectiveness of adaptation actions.

In conclusion, the strategy aims at improving the resilience of the EU territory promoting the implementation of adaptation measures through the increase of the climate-related expenditure to at least 20% of the EU budget. These efforts represent a serious commitment from the European Union to address the issue of climate change, but they cannot be considered sufficient: current strategies seem to be mainly focused on some important factors (efficiency, cooperation and knowledge), ignoring others (diversity, redundancy, creativity), which could also be very significant in improving urban resilience (Galderisi, Ferrara 2012).

ELEMENTS FOR A NATIONAL STRATEGY ON ADAPTATION TO CLIMATE CHANGE

The lack of a coordinated national vision on adaptation strategy to climate change in Italy has been overcome with the adoption of the National Strategy in 2014. The final document provides a scenario of the possible consequences of climate change in different sectors – social, economic and environmental – and it defines a set of actions and adaptation measures to deal with those impacts. Therefore, its goal is to reduce risks due to global warming, to improve the ability of urban systems to adapt to them, as well as to take advantage of the possible opportunities that might be provided by new climate conditions.

The Strategy has been shared among all stakeholders, which have been involved in the process through an on-line survey in 2012 and with a number of meetings.

Twelve areas of actions or sectors have been identified because considered more at risk than others:

- Water resources;
- Hydrogeological instability;
- Forests;
- Coastal areas;
- Health;
- Infrastructures;
- Desertification;
- Biodiversity;
- Agriculture and fishing;
- Tourism;
- Urban settlements;
- Energy.

In addition to this list, two *special cases* have been added: the areas of Alps and Apennines and the hydrographical district of the Po river, considered relevant for their role in terms of impacts on environment and economy. For each sector a different number of actions have been defined, distinguishing between *grey, green* and *soft* measures, according to the White Paper "Adapting to climate change: Towards a European Framework for Action" (EC 2009).

In the final part of the Strategy, a critical analysis identifies the elements that are still missing to Italy for building an efficient adaptation system; those are a national platform on adaptation, the development of a national Plan and a reliable monitoring method to evaluate the progress achieved.

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IMAGE SOURCES

Fig. 1: https://www.flickr.com/photos/suburbanbloke/381634787/
Fig. 2: http://www.verdantix.com/blog/index.cfm/post/high-energy-costs-put-pressure-on-european-industrial-giants-73
Fig. 3: http://www.city-data.com/forum/weather/1842556-mean-yearly-highs-temperatures-europe.html
Fig. 4: http://en.wikipedia.org/wiki/UEFA_Euro_1968

04

CITIES, ENERGY AND CLIMATE CHANGE

REVIEW PAGES: URBAN PRACTICES

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In this number

PLANNING FOR ADAPTATION TO CLIMATE CHANGE: THREE CASE-STUDIES

According to the United Nations (UNFCCC, 1992), the climate change can be defined as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere". While debates, so noted in the mainstream media and in the academic literature, persist about whether or not climate change is due to anthropogenic causes (Hoffman, 2011), it is clear that new weather and climate patterns are emerging and that these changes are putting urban residents and settlements at risk (World Bank, 2010). Some cities have already seen changes in rainfall, resulting in more floods. Others have experienced changes in temperatures that have contributed to extended heat waves and droughts. Still others have encountered storm surges, coastal erosion, and the disappearance of wetlands (U.N.-Habitat, 2011). As these and other changes become more pronounced in the coming decades, they will likely present challenges to our urban environment (Salat and Bourdic, 2012).

The challenges imposed by the changing climate have been traditionally addressed from international and national initiatives under the umbrella of the United Nations Framework Convention on Climate Change and the Kyoto Protocol. However, in the last fifteen years, there has been a considerable effort to reframe this debate towards the local scale and focus on local causes and impacts of climate change (Urwin and Jordan, 2008). As a result, international and national programmes to assist local jurisdictions to develop local climate action plans emerged, and formal planning for climate change adaptation is rapidly accelerating (Baker et al., 2011). Today cities worldwide are increasingly recognizing the need to prepare for the impacts of climate change and, in the last decade, some have introduced new planning instruments finalized to ensure long-term, cost-effective adaptation measures. These measures are generally part of broader adaptation plans aimed to facilitate the adjustment of urban settlements and ecological systems to altered climate regimes. In this section, three relevant case studies of European cities that have recently developed climate change adaptation plans are illustrated:

- Copenhagen (Denmark);
- London (United Kingdom);
- Rotterdam (the Netherlands).

COPENHAGEN

Copenhagen is the capital and most populated city of Denmark, with an urban population of over 1,2 million. The city, well reputed for its initiatives aimed to combine economic growth and sustainability, is currently working towards achieving carbon neutrality while also preparing for the extreme weather expected in the next decades. In August 2011, the city approved the "Climate Adaptation Plan" aimed to prepare Copenhagen for the future by developing the Danish capital as a climate proof, attractive, and green city. The climate change adaptation plan has been developed to ensure adaptation measures are undertaken in the most cost-effective and efficient way. The plan is based on the analysis of a long-term scenario witch has led to the identification of the two must relevant threats resulting from climate change (City of Copenhagen, 2011):

- More and heavier downpours. The cloudbursts over the last few years have smacked the city budget. The heavy storm in 2011 alone cost the city over one billion of euros. Precipitation in Copenhagen is expected to increase by 30 to 40% by 2100.
- The rise of the sea level. With most of the city only having an average altitude of 9 meters above the sea level and with a significant number of people and amount of property lying close to the water level, Copenhagen is potentially vulnerable to the effects of natural variability in sea level and, on decadal timescales, anthropogenic sea level rise. Water levels around the city are likely to rise by up to 1 metre over the next hundred years.

Regardless the issue of the increasing precipitations, two main and complementary strategies have been identified. The first deals with the improvement of the drainage systems, so that they will be capable of coping with major downpours. To this end, a range of tools will be used for better rainwater management including rain and sewage reservoirs, permeable paving, filters and infiltration trenches and other sustainable urban drainage tools. The second strategy deals with the improvement and the connection of the urban green areas. The number of green areas – including 'pocket' parks, and green roofs and walls – will be increased to slow rainfall run-off. Green roofs not only will capture 60% of rainfall, but will also improve air quality, vegetation and wildlife habitat, while reducing urban heat-island effects. Regardless the issue of the rise of the sea level, there is an option to establish a barrier at Nordhavnen and Kalveboderne and to raise the rest of the coastline out towards Øresund. The barriers will be established so that they will protect the city against storm-surge events but without disrupting harbour operation at the same time. The plan take into consideration the future urban expansion and proposes that new constructions and new buildings in areas that are at risk of flooding from the sea and rising groundwater levels will be equipped and designed considering site-specific solutions. An interesting aspect of the plan is that adaptation is not only considered as a negative measure but also as an occasion to increase the quality of life for the city's inhabitants and create synergies with other planning initiatives. For instance, the "green" perspective embodied in the adaptation plan, while increasing the urban resilience, is expected to attract new private investments and, at the same time, expand and improve the quality of public spaces. The plan is the result of a 2 years public hearing and political discussions during witch detailed studies of the most relevant topics was executed together with stakeholder involvement as basis for the new climate change adaptation plan including risk assessments and economical consequences as well as suggestions for specific projects for implementation. Positive impacts of the adaptation plan will occur in the next decades. However, the plan provides a robust economic argument for timely and preventative measures for adaptation to the changing climate.

LONDON

London is the capital and most populous city of England and the United Kingdom, with an urban population of more then 9,7 million. As one of the top financial centres in the World, London is considered an alpha world city in the global economic system. The city has a long tradition of planning and revitalization projects aimed to promote sustainable development, including mitigating and adapting to the impacts of climate change, as well as promoting health and equality.

In October 2011, the city approved the "Climate Change Adaptation Strategy" as part of a series of strategies that together set out actions and policies to make London a sustainable and climate-resilient city. The strategy outlines a series of proposed actions the city should take in order to meet the challenges of climate change. Based on the analysis of a long-term scenario, the plan identifies three must relevant issues related to future changing climate (City of London, 2011):

- Flood risk. The UK Environment Agency has undertaken a study to identify the flood risk management options to protect London and the Thames Estuary from tidal flooding to 2100. Different adaptive measures were identified from raising the height of existing defences to constructing a second Thames Barrier. The thresholds to protection against rising sea levels provided by each of the options have been plotted against sea level rise. This approach helped decision makers to understand the suite of options open to them and how they can be combined into a 'decision pathways' that create a portfolio of measures through the century.
- Water resource scarcity. Over 600 million liters of treated water per day, nearly a quarter of all the water distributed in the mains network, is lost in leakage. This is due to the fact that nearly a third of the pipes that make up the distribution network are more than150 years old. To prevent water resource scarcity, the plan adopted a solution, referred to as 'water neutrality'. In principle, this means no net increase in demand despite a growth in the number of Londoners. To this aim, efficiency measures are planned for Londoners' homes at no cost to the householder.
- Ground condition. London's urban realm and land cover intensify many of the climate impacts. For example, the traditional construction of roads and buildings causes the loss of permeability and increase the risk of flash flooding while the loss of vegetation helps create the heat island effect. In this regard, the plan sets a target of increasing green cover in central London by 10% by 2050. The urban greening will help cool the city in summer and reduce the frequency and intensity of floods.

A number of cross cutting issues have been taken in consideration in the adaptation plan. These include the assessment of the consequences of climate change for urban systems such as health, well-being and economy. London's work on adaptation has benefited from strong and consistent political support, which has been the driving force for the setting up of other enabling factors such as financial support and a coordination unit in the form of the London Climate Change Partnership. An interesting aspect of the plan is the strong engagement of the city's residents. In this regard, digital media channels have been intensively used to ask Londoners what they could and should do to adapt. This included YouTube movies starring the Mayor and an interactive website where Londoners can give their ideas and vote on other peoples' ideas. This allowed a wide audience engagement in policy development and helped raise both awareness of the issue and ownership of the risk.

ROTTERDAM

Rotterdam is a thriving world port city with an urban population of over 1 million. The city has a long tradition of continually adapting to new circumstances and anticipating and benefitting from economic and social change.

In December 2012, the city adopted the "Climate Change Adaptation Strategy" that sets the course that will lead to a climate-proof city and provides insight into the opportunities that climate change presents. The Strategy provides the framework and the starting point for a future-proof development of Rotterdam and ensures that, in the future, topics such as water safety, accessibility and the robustness of the city are included as the basis for each (spatial) development right from the start of the process. The plan is based on the analysis of a long-term scenario and addresses five main themes:

- Flood management. Rotterdam is located in the delta of the rivers Rhine and Meuse. The vulnerability of Rotterdam to flooding is illustrated by several events in the 20th century. Rotterdam needs to be protected against flooding, both inside and outside the dykes. To this aim, the plan provide the construction of flood defensive works and high levelled embankments in order to protect the city against rising sea levels and make the Rotterdam harbour one of the safest ports in the world. Above this "structural" measures many others small-scale interventions have been proposed. These include water squares which relieve the sewage system, infiltration zones along infrastructures and the integration of trees and greenery in outdoor areas (both public and private), which also benefits the city environment. By frequently applying these small-scale measures to the 'capillaries of the city', the plan aims to reduce Rotterdam's vulnerability.
- Accessibility. Accessibility of the city and the port is recognized as an important aspect of the climate for establishing a business. If water plays a more significant role in spatial planning and more housing accommodation is realized on the water, by consequence, transport over water should equally be stepped up. By 2025, the transport infrastructure of the city and port will be climate proof and an intensive public transport network over water will contribute significantly to the accessibility of the city
- Urban water security. Climate change can lead to increased precipitation, but also to longer periods of aridity. In order to guarantee water security, flexible water level management in watercourses and ponds will be used to realize additional seasonal storage. In addition, large diameter water connections to the regional water system will be constructed to increase the supply of fresh water.
- Adaptive buildings. One of the objectives of the Rotterdam City Vision (2007) is to realize densely populated residential environments in the port areas in and around the city centre. Building in these areas requires a proactive response to the effects of climate change. In this regards, in two pilot areas of the city, the test of adaptive construction methods is ongoing. The results of the pilots will be used to develop new planning guidelines for future developments.
- City climate. The city climate is influenced by the layout and design of the city. In this regards, the plan stresses the need to pay attention in the future to the distribution of green/blue areas, heat stress resistance, presence of sheltered and cool places in the open space.

One of the most interesting aspect of the plan is that it seeks to find a balance between civil engineering and naturally functioning biological components, in order to make optimal use of potential ecosystem services and functions for the benefit of safety against flooding and freshwater availability.

The climate change adaptation strategy offers many opportunities to strengthen the economy of the city and the port, to improve the quality of life in neighborhoods and districts, to increase biodiversity in the city and to foster committed and active participation by Rotterdam residents in society.

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IMAGE SOURCES

The image shown in the first page is from http://www.grist.org; the image shown in the second page is from http://e-architect.co.uk; the image shown in the third page is from http://www.wikipedia.org; the image in the fourth page is from http://www.holland.com.

05

CITIES, ENERGY AND CLIMATE CHANGE

REVIEW PAGES: NEWS AND EVENTS

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In this number

SOLUTION SHARING STANDPOINT FOR THE CLIMATE CHANGE CHALLENGE

From the next November 30 until December 11, Paris will host the 21st Conference of the Parties (COP21); it represents an important step towards reaching a universal climate agreement by adopting and implementing new legal and political instruments applicable to all the members of the United Nations Framework Convention on Climate Change (UNFCCC). The main goal is keeping global warming below 2 degrees Celsius above preindustrial temperatures by reducing global emissions of greenhouse gases.

After almost 20 years from the Kyoto protocol, in fact, the issue of climate change is increasingly present, as demonstrated by the 35-page of Summary for Policymakers of the Fifth Assessment Report, which confirm the robustness of scientific hypotheses about the planet climate changes occurred in the last century and the alarming expectations for the next decades. New evidence strengthens and confirms the data on climate change as result of an extensive series of scientific observations and models of new generation (IPCC, 2014). We can therefore say with a "very high level of confidence" that:

- Since the 1950s, many of the observed changes are unprecedented over decades to millennia;
- Human influence on the climate system is clear, and the main reason is linked to the emissions of greenhouse gases in the atmosphere.

There are two kind of strategies to face with those issues:

- preventive strategies through mitigation measures aimed at reducing GHG emissions;
- prefigurative strategies through the development of resilient systems (Colucci, 2012).

Till now the main approach used by the UNFCCC was based on a burden-sharing standpoint more than a solution sharing one; one of the most interesting news introduced in the COP21 is the *Agenda of Solutions* that propose a different approach to the climate change consisting in a "set of tangible initiatives and a demonstration of what is feasible by pioneers, encouraging all stakeholders to take action, share best practices and knowledge around low-carbon solutions, and contribute to the resilience of economies and the development of structuring projects" (www.cop21.gouv.fr). Therefore, the experience exchange became one of the crucial tools of this challenge.

In this perspective were selected some international events taking place in the coming months, that will contribute to the networking of experience, knowledge and best practices on the issue of climate change, thus enriching the topics of Paris conference.

RESILIENT CITIES 2015

Where: Bonn – Germany
When: 8 - 10 June 2015
http://resilient-cities.iclei.org/

Diversity of thoughts and approaches is the core of "Resilient Cities", the Annual Global Forum on Urban Resilience and Adaptation, hosted every year in Bonn. This International Congress, now in its fifth edition was created in 2010 thanks to the collaboration of Local Governments for Sustainability (ICLEI), with the World Mayors Council on Climate Change and the City of Bonn, the aim of the initiative was to create a network between members of the institutions and experts on the issues of the urban environment resilience. Mayors, councillors, commissioners and governors chiefs of sustainability, as well as global climate change and adaptation experts, urban regional planners, university students and researchers are invited to discuss together about a wide variety of topics; the main topics of the 2015 edition are:

- Urban risk and vulnerability including risk data and analysis;
- Adaptation planning and policy and integrated approaches;
- Communicating resilience and applying ICT solutions;
- Ecosystem-based adaptation and resource security;
- Creating resilient public health systems and communities;
- Resilient building, design and infrastructure;
- Capacity building, Governance and Collaboration;
- Financing resilience planning and development.

THE 2ND INTERNATIONAL CONFERENCE "CHANGING CITIES"

Where: Porto Heli – Greece
When: 22 - 26 June 2015
http://changingcities.prd.uth.gr/

The strategic role played by the urban development to address the climate change challenge is also one of the main topic of the 2nd international conference "Changing Cities", organized by the Department of Planning and Regional Development, University of Thessaly, under the aegis of the Greek Ministry of Environment, Energy & Climate Change.
The main conference themes come from the observation of the social, economical and environmental urban phenomena occurred in the last decades like the rise of post-industrial urban economies (mainly involving ICTs and leisure activities) or the formation of a multi-ethic and multi-cultural urban societies; those issues are closely related with the emerging new patterns of urban space morphology and landscape and represent the basis on which urban planners and designers, architects, landscape designers, urban geographers, urban economists, urban sociologists, and demographers, are called to investigate and propose ideas, visions and new challenges concerning cities and their future. In particular, this edition main topic is "planning and designing resilient cities under economic and environmental uncertainty"; it invites to reflect that the urban resilient strategies to be effective have to face also with economic and social contingencies.

OUR COMMON FUTURE UNDER CLIMATE CHANGE

Where: Paris – France
When: 7 - 10 July 2015
http://www.commonfuture-paris2015.org/

A similar concept is expressed in the call of the Conference "Our Common Future Under Climate Change", focused more on key issues concerning climate change in the broader context of global change. Also in this case the measures for climate phenomena are seen as closely connected to political and economical uncertainties; for this reason one of the key point of the conference is about the effort to "identify areas of consensus, and map controversies while taking stock of the multiple connections to development and environmental challenges within a large diversity of local, national and regional contexts" (www.commonfuture-paris2015.org). Therefore, a large emphasis is placed on transdisciplinary and integrative approaches, able to join different stakeholders and communities, thus encouraging multi-disciplinary and multi-lateral thinking. On these bases, the structure of the conference is organized in four daily themes:

- state of knowledge on climate change;
- landscape of our common future;
- responding to climate change challenges;
- collective actions and transformative solutions.

It starts with a session on the latest knowledge from both natural and social sciences and closes by exploring transformative solutions to climate change from different perspectives in order to reach integrated and shared solutions.

10TH CONFERENCE ON SUSTAINABLE DEVELOPMENT OF ENERGY, WATER AND ENVIRONMENT SYSTEMS

Where: Dubrovnik – Croatia
When: September 27 - October 3 2015
http://www.dubrovnik2015.sdewes.org/

One of the main issues concerning climate change challenge is related to the sustainable use of natural resources and the development of new knowledge based economy, taking into account methods for assessing and measuring sustainability of development, regarding energy, transport, water, environment and food production systems and their many combinations. The "10th Conference on Sustainable Development of Energy, Water and Environment Systems" is focused on the improvement and dissemination of methods, policies and technologies about sustainability. In this direction the conference proposes wide array of topics amongst which it is worth mentioning: green economy and better governance; decarbonisation policies; energy, transport, water and environmental policies; technology transfer and development; sustainable resilience of systems; smart energy systems; energy planning; transport management; renewable energy resources; energy markets; emission markets; political aspects of sustainable development. In particular, the Conference will address the core goals of the Energy Community like the creation of a competitive integrated regional energy market or the development of the Mediterranean power ring.

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WEB-SITES

Paris 2015, 21st Conference of the Parties: www.cop21.gouv.fr/en/choice-france/agenda-solutions

"Our Common Future Under Climate Change" Conference: www.commonfuture-paris2015.org

IMAGE SOURCES

The image shown in the first page is taken from: www.nextjuggernaut.com

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CITIES, ENERGY AND BUILT ENVIRONMENT

STRATEGIES FOR CONSUMPTIONS' REDUCTION

2 (2015)

The ZCB Zero Carbon Building, designed by Ronald Lu & Partners, conceived to promote a low carbon emission lifestyle and to be a showcase of technologies to initiate a cultural change.
Image is from: http://alandrealty.com

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EDITORIAL PREFACE:

CITIES, ENERGY AND BUILT ENVIRONMENT

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The improvement of energy efficiency is one of the main challenges we need to address to reach the objectives set by the EU 20-20-20 Strategy. Cities are responsible for two-thirds of the global energy consumption and this proportion is expected to grow further. Cities represent complex systems in which physical assets, strategic and economic activities as well as most of the world population are concentrated. Hence, to achieve relevant and enduring results in addressing energy efficiency issues, it is necessary to broaden our vision from the building scale to the whole urban structure. Urban planning is increasingly considered a crucial element in the long-term energy efficiency strategies. Hence, relevant and enduring results in addressing energy efficiency issues can be achieved, broadening our vision from the building scale to the entire urban system, and considering the relationships between the different urban components and energy consumption.

This issue of TeMA focuses on the topic of Cities, Energy and Built Environment. The first article, titled "Urban Planning Dealing with Change and Infrastructure", by Sonja Deppisch and Daniel Dittmer (Hafencity University Hamburg), deals with urban planning and the transformation processes that potentially affect local infrastructure. The overarching theoretical social-ecological resilience-thinking frame and its potential application as well as implications for urban land-use development. The paper illustrates two explorative studies in Germany. One study gains its material from a scenario process with planning practitioners and urban stakeholders of a medium-sized city. The second explorative study presents research results on the readiness to apply the resilience concept to urban planning, dealing with change and local infrastructure in a small community. The simulation shows that applying social-ecological resilience thinking to urban planning helps to critically consider the paths taken so far in building local infrastructure. Nevertheless, such a process requires additional financial, as well as human, resources and implementation tools. Also, the given path dependency as well as financial constraints are impeding the perception of any leeway in infrastructure development at the political level. The second article titled "Smart City and Metropoletan Area: the Energy Component in the Case Studies of Genoa and Naples" presented by Rosaria Battarra, Chiara Lombardi e Marco Raimondo deals with the metropolitan levels and proposes a survey of the experimentations carried out in the two Italian cities of Naples and Genoa referring in particular to the energy component. In order to define the inclination towards "smartness" of these two metropolitan Italian cities a methodology is developed. This survey was structured in two macro-phases: the first one aimed at collecting information studying documents, databases, projects, programmes and actions, the second one based on stakeholder interviews. Authors highlight that from the analysis of the experiences and policies initiated in the metropolitan areas of Genoa and Naples, among the many themes defining Smart City, the energy component emerges as a central subject. In both case studies, in fact, smart actions are primarily aimed at energy saving or, alternatively, at environmental protection. The need to mainstream, in the regular urban planning process, actions and tools aimed at implementing energy saving is highlighted by the authors as one of the necessary condition to action.

The section Land Use, Mobility and Environment collects four articles. The first one titled "Less Smart More City" focuses on the Smart City concept evolution and its relationship with urban planning. The paper presents the results of research aimed at analyzing and interpreting the different formulations that are made of the term smart city mainly, but not exclusively, through lexical analysis, applied to a textual corpus of 156 definitions of smart city formulated in the last 15 years. In particular, the study identified the main groups of stakeholders that have taken part in the debate, and investigated the differences and convergences that can be detected between the approaches of the: Academic, Institutional, and Business worlds. Beyond the differences that characterize these three groups, it demonstrates that the debate is increasingly in the hands of businesses, while institutions take a secondary role and the scientific community tries to carve out its own space with difficulty within the themes promoted by research funding. The second one, titled "Urban development in Tuscany. Land uptake and landscapes changes", written by a group of researchers from the Universities of Aquila and Florence, addresses the phenomenon of urban sprawl. It has been already recognized as one of the major anthropic threats to natural ecosystems and landscapes while the negative aspects of the phenomenon are still only marginally taken into consideration in the scientific and local government circles. The study regards the processing of data on urban land conversion over the past 50 years and the effects in the areas of high environmental vulnerability in Tuscany, one of the most important Italian regions. The historical data was compared from a qualitative and quantitative point of view with the present-day geography of settlements, which showing changes found in today's settlement-territorial structure. The conclusions focuses on collated environmental criticalities and the margins for recovery of the compromised territories that still today receive little attention from central institutions and local authorities and that are scarcely taken into account by land management tools. The third one, titled "Smart City, Metropolitan Areas and Competitiveness: the case study of Florence", like Giffinger et al., considers the Smart City articulated in six dimensions. One of these is the Smart Economy, which refers to the activation of development processes that increase the competitiveness of urban systems. Among the results of the research activities, it suggests that some metropolitan areas, such as Florence, have invested in policies and actions aimed at implementation of Smart City in order to increase their competitiveness in key sectors of their economy. Therefore, after the description of the relationships identified in the scientific literature between Smart City and territorial competitiveness, this paper describes the policies and the measures adopted in Florence, regarding the sector of cultural heritage and tourism, for the constitution of the Metropolitan City. The last one, titled "Sustainable Urban Mobility Towards Smart Mobility: the Case Study of Bari Area. Italy", discusses preliminary findings of a Research Project conducted at University of Naples, DICEA, funded by EU (PON REC 04A2_00120 Asse II), "Smart Energy Master – Toward Energy-based approaches for Regional Planning". The primary goal of the work is to review policies, programs, projects for sustainable urban mobility and smart mobility solutions in the Bari area. The second goal is assess the trends of urban mobility in order to evaluate its sustainability and smartness. A comparison, focused on matching the local strategies to European programs, is presented. Finally, a consideration on how the "smart" framework may improve urban mobility planning is proposed.

Finally, the Review Pages define the general framework of the theme of Smart City, Energy and Built Environment with an updated focus of websites, publications, laws, urban practices and news and events on this subject.

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URBAN PLANNING DEALING WITH CHANGE AND INFRASTRUCTURE

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ABSTRACT

This paper deals with urban planning and change processes potentially impacting local infrastructure. The overarching theoretical frame is social-ecological resilience thinking and its potential application to as well as implications for urban land-use development. The paper draws its main attention on if this concept can be of use for urban planners dealing with change and urban infrastructure and if a readiness towards its application can be identified. This endeavor is informed by two explorative studies in Germany. One study gains its material from a scenario process with planning practitioners and further urban stakeholders of a medium-sized city. Main topic was how to deal with the challenges of climate change impacts in urban planning and development. The second explorative study reflects research results on the readiness to apply the resilience concept to urban planning dealing with change and local infrastructure in a small community. The scenario process showed that applying social-ecological resilience thinking to urban planning helps to critically reflect so far taken paths in local built infrastructure, to take on an integrated perspective and to develop new and innovative strategies for further land-use development. Nevertheless, such a process requires additional financial as well as human resources and translation exercises. Also, the given path dependency as well as financial constraints are hindering to perceive any leeway in infrastructure development at the political level, so that concrete implementation at the moment seems to be out of sight, which is also caused by multi-level dependencies.

KEYWORDS:
urban resilience, urban planning, social-ecological resilience thinking, infrastructure

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应对变化和基础设施的城市规划

摘要

本文论述 了城市规划 和变化过程 对当地基础可能造成的影响。总体理论框架是思考社会生态的恢复能力及其在城市土地利用和发展中的潜在应用及影响。本文重点关注此概念是否可以被城市规划者用来应对变化和建造城市基础设施，以及其应用是否可以就绪。此工作由德国的两项探索研究完成。一项研究从规划从业人员的方案和一座中等城市的利益相关者中获得材料。主题是如何在城市规划和发展中应对气候变化的影响。第二项探索性研究反映了恢复力的概念在小型社区应对挑战和当地基础设施时的准备成果。该方案过程表明，运用社会生态恢复力来思考城市规划有助于进行批判性反思，以及在基础社会的建设中获取捷径，采取综合角度为土地的利用与开发制定进一步创新战略。然而，这样的过程需要额外的资金、人力资源以及翻译操作。此外，对给定捷径的依赖以及金融制约也在政治层面阻碍着基础设施的开发，因此任何真正的实施要淡出人们的视线也是多层次的依赖所造成的。

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关键词
城市规划, 当地技术基础设施,
社会生态复原, 变化

1 URBAN RESILIENCE MEANDERING BETWEEN BUZZWORD AND COMPLEX CONCEPT

There is a growing discussion on the resilience concept and its relevance to different fields of science. Accordingly, there are seemingly almost as many resilience definitions as authors who write about the concept, even within the same discipline. This paper draws on the discussion of social-ecological resilience and discusses its potentials for being applied to urban planning and urban administration dealing with local technical infrastructure. The main question tackled here is if and how this complex and abstract concept can be of use for urban planners and related colleagues of urban administration dealing with local infrastructure, and if there can be detected a readiness to apply resilience thinking.

Especially with reference to cities and urban development resilience received a growing attention and use as catchword of importance not only within the scientific discussion (e.g. Galderisi and Ferrara, 2012, for an overview and grouping into "families" of bodies of literature see Colucci, 2012), but also in practice. The latter is for instance manifested in the 2013 Rockefeller's Foundation competition "100 Resilient Cities" (Rockefeller Foundation, 2014) with several hundreds of international applications from cities and also in the annual practice-oriented conference on Resilient Cities of the international cities association "Local Governments for Sustainability".

The growing use of the catchword resilience risks rendering the term to a fashionable buzzword loosing conceptual depth and meandering between very different definitions (Bahadur et al., 2010; Mazzeo, 2014; Papa et al., 2015). Also, as Papa et al. (2015) state, out there are not many concrete definitions of what is meant by urban resilience, but the ones provided share the common line of focusing on safety and the uphold of urban functions in case of crisis and further external forces. While as not that many explicit definitions exist, the term resilient city is often used. For further clarification, therefore, in this section, it will be explained what is meant by using resilience. It is referred to a specific body of literature, namely to the social-ecological resilience concept.

This conceptual understanding of resilience is considered as helpful looking at cities dealing with change, as it offers a perspective different to the common perspective used in practice. It highlights change as immanent component of a system instead of perceiving it as an external factor only. The interdependence of ecosystems and society is a crucial element of this concept, based on the understanding of inseparable social-ecological systems which develop dynamically and in a non-linear way. Their dynamics are described with so-called adaptive cycles and are illustrated with the figure of a "lying" number eight (Holling and Gunderson, 2002). This "lying eight" symbolizes the systems moving continually between four different phases. Walker and Salt (2006) highlight that the systems can also show different dynamics as these theoretically described ideal phases. Within this context, social-ecological resilience is understood as the capacity of social-ecological systems to persist continually and eventually to reorganise themselves. This happens through maintaining essential functions and structures of the whole system and further developing through incorporating change (Berkes et al., 2003; Walker et al., 2004). To reach resilience in this understanding, Berkes et al. (2003) propose as essential system abilities to learn to live with change and uncertainty, to support diversity, to combine different forms of knowledge and to provide for self-organization. An additional essential component of the social-ecological systems concept is the understanding of "panarchy" (Holling and Gunderson, 2002). Panarchy describes, that the considered system influences and is influenced mutually by systems on different levels which also go through adaptive cycles. In consequence, also dynamics on smaller or bigger scales can evoke disturbance or even shocks for the considered system.

As this understanding of social-ecological systems and of resilience roots in systems ecology, it still undergoes strong discussions being applied to social dominated systems (see e.g. Swanstrom, 2008). Adger (2008) highlights as an answer to these critics that the concept is mainly to be understood as an analytical tool and that it does not provide normative judgments. Nevertheless, even if it is understood as an analytical tool only, the highly abstract as well as multi-dimensional concept renders it difficult to bring it to further and concrete use in practice, especially in human dominated systems. While there is a multitude of very different approaches to operationalize the social-ecological resilience concept, these are mainly developed in non-urban research contexts or are very broad if it is dealt with urban complexes. But research and literature on urban resilience is fast growing, also within the social-ecological resilience concept it got increased attention during the last years. Especially the complexity of urban systems and the difficulty to define their confines due to the matter of fact that they are decoupled from the resources they use, render analyses of their system dynamics or their social-ecological interdependencies very demanding (Alberti, 2008; Colding, 2007).

With regard to the question we deal with here, the reference to social-ecological resilience is helpful, because it allows us to understand cities or, even broader, urban regions as complex adaptive systems. They are characterized by a variety and multitude of interactions and interdependencies between humans and the environment on different spatial and temporal scales. Additionally, they are undergoing uncertain or even surprising non-linear conditions of social, political, technological, economic or environmental change. Approaching urban planning and administration with this concept can mean to scrutinize dominant linear and complexity-reducing thinking in planning practice as well as the sectoral split within urban governance and administration (Deppisch et al., 2014). Referring to social-ecological resilience in practical spatial planning would mean in consequence to emphasize complexity and here especially non-linearity, emergence, uncertainty and potential states of not-knowing, relevant other temporal or spatial scales (panarchy) as well as social-ecological interdependencies.

In bringing these ideas and concepts closer to planning practice, the main attention is drawn on if and how this complex theoretical concept can be of use for urban planners dealing with change and local infrastructure and if there can be detected a readiness towards its application.

2 EXPLORATIVE RESEARCH SETTING AND CONTEXT

This endeavor is informed by two explorative studies in Northern Germany. One study gains its material from a transdisciplinary scenario planning process in a medium-sized Northern German city located at the Baltic Sea coast. This process used a translated resilience perspective as the conceptual point of reference. It was undertaken in a period within two years (2011 to 2012), prepared and conceptualized by a core-group consisting of practitioners from urban and regional planning and administration as well as of scientists with different disciplinary backgrounds. The idea to emphasize the characteristics of a translated resilience perspective was brought in by these scientists. The process consisted of three main scenario workshops with up to 40 participants from different fields relevant to urban development, ranging from planning practitioners to urban politicians, economic actors and further urban stakeholders. Main topic of this process was how climate change as well as other factors will impact future land-use development of the urban region and how urban and spatial planning can deal with the challenges of these change processes (for details see Hagemeier-Klose et al., 2013). For the intention of this paper, it will be looked especially at the interim as well as the final outcomes of this process with reference to the topic of the current state of the urban infrastructure and its further development. As empirical material it is referred to protocols of the scenario planning workshops (plan B:altic, 2011a-b, 2012) as well as the finally developed climate change adaptation concept adopted by the City Parliament (Hansestadt Rostock, 2013). For further contextualization of the urban planning and infrastructure situation, it is referred to the preparatory land-use plan (Hansestadt Rostock, 2009) and further documents of the city. With reference to infrastructure development, Rostock provides several characteristics. So it has an important sea harbor for cargo and for passenger handling, and further enlargement of the harbor is not only discussed but also foreseen within the preparatory land-use plan (ibid.). Such an enlargement could also require additional traffic structures or improvements of given structures with a general municipal road system which can be considered as sufficient and in a good state as it was improved after German Reunification. Public transport is ascribed an important role by urban planning (ibid.) and next to the upgrading which already took place during the last decades, further upgradings and improvements are planned, especially to strengthen public transport against road traffic (ibid.).

Further information comes from a second explorative study. This study reflects research results on the applicability of the social-ecological resilience concept to urban administration and planning in dealing with change and local technical infrastructure in a small Northern German town, based more inland. The research material in this explorative study was gained through semi-structured interviews with practitioners from urban and regional planning, urban administration and from the service provider for energy. Additionally, documents of relevant local political committee meetings were analyzed (Gemeinde Seevetal, 2013a-c, 2014a-c). With identified key persons of urban planning the material gained was also re-discussed and it was analyzed if there is to be found a readiness to apply a resilience perspective in dealing with local infrastructure in preparatory land-use planning at the community level.

As can be judged already from the material, we here deal with two explorative studies and do not pretend to have performed an all-encompassing broad study. Nevertheless, we think that this material is worth to be published to give further – and practically tested – information and insights on the discussion on urban resilience.

3 RESULTS

3.1 OUTCOMES OF A TRANSDISCIPLINARY SCENARIO PLANNING PROCESS HIGHLIGHTING UNCERTAINTY AND COMPLEXITY

Starting with the first explorative case study, we look at Rostock, a medium-sized city at the German Baltic Sea coast with around 200 thousand inhabitants. It is an old hanseatic town and spreads basically from its old medieval center along the river which is mouthing in the Baltic Sea.

Fig. 1 Rostock, the old hanseatic center and the river Warnow mouthing in the Baltic Sea

This city, which is not belonging to an administrative district due to its size, and its surrounding suburban area started together with a research team in 2011 a process on dealing with climate change impacts on future land-use development and here especially with related complexity and uncertainty. Before, it was not dealt purposely with climate change impacts with regard to the land-use development in the urban region, neither in the urban nor in the regional land-use plan. Potential climate change impacts to be expected within the city are storm floods with an increase in intensity as well as frequency, more and more severe flooding events due to sea-level-rise and an increase in frequency and intensity of extreme events such as heavy precipitation events or droughts. Also the already existing urban heat island is expected to rise due to rising temperatures. Nonetheless there can be identified some strategies within the preparatory land-use plan of 2009, which can also serve as adaptation strategies. The intention to create a strcuture with multiple centers for energy production is such an example to distribute to diverse territorial parts of the town diferent functions of the grid (Hanstestadt Rostock, 2009, 62), which then can, due to this diversification, better react to extreme weather events. But at the same time there are also other strategies, which can run contrary to adaptation purposes, as climate change adaptation was not a topic during developing and adopting this preparatory land-use plan in 2009. Examples are planned new settlements as well as tourist infrastructure close to the river or the sea-side (ibid, 99ff.), which can be threathened due to extreme floodings or storm surges.

For the purpose of this paper, we focus here on aspects of energy and further local infrastructure and their discussion within the general land-use development as well as urban planning context. As method to deal with the potential future of land-use and influencing factors, a scenario-process was performed. This process showed that while dealing with climate change impacts and the related complexity and uncertainty issues in the land-use development of the core city and its hinterland, the most prominent infrastructure topics were energy and transport. But also, water drainage, further built infrastructure as well as drinking water supply were discussed.

Energy supply and related infrastructure was already a prominent topic within the city since a first framework concept on climate change mitigation was developed in 2005, long before the scenario process started. It was aimed at mitigating further climate change and at sustaining the future local and regional energy supply through renewable sources. Here, also an explicit reference to an energy optimized urban as well as infrastructural development was made (Energiebündnis Rostock, 2011). In consequence, it was also a very prominent topic within the scenario-process which had a focus on how to deal with climate change impacts (plan B:altic, 2011a-b, 2012). The participating stakeholders and practitioners from civil society, politics, economics as well as urban and regional planning and administration highlighted the importance of an energy transition with reference to both sides of the coin climate change.

What exactly was considered as important to be dealt with referring to the energy supply? The energy transition to a mainly renewables-based energy generation got a high attention throughout the whole scenario-process. It is seen as a potentially benefiting factor for the further economic development of the core city and the urban region through saving current high costs for fossil energy and replacing them with locally produced renewable energy. The boosting effect for the local economy is not only seen in the energy production and supply itself, but also in further related economic fields such as rendering the urban region to a focal point of related technology development and transfer. Still, it was also taken into account that an energy transition of this kind would depend on funding mechanisms supporting renewable energy as otherwise the so produced energy would be too expensive for the inhabitants in comparison to conventionally produced energy. Also it was critically judged if full support for such a transition by the inhabitants could be expected as they were not as familiar with potential changes, related complexity and uncertainty as the actors who were participating in the scenario planning process. Also, climate change was considered to be a negatively biased topic in the public sphere so that it cannot be expected to foster the willingness to transform the energy supply and to accept the consequences, such as higher prices for locally produced energy. The latter as well as the transition as such were also discussed in dependence from the global market, such as the price development for coal or oil. Not to forget, it was mentioned that there will be an increase in future energy demand due to needed cooling purposes which are expected to be necessary due to future climate change impacts such as extreme heat events or increased urban heat island effects.

Setting these points in relation to urban and regional planning as well as spatial development, it became obvious, that aiming at this energy transition, there are further areas as well as further infrastructure developments needed for implementation. Additionally, the risk was seen to focus on renewables only in a way of "mono-culture". With reference to land-use development, the need for additional areas to plant biomass for bio-energy purposes which are now used for other purposes such as crop production or the need for new solar or wind energy production sites was seen very critical. These needs also conflict with other measures developed within the process to deal with potential climate change impacts, such as the strategy to hold as many areas as possible free from use to mitigate the urban heat island and to still have options to deal with unforeseen events or to focus on urban and regional agricultural food production. Here it was also seen as necessary to develop further strategies to re-use already sealed areas or to think on multi-use strategies. Such a potential for a multi-use strategy was for instance seen within the harbor area of the town, where the potential for solar or wind energy production was identified (Albers and Davidse, 2011). Such a development would then require further infrastructure to distribute the generated energy. Potential disturbances for the – then already transitioned – energy supply were also seen by climate change impacts such as an increase in intensity and frequency of storms leading to damage of the related energy infrastructure like aerial lines.

During discussing potential unexpected events, off-shore wind energy sites were considered as potential reason for unexpected disturbances of the sea-based traffic. This traffic is important for the city as its harbor is an already established important economic factor for the urban as well as the regional scale. Looking at further transport infrastructure, an important measure of dealing with climate change impacts was discussed, namely to intentionally use specific roads as areas to be flooded, especially in case of future heavy precipitation events (Richter and Davidse, 2012). The use of these roads as flooding zones would in consequence require providing better connected and combined transport modes throughout the urban territory. While this was discussed during the workshops as a long-term implementable non-conventional measure of flood-protection, the participants also ended up with a completely opposite idea they prioritized finally. The proposed important as well as short-term implementable adaptation measure was to raise the main roads which then would also function as protective dykes in case of floods within the city (plan B:altic, Hagemeier-Klose et al., 2012).

With regard to surface water drainage it was highlighted as important to create new drainage axles on the surface within the city to prevent devastating flooding events. Also it was considered necessary to adapt the sewage system technically to potential water volumes of heavy precipitation events. But this was then denied as over-dimensioned sewage systems would cause severe problems in case of periods without increased precipitation or even with droughts. Further infrastructure-related potential adaptation strategies which were developed, were to apply amphibious infrastructure solutions in the spheres of transport (especially for the harbor area), tourism and housing as well as general infrastructure purposes. But their potential usability was only seen in a limited way as the participants also expected problems with this kind of innovative infrastructure if extreme events such as storm surges or major flooding events would occur.

As far as general infrastructure planning was discussed, it was seen as a short-term need to take potential climate change impacts into account in ongoing planning and land-use decisions about long-lasting infrastructure and to use a more generalistic approach within urban development looking at infrastructure development. It was emphasized to respect the need in further plans to think in different plausible futures which might also have very opposite consequences such as a drought or a heavy precipitation event as well as to try to create more flexibility and diversity. These points are also concretely reflected within the urban framework concept (Hansestadt Rostock, 2013, 13), where a future critical assessment of the urban infrastructure (transport, energy, etc.) is envisaged. As main criteria to be used for this assessment were laid down the functioning of all supplies even if some parts fail, to reduce vulnerability of the infrastructure against extreme events and to guarantee the main functions and infrastructure services. Also, a mid-term reflection of the municipal urban planning and environmental department on the need to retreat from certain already built areas found its way in this framework concept on climate change adaptation (ibid., 21).

A difficult and therefore only cursory discussed point was the further population development of the core city as well as the sub-urban communities. Both, the further ongoing trend of re-urbanization but also a return of sub-urbanization processes were seen as possible, the latter for instance could be caused by increased urban heat islands effects or heat extremes. Especially the latter would have an effect on further infrastructure needs.

Overall, the participants highlighted as a very fruitful additional outcome of the process to have established a wide spanned network crossing sectors within urban administration as well as going beyond administrative actors and crossing the city boundaries, too. This crossing was seen as essential to get a comprehensive impression of social-ecological-technical interdependencies and to be able to discuss a wide array of potential future land-use developments and respective consequences in the urban region.

3.2 OUTCOMES OF A STUDY ON READINESS TO APPLY THE SOCIAL – ECOLOGICAL RESILIENCE THINKING IN URBAN PLANNING

The second study was performed between 2014 and 2015 on the main topic if at all and if yes how a comprehensive approach within urban planning dealing with local technical infrastructure can be fruitful, which is based on social-ecological resilience. The focus was on a holistic perspective including complexity and change as a system-immanent component of the local system. In contrast to the first case, here, a transdisciplinary process to implement a perspective of social ecological resilience within land-use development was not performed. Instead, it was focused on the current readiness of urban planning to implement social-ecological resilience from a pure scientific perspective. Also, barriers to practically implement such thinking were of concern. The case is based in a Northern German local community of around 40 000 inhabitants, located inland. In difference to the above mentioned case, this is a smaller local community which belongs to an administrative district. It does not have an old center but provides a polycentric structure as it originates in 19 different local communities being organized into one in 1972. It provides some central functions to its neighboring more rural communities. As a consequence of the former structure of 19 single and autonomous local communities, the now united community provides a quilt-like picture of a big energy and water supply as well as sewage network.

While there are only some smaller private energy production sites (solar, wind and water power), the very main part of the energy supply comes from external sources. As far as water supply and sewage is concerned, these are also externally steered at the administrative district level. But there can be found relevant productive infrastructure within our considered community, which serves for both, for itself as well as for the district. Especially the sewage plant is of relevance for the whole administrative district. Within the process of compiling a new preparatory land-use plan for the whole territory of the local community, this infrastructure was of special relevance as its state urgently needs to be renovated in some parts. It was emphasized to seek for synergy measures concerning the built infrastructure. Decentralizing infrastructure within the community with the aim of rendering it less dependent from upper administrative and political scales was not a topic at all. The main questions of supply and sewage are now strategically prepared at the district-level. This tributes to the fact that local single action is nearly possible given the already built infrastructure networks and related dependencies, at least at the community level.

Urban planning is having difficulties in dealing strategically on the land-use development of the whole local territory; also its position was weakened substantially in giving up the idea of establishing a new formal preparatory land-use plan. This plan was intended to revise strategically the so far ongoing land-use and the related future land-use development concepts. Instead, local politics decided upon an informal concept which is also to be respected in the binding land-use plans but which does not provide a coherent land-use strategy for the whole municipal territory. A formal preparatory land-use plan would have encompassed decisions or at least contents regarding local infrastructure for the whole territory, which are now lacking in the informal concept. The latter mainly contains single areas for further development and related prioritized measures.

An astonishing result was that urban planning uses different (old) plans of local infrastructure, especially in the field of water supply and sewage, while as in the same building their colleagues from the local civil engineering department are using different and new plans. So urban planning in this case is not up to date as far as the state of the local technical infrastructure is concerned. Additionally, both departments are also working with different concrete data, not only with different plans. The supply and sewage structures are not an explicit topic within the established informal concept concerning land-use, a general strategy with reference to urban development is lacking.

These infrastructures are only discussed with reference to certain potential areas for further development and the current state of infrastructure and the link from these areas to the infrastructures are discussed. In case these considerations led to the potential need to change infrastructure networks, the respective areas were not considered for further development due to the then necessary high development costs. The dominant thinking is oriented on a stable state equilibrium and does not provide an overarching strategy. Questioning the future-fitness of the local infrastructure system would have been possible within a cross-cutting and all-encompassing preparatory land-use plan which was not pursued anymore, but instead an informal and punctual concept. Ideas on implementing local renewable energy were raised, but not implemented.

Generally, questions of change, uncertainty and resilience are not at all discussed at the local level, neither in general urban planning nor in urban planning dealing with infrastructure related questions. Instead, the term of sustainable development is of relevance to German urban planning, so also in this case, as it is part in the German national land-use and building law. But this is only of a theoretical nature as it does not play any prominent role in concrete urban planning of our case. The interviewees were mentioning that a general strategic concept on sustainable development of their community is lacking to guide land-use planning. Additionally the dominant priority in financial spending of the community is focused on efficiency. The application of this principle does not allow for leeway or to develop buffering capacities as they are considered as financially inefficient.

A good example for this way of thinking is the already occurred problem with surface water running over the run-off sites and leading to flooding and potentially also threatening buildings. Even if this problem occurs from time to time and can be expected to increase due to climate change, it was politically decided not to act upon this to prevent further surface water runoff problems but to prevent financial investments. This decision was taken in spite of several problem analyses of different administration departments. A general discussion on resilience thinking and related aspects with the planning department had as an outcome that urban planning in this case is dominated by single projects and by higher-level planning. A critical reflection of eventually implicitly applied planning strategies is nearly undertaken, but would be essential to identify capacities or willingness to implement resilience.

4 DISCUSSION

Both studies show that resilience can more be understood as a process (Folke, 2006) than a property of cities or local communities. Nevertheless, it does not provide for a concrete end or aim of the process, but it indicates so far blind spots not considered within practical urban planning. Dealing with change is explicitly challenging looking at built or yet to be built technical infrastructure. Roggema et al. (2012) distinguish three different types of dealing with change in land-use planning and refer to them as incremental change (the weakest version of changing the existing), transition as a further version of change and transformation as the strongest version changing fundamentally the existing (Roggema et al., 2012, 2525). Even if the first case started explicitly with a complexity and uncertainty perspective, it did not end with a transformative notion in this understanding. But it already provided a very comprehensive discussion of manifold interdependencies and led to in this sense transition-oriented strategies and measures. Also, the participants of the process found many new interdependencies or cascades of interrelations and consequences of new strategies they considered beforehand more in a one-way perspective in thier daily working routine. During the process, the willingness to deal with these issues and to adopt such a resilience-based perspective was growing as it showed advantages. Also, a certain share of these ideas and strategies already found its way in the politically adopted municipal framework concept on climate change adaptation (Hansestadt Rostock, 2013). The second study, however, showed the barriers towards such a readiness within the daily practice of urban planning, especially in smaller local communities.

In practice it is nearly possible to analyze all interdependencies or complex states of the urban system and its non-linear dynamics. This was not only shown by the very sectoral planning approach even the so-called cross-cutting urban planning in the second case showed. Also the first case could just get a superficial impression in many interdependencies and cascades of consequences of socio-technical decisions, even if there was applied a complexity perspective. One has also to consider that this process was externally funded and supported by a research team. The practitioners were convinced that a repetition of a process like that would not be possible without this extra funding and support due to lacking additional man power to cover new tasks next to the regular duties. Additionally, it is difficult to gather all available and current information as well as knowledge needed due to the sectoral divide within urban administration and the different responsibilities. This serves as a barrier to apply the resilience concept and its holistic approach, too. This became also obvious in the second case, where urban planning behaved more than a single sectoral task instead than a cross-cutting one, which would encompass everything relevant to further land-use development. Here, local infrastructure seems to be not of a business of urban planning. But also the first case shows that the integrative and all-encompassing approach of social-ecological resilience is very challenging as it meets a practice which is segmented in sectors. And as the second case demonstrated, these sectors are not forceably using the same updated plans even if they are working on the same municipal territory.

With regard to the panarchy concept, the cities are dependent on developments on other levels or outside of politics and administration, especially in the field of water or energy leading networks. The smaller city shows this dependence even more, as some responsibilities of public administration are decided upon at the administrative district level. And if we look especially at local technical infrastructure, main decisions are taken at other relevant levels than the one of the city or local community. One aspect illustrating this is the essential legal basis for financing renewable energy infrastructure which is taken at the national level. This law regulates who is allowed to supply with current at which charges. Also it is decided on upper levels which form of energy production is supported by financial funds and further supporting schemes.

Even if these dependencies as well as interdependencies are given, it is possible to reflect them critically and discuss opportunities of self-organization, as the first study showed. Here it was discussed already before the resilience-oriented scenario process started to change the given path of the mainly external fossil-energy supply. Was this at the beginning mainly triggered by financial incentives, it was discussed comprehensively within the scenario process, reflecting also potential land-use conflicts. The second study, in contrast, showed the opposite as here even the opportunity of looking strategically at taken paths within infrastructure development of the whole territory was not seized through following up with a new preparatory land-use plan. Instead, this endeavor was given up and in consequence, the strategic decisions were left open and delegated to the district level.

In both cases – in the first above all at the beginning of the process, in the second during the first contacts with practitioners – there were lacking boundary points to identify potential contacts between the theoretical concept of social-ecological resilience and the daily planning practice and concepts it uses. Here, within the small second study, it was only possible to talk about these ideas and their potential use in planning through using a reference to sustainability. If a reference to resilience is made, then it is – if we follow here the differentiation of Folke (2006) – the engineering type of understanding resilience which emphasizes a stable and constant equilibrium and the time of reaction as well as the efficiency of returning to this equilibrium. This is in close connection to the reductive perspective on infrastructure on its technical functioning; measures related to infrastructure are then maintaining the status-quo technically. The idea of other possible states outside of the path taken so far is hard to be found. The first case shows thinking which goes beyond the current state, but doubts its practical transition-oriented implementation at the end. This is also related to the high costs related to infrastructure development and the difficulty to change the paths taken so far. The latter would require huge changes correlated with huge financial investments. The bounce back oriented thinking ("engineering resilience", Folke, 2006) is even more prominent in the second case as the example of surface water shows as well as the decision to waive a new general land-use strategy. The latter might have offered also a future-oriented strategy in dealing with local technical infrastructure. This is a clear identified barrier to implement resilience, which depends on local politics and not on urban planning alone. And it supports the point of Papa et al. (2015, 29), who emphasize that it is important to consider both, the so-called hard as well as soft components of an urban system to built up or improve its resilience. This was reflected in the first case more comprehensively.

A relevant point to add and emphasize is the path dependency of the so far existing infrastructure which does not surprise while dealing with built infrastructure. This path is oriented on a stable state equilibrium and in case it works it does re-strengthen itself through many different feed-backs (Gößling-Reisemann, 2008). But if we look at discussed changes such as the change of the energy supply system to foster energy transition, also the transport of energy is of relevance. Such a transition would not only require a change in main energy sources, but also a change of the centralized supply network.

A decentralized system with many polycentric networks allowing a diversity of current injections would be necessary requiring an additional change in infrastructure (Gößling-Reisemann, 2008). The local communities in Germany have the autonomous power to take the necessary decisions by themselves. But a real change not only in the energy generation infrastructure but also in the supply networks and related feedbacks would require too many financial resources, especially for local communities with tight financial backgrounds or already problematic financial states, which are leading already to weakened investments and shortages even within municipal compulsory tasks (Deutscher Städtetag, 2014). This renders the path dependency even higher, due to the long-lasting permanence of built infrastructure as well as their high building-investment costs and also necessary destruction works and consecutive costs. But nevertheless, as the scenario process in case one showed, it is possible also within tight municipal financial constrains to think on diverse, redundant as well as multiple-use strategies and to leave given paths of infrastructure location as well as abilities.

5 CONCLUSION

Returning to the main question we raised at the beginning we can sum up the following answers. First, it was shown that the concept of social-ecological resilience thinking can be of use for urban planning and related administration to deal with change and local infrastructure. Introducing social-ecological resilience and the related thinking to urban and regional land-use development initialized new discussions and catalyzed the confronted practitioners to reflect certain topics within land-use development and local infrastructure development in a different way. Also new strategies such us multiple uses of transport infrastructure or local polycentric infrastructure networks were identified. Also the application of this thinking can be of use if it is brought to a concrete territory and applied there as this can reveal: (a) so far blind spots not considered within practical urban planning as it highlights socio-technological and ecological interdependencies, related complexity, uncertainty and change as ever-present system-immanent features cities have to deal with; and (b) severe conflicts between different land-uses, even if they appear per se as general positive contribution to a sustainable urban land-use and infrastructure development.

Considering the established technical infrastructure, it appears more as an outcome or interplay of contingencies leading to current path dependencies, and less as a planned strategy. This does not contradict resilience thinking but it puts into question if a comprehensive and strategic approach at community level on applying and especially implementing social-ecological resilience thinking is realistic, even in a mid- or long-term perspective. This is especially questionable if local financial constraints are tight and if urban planning does not have a strategic role or even a role of importance attributed by local politics to generate innovative strategies with reference to land-use and immanent change, over spanning spatial as well as temporal scales.

At least and refering with that to the second part of the initial question how the concept can be of use, reflecting critically so far taken paths is possible and supported by an integrated resilience perspective which also brings to the light further interdependencies and consequences, also in relation to future change processes and their spatial consequences. Also it is helpful to develop manifold options for further actions as well as integrated strategies, which can also deal with potential surprises and further uncertain or unexpected not yet known change processes and events. This would be an alternative to the predominant bounce-back understanding of resilience.

Finally with reference to the third aspect of our question, if there can be detected a readiness towards applying social-ecological resilience thinking in urban planning already now, it still remains questionnable, if these developped diverse options or multi-use strategies will also be implemented. This depends on the political will, which seems to be dominated by the (financial) efficiency paradigm, while as implementing social-ecological resilience thinking would require sumptuous strategies and measures leading to many different as well as decentralized ways of maintaining energy as well as water supply and sewage. Such a readiness to apply this thinking on the whole urban territory and all its socio-technical-ecologocial interdependencies is also depending on available personal as well as financial resources to start all-encompassing analyses and the identification of cross-sectoral strategies and measures. It is easier for well equipped bigger cities or, as the first case showed, additionally supported cities, to test an application of this thinking than for smaller communities staffed with less human and financial resources. For the latter, also upper administrative levels can be attributed the role of initiating resilience-oriented processes. Additionally the actors available as well as filling the relevant positions within a place and their respective cross-scale networks and openness play a role, so that within the explorative cases shown, this can play an additive role next to the available resources and size of the city (see also Pike et al., 2010). Still, tackling urban complexity as well as a holistic social-ecological resilience approach are the most challenging aspects, especially in an administration divided by sectors, even within cross-cutting land-use planning.

In these respects it does not suffice to discuss the social-ecological resilience concept with experts of urban planning and infrastructure, but to bring it up to broader political discussions. Here one could also raise the further research question on the usefulness of respectively changed laws to force local communities as well as administrative districts to deal explicitly with the characteristics of social-ecological resilience and the meaning for their current as well as further land-use and infrastructure development.

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IMAGE SOURCES

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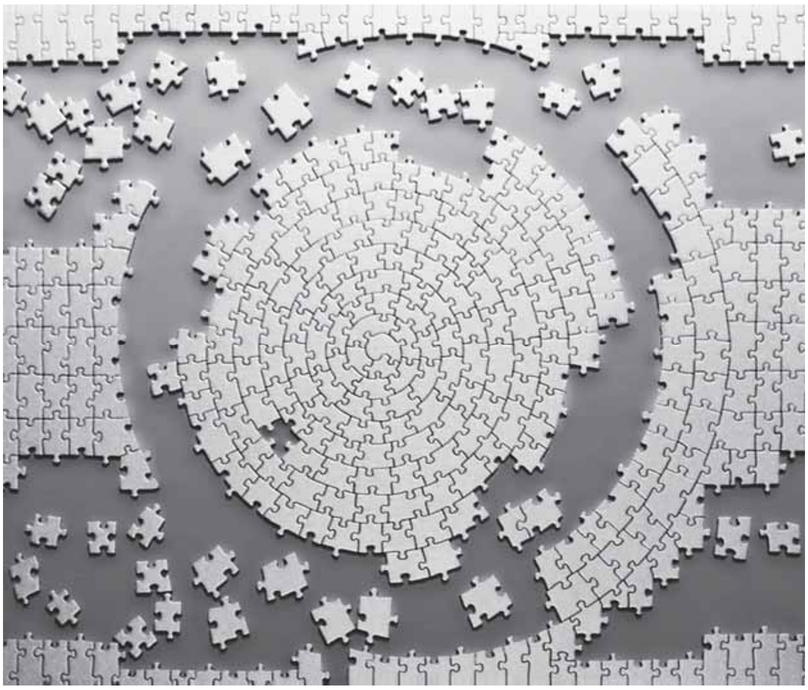

SMART CITY AND METROPOLITAN AREA

THE ENERGY COMPONENT IN THE CASE STUDIES OF GENOA AND NAPLES

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ABSTRACT

The Smart City model is now considered one of the opportunities to rethink cities and, in general, the development of urban communities. One of the most relevant themes in the application of the Smart City paradigm is the city/energy relationship and Italian cities are fielding several actions to effectively cope with the energy issues. Nevertheless, actions and projects are often uncritically promoted as 'smart', but actually lack innovative contents and methods. Therefore, the aim of this research, of which we present the first findings, is the drafting of a survey, tested through field analysis, of the experimentations of Italian metropolitan areas on the Smart City topic. The in-depth analysis of two case studies, Genoa and Naples, allowed us to compare the actual state of the two cities. We have that they have undertaken a common path in the implementation of strategies to try to transform themselves into Smart Cities, focusing especially on the energy aspects.

KEYWORDS:
energy efficiency, smart city, smartness indicators, Genoa, Naples

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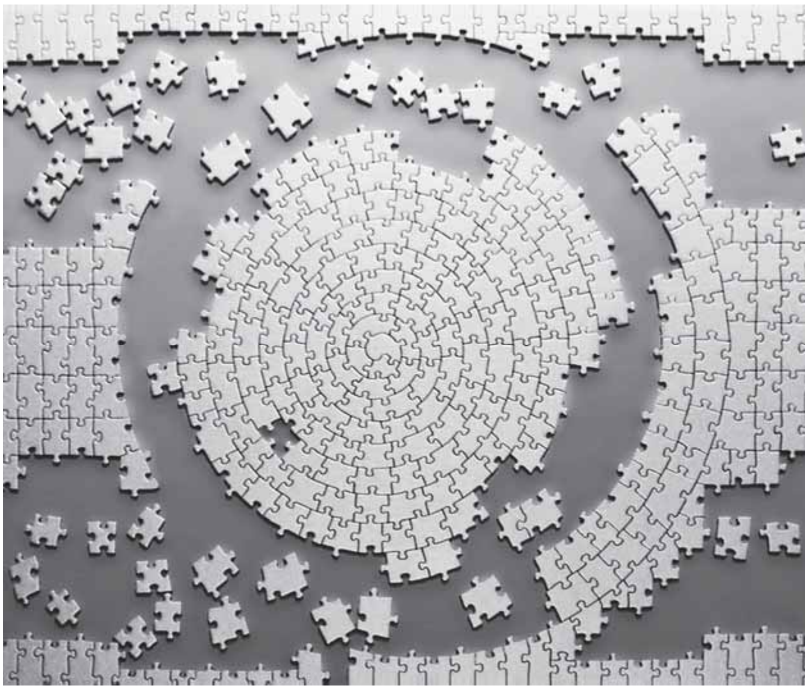

智能城市和都市圈

热那亚和那不勒斯能源个案研究

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摘要

智能城市目前被认为是重新思考城市和城市社区发展的机会之一。在智能城市模式的应用中最相关的主题之一就是城市/能源和意大利城市的关系为有效应对能源问题提出了若干举措。尽管如此，举措和项目还是常常不加批判地被作为“智能”来推广， 但实际上却缺乏创新的内容和方法。从这个意义上说，第一项发现的目的就在于起草一份概述，通过智能城市这一主题，对意大利都市圈进行实地探测分析。热那亚和那不勒斯的两项深度个案分析让我们可以对这两座城市的实际状况进行比较，从而表明两座城市在建设智能城市的战略实施中采取了共同的道路，特别关注了能源方面。

关键词

能源效率，智能城市，智能指数，热那亚，那不勒斯

1 SMART AND METROPOLITAN CITIES: AN OPPORTUNITY TO RETHINK URBAN DEVELOPMENT

The topic of Smart Cities has gained, in the last few years, an increasing relevance in the scientific debate and in the national and international operative practises, becoming one of the opportunities to rethink cities and, in general, the development of urban communities.

The first considerations, studies and projects on the subject seem to agree that a "smart" sustainable development combines physical components – infrastructures and material networks – and social components – actors and city users to pursue sustainable purposes, efficiency and urban quality. Adopting this approach, the Smart City takes shape as a system providing services and infrastructures that derive from stakeholders and city users' needs, focusing on the aspects of sustainability and environmental protection. In this sense, what makes the Smart City different from other "city models" is the use of new information technologies at the service of an urban community inclined to revise its own lifestyle to pursue a model of sustainable development (Gargiulo, Pinto and Zucaro, 2012).

From 2009, the European Community has conferred substantial resources to Member States, to allow scientific in-depth analysis and practical applications of this approach through different financings such as National Operative Programme *Research & Competitiveness* 2007- 2013 "Smart Cities and Communities". Among others, this Programme has funded a research project called "Smart Energy Master for the energy management of territory (SEM)", which involves the Department of Civil, Building and Environmental Engineering of the University Federico II of Naples.

Focus of the SEM project is the identification of best practices and integrated solutions for energy saving and efficiency at urban and metropolitan scale. Within the SEM project a survey entitled "Governance Analysis Project for the Smart Energy City (GAP)" is under development.

Scope of this study is to verify whether - and how - the adoption of the Smart City paradigm can support the radical process of administrative transformation that Italian cities must face after the approval of the regulation 56/2014 «*Dispositions on Metropolitan areas…*». This analysis has taken into account the ongoing actions in the Metropolitan areas, which can be considered as the first applications of the "Smart City" model, because they also make extensive use of ICTs for the deployment of services and apps for citizens.

Among the various Italian Metropolitan areas, this research has focused on the best practises in the field of energy saving/efficiency as this topic has a particular relevance in the pursuit of a sustainable development for the protection of environmental resources which, as mentioned, is a crux of the Smart City model.

This paper presents the first results of the research activities conducted on two case studies: Genoa and Naples. Although Genoa is in the North of Italy and Naples in the South, they present some "physical analogies": both are coastal towns, and both have a historically stratified urban settlement and a complex morphology. Furthermore, although with different levels of development, they are both experimenting noteworthy actions in the energy sector, for the application of the Smart City model. The aim of this research is the evaluation of the two approaches adopted, considering the present energy management of their territories. Moreover, on the one hand it draws attention to the vocations and weaknesses and on the other to the development trajectories of the implemented strategies.

2 MEASURING THE SMARTNESS

In the last decade, a wide literature on the matter of Smart City has been produced to define contents, strategies and objectives. Simultaneously, numerous contributions have been dedicated to "measuring" the level of smartness of the different cities, to define their strategies.

In Europe, one of the most known and qualified studies is the one conducted in 2007 by the Vienna University of Technology, University of Lubiana and the Delft University of Technology on medium sized cities (Giffinger et al., 2007). This research states that the good performance of a city can be measured by the combination of endowments and activities of self-decisive, independent and aware citizens in a framework constituted by 6 characteristics of smartness: *"Smart Environment", "Smart Mobility", "Smart Governance", "Smart Living", "Smart People" and "Smart Economy"*. The structure of Giffinger's model countains 31 factors, divided into 6 characteristics, creating the framework to identify 74 indicators in order to describe different aspects of urban life. E.g. referring to the characteristic "Smart Mobility", the component "Sustainable, innovative and safe transport systems" articulated into 3 indicators: "Green mobility share", "Traffic safety" and "'Use of economical cars".

In the United States, among various attempts to measure smartness of cities, the study "The Smart Cities Wheel" (Cohen, 2012), emerges, conducted in 2011 by the climate strategist Body Cohen from University of Colorado. Cohen deals with the theme of the classification of the level of smartness of the world's largest cities, using the same characteristics identified by Giffinger but connected to only three factors.

In Italy, an application aimed at establishing a national ranking has been conducted by FORUM PA, which has proposed the "I City rate" index (Forum PA, 2014). Also in this case, the model proposed by Giffinger is applied, though with some differences; it did not identify factors but only about 100 indicators, divided into Giffinger's six characteristics.

Another interesting research at the national level has been conducted by the National Council of Economy and Labour (CNEL) and the National Istitute of Statistics (ISTAT) in 2010 to define a method to evaluate the Sustainable and Equal Wellness (in Italian: Benessere Equo e Sostenibile - BES from which the name UrBES derives) (Cnel, Istat, 2013). The research identifies a set of indicators to measure BES, considering different aspects of urban living and not only GDP. The pursuit of new dimensions and new indicators is particularly interesting for a city that aspires to be "smart" not only in the sense of being more efficient from an economic, environmental and infrastructural point of view, but also in the sense of social inclusion and sustainability. Though not explicitly aimed at the definition of the Smart City, UrBES has many similiarities with Giffinger's study, proposing a quantitative evaluation, also for not easily measurable aspects of urban life, such as people's open-mindedness. These two studies reach comparable conclusions, though with some differences in the methodology and adopted procedures (DIST Polito, 2013).

Still referring to the Italian case, starting from 2013, the "Smart City Index" has been proposed (Between, 2014), a ranking of 116 Italian provincial capitals. The peculiarity is that, instead of measuring the level of smartness of a specific city, the attention is focused on the evaluation of the distance between the city identified as the best and the others.

From the comparison of all these studies, the great importance assumed by the cities' performances in the field of energy and environment emerges. They underline how the cities smartness is strictly connected to a vision that considers environmental protection of natural resources and energy efficiency as essential elements (Benevolo, Dameri, 2013). Besides the mentioned studies, there are many other surveys that measure the smartness, such as: Smart Cities in Italia: un'opportunità nello spirito del Rinascimento per una nuova qualità della vita (CERTeT Bocconi, ABB, The European House – Ambrosetti, 2012), EfficienCities (Cittalia, Siemens, 2012), La mobilità sostenibile in Italia (Euromobility, 2013), Ecosistema Urbano (Legambiente, 2014), Qualità della vita (Il Sole 24 ore), Smart cities and housing markets: evidence from Italy (Maltese, Mariotti and Boscacci, 2013) Dati ambientali nelle città (Cnel, Istat, 2012).

The limits of these works is that they take a somewhat extremely synthetic picture of a very complex phenomena. Therefore, besides consulting scientific literature on the identification of quantitative indicators describing the present state and the vocation of each urban area, this research has analysed policies and actions being developed in each territory to give a framework of their trends of development.

3 RESEARCH METHOD

In order to define the current inclination towards "smartness" of Italian cities and, at a later stage, verify the consistency between allocations, strategies and actions currently underway, a methodology applicable in different metropolitan territories has been developed. This survey has been structured in two macro-phases; the first aimed at collecting information studying documents, databases, projects, programmes and actions and the second based on stakeholders interviews.

A huge amount of materials, documents and information available on the web about the cities' actions, often uncritically promote them as "smart", but they actually lacks innovative contents and methods.

Through field analysis, we have tried to give a picture as close as possible to the reality of each metropolitan area, to understand whether the projects and actions are effective and coherent with the objectives.

A systematic set of information (administrative documents, proposals, projects, etc.) has been developed, which gives a complete overview of what is been done in the 12 metropolitan Italian cities (instituted by Delrio Law n.56/2014).

The research has been structured in different phases.

In the first phase, based on the extensive available literature, the set of indicators to characterize territorial and urban "smartness" was defined. Indicators were selected by taking into account their occurrence in the different studies, the availability of data at different scales (national, regional, provincial and municipal) and the reliability of the sources. In particular, regarding this last aspect, we used data provided by the Italian National Institute of Statistics (ISTAT) and by public and private research institutions.

This process led to the identification of 39 indicators calculated in a 10 year period, to also evaluate the development trends of the metropolitan systems. We have employed those indicators on different scales:

a. metropolitan capital;
b. metropolitan municipalities minus capital;
c. metropolitan area (a + b);
d. region;
e. nation.

We have distributed 36 indicators into 6 smartness characteristics both taken from literature; they have given a first overview on the smart characterization of the examined cities.

The second phase dealt with the screening of the actions, either currently underway or simply planned.

The selection of actions took into account: the actual state of completion; the consistency between early assumptions, targets and results achieved; the effectiveness in relation to impacts (economic, social, environmental, etc.) on the city; its reproducibility in other territorial contexts. The screening was carried out through an indirect analysis of documents, news available on the web and through the comparison with the urban planning documents, and the Sustainable Energy Action Plans (SEAP).

Actions have been classified by:

- their type (researches, interventions, projects, technologies, products and innovations, plans and programmes, promotion and awareness actions);
- their smart characteristic;
- their actuators (public bodies, companies, associations, institutions of research);

During the third phase, the fieldwork consisted in interviews to actors and stakeholders, based on in- depth analysis sheets on the different actions, previously collected.

The selection criteria of the significant actions to focus on, favoured those included in Smart Environment, and, in particular, those related to the energy sector, that is the focus of the SEM research project.

4 GENOA AND NAPLES: TWO SMART APPROACHES IN THE ENERGY FIELD

Focus of the SEM project, as stated, is to increase the energy efficiency of the territory and in the course of the activities, a special attention was given to the Italian metropolitan cities that are experimenting innovative actions in this field.

The analysis revealed t that Naples and Genoa (Figure 1) are characterized by a marked concentration of actions in the "Smart Environment" category, with a focus on energy issues. In particular, the energy aspect is the determining factor in the difference of the approach that the two cities are following for "urban smartness"; difference in both the number and the scope of the actions put in place. Moreover, as explicitly stated by interviewed respondents, since Genoa represents a "model" for Naples in the development of intervention strategies for the implementation of the Smart City, it seemed interesting to analyse in detail the two cities to determine whether and how effective a policy can be if it replicates the actions in several metropolitan areas.

Furthermore, as mentioned in the introduction, since one of the objectives of the research project was to precisely verify the incisiveness of some actions in the implementation process of a metropolitan Smart City, the possibility offered by Naples and Genoa to verify the effectiveness of actions in contexts that, although similar, have different vocations and services seemed particularly interesting.

Subsequently, the first findings of the research activity are then synthetically shown below and divided in two principal components:

- the Smart vocation of the two metropolitan areas;
- the ongoing experimentations which adopt the Smart City model, with special regards to those in the energy field.

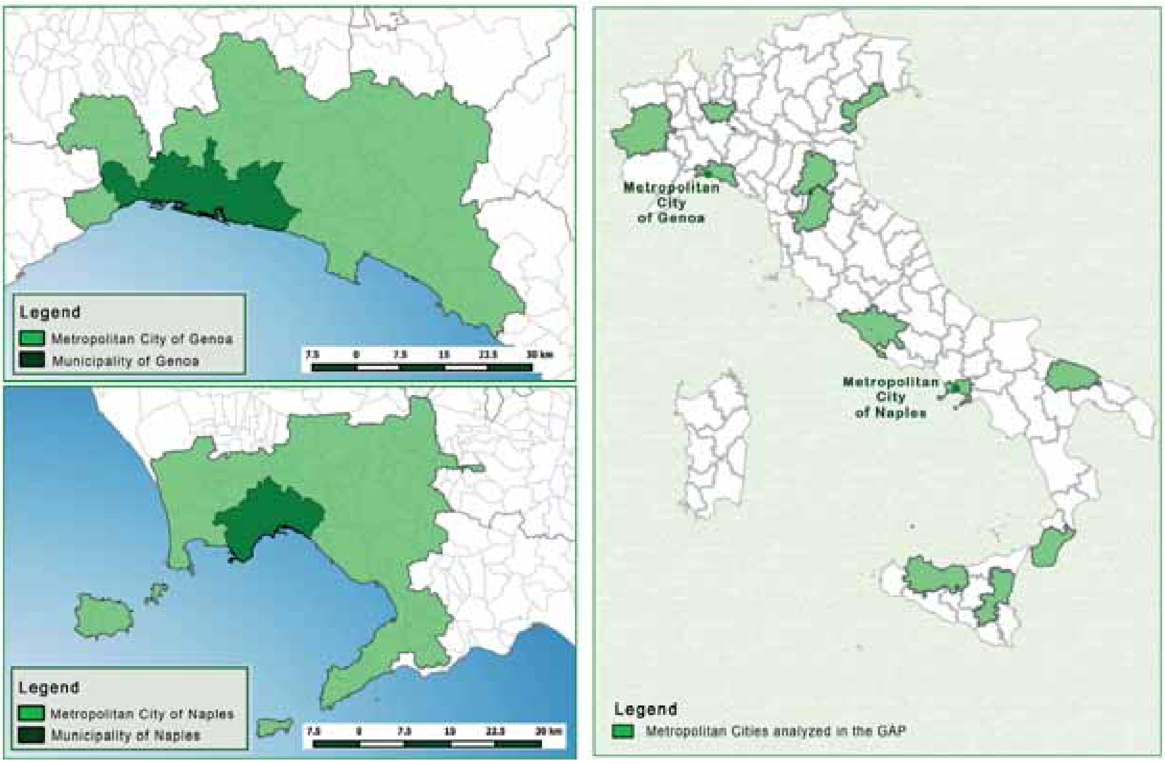

Fig. 1 Location of the two Italian metropolitan case studies

4.1 SMARTNESS INDICATORS AND ONGOING ACTIONS IN THE METROPOLITAN AREA OF GENOA

The metropolitan area of Genoa is composed of 67 municipalities, with a population of 855,834 and covers an area of 1833 km^2, with Genoa as its capital, which has a population of 586,180 and covers an area of 240 km^2.

The application of the methodology for the study of Genoa has allowed us to build a picture of its performance in relation to the smart characterization and brought out its strengths and weaknesses, but also its vocation and its level of propensity towards the Smart City. The 36 indicators referring to a ten year period and at different spatial scales provide the trend of the performance of each analysed aspect.

Figure 2 shows the values of Genoa in the different dimensions of smartness, differentiating the metropolitan territory from the Capital. The performance of the metropolitan area of Genoa than the Capital's emerges, with regard to all the characteristics except Smart Environment where a strong predominance of the capital city is evident.

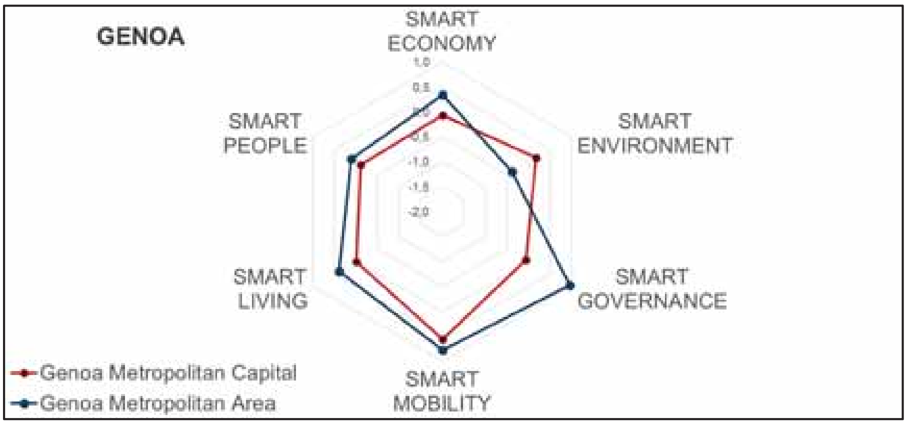

Fig. 2 Smart characteristics for Genoa and its metropolitan area

Concerning "Smart Environment", in particular, the identified indicators are:

- PM10 emissions;
- green urban spaces;
- energy consumption;
- Sustainable Environmental Action Plan;
- renewable sources from solar PV systems;
- recycling.

In particular, in relation to the focus of this paper, analysing the values of the indicators related to energy , the findings show that energy consumption for the metropolitan city of Genoa in 2011 are in line with the Italian average (1179 kWh/cap for Genoa against 1177 kWh/cap for Italy). In addition, it is interesting to note that, as shown in the graph on the urban smartness, the capital city has a lower energy consumption than the metropolitan territory, whose values are higher than national's. However, values referring to 2011 are higher in all territorial scale compared to 2001 (Figure 3 first part). As for energy production per capita by photovoltaic for 2014, the graph shows a greater inclination of metropolitan municipalities rather than the Capital to install photovoltaic systems. Probably, it is linked to the objective difficulty to install them in the city centre (Figure 3, second part).

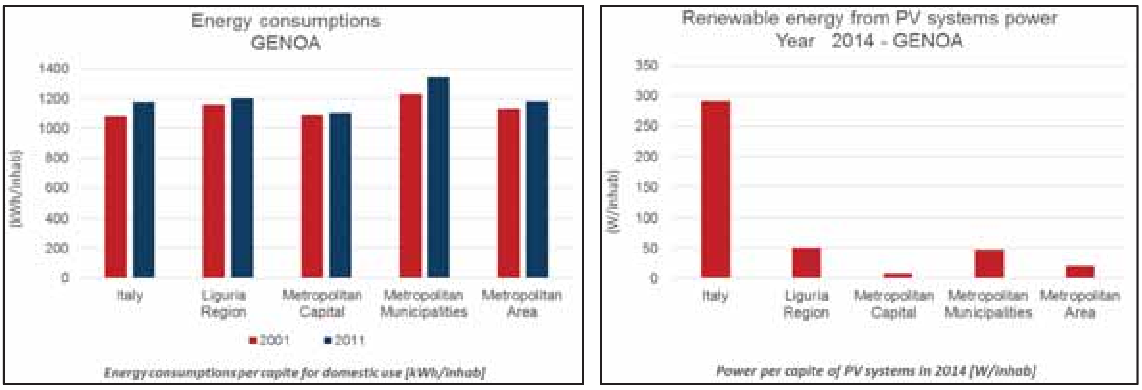

Fig. 3 Histograms related to energy consumption and renewable energy indicators for Genoa

The second phase which is, as mentioned, about the screening of actions to implement a Smart City, revealed that a significant number of actions concerned Smart Environment (Figure 4).

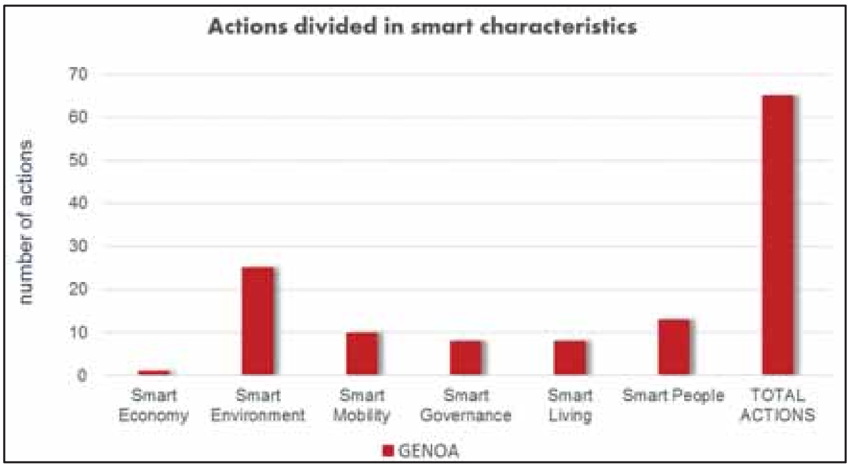

Fig. 4 Actions divided by characteristics in the Metropolitan City of Genoa

In particular, the first graph in Figure 5 shows that Genoa is mainly investing in interventions, infrastructures and projects (57.14%). This testifies its propensity to implement the Smart City. In the second graph of Figure 5 on the articulation of the actions for actuators, there is a clear preponderance of the local authorities and institutions. This finding is consistent with the type of prevalent actions (infrastructures and interventions) that can only be implemented by public local entities rather than by associations, companies or research institutes.

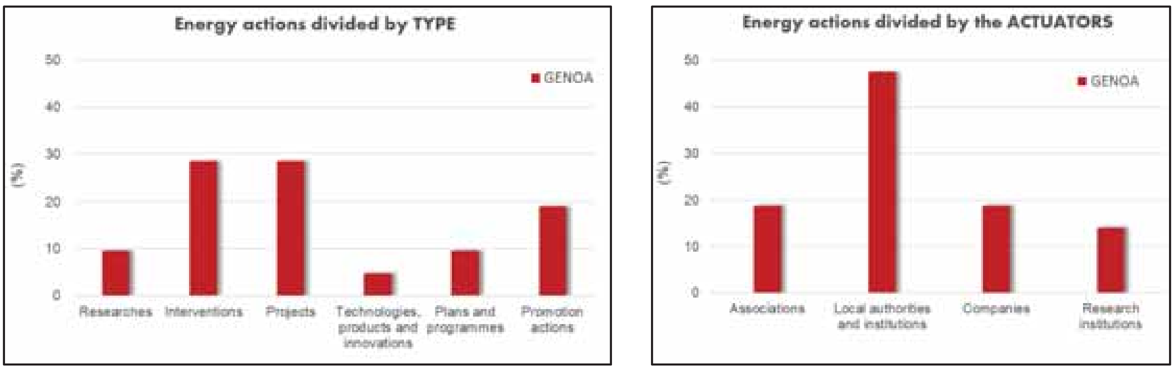

Fig. 5 Energy actions divided by type and actuators for Genoa

As the graph below shows (Figure 6), among all the actions associated to the Smart City, those related to energy issues have a significant share, 32% of the total.

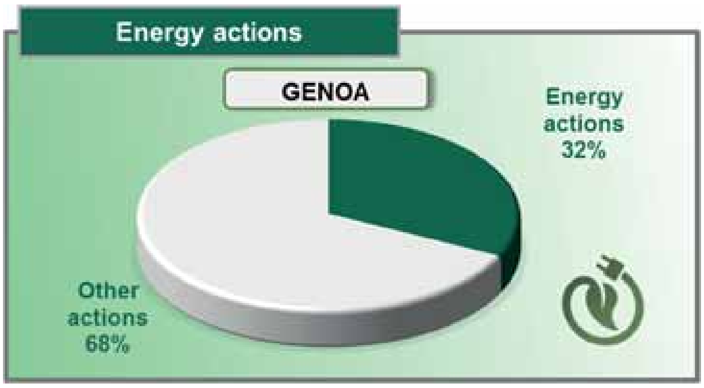

Fig. 6 Share of energy actions on the total actions for Genoa

From this initial analysis, we can deduced that in order to reduce energy consumption, that is very high and above the national average, Genoa is heavily investing in experiences, projects and actions to address energy efficiency and savings.

4.2 SMARTNESS INDICATORS AND ONGOING ACTIONS IN THE METROPOLITAN AREA OF NAPLES

The metropolitan area of Naples is composed of 92 municipalities, it has a population of 3,054,956 and covers an area of 1,171 km^2. Its capital, Naples, has a population of 962,003 and covers an area of 119.02 km^2. Figure 7 shows the values of Naples in the different dimensions of smartness.

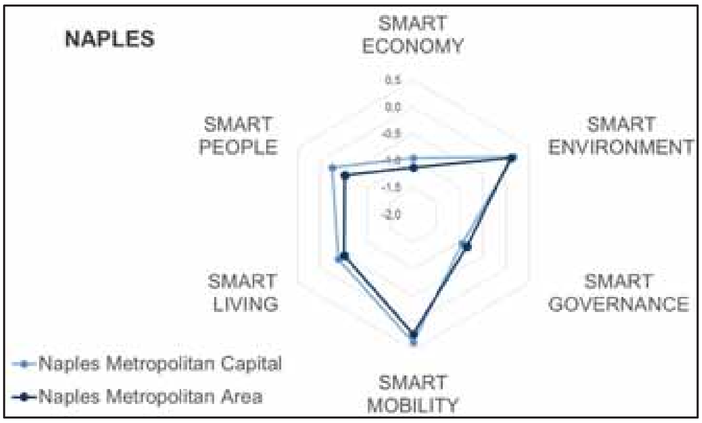

Fig. 7 Smart characteristics for Naples and its metropolitan area

Analysing the Neapolitan case, we can say that, regarding residential energy consumption, Naples shows slightly lower values than the National average both in 2001 and in 2011 (Figure 8, first part). The graph on the energy per capita produced by photovoltaic systems, also in this case, shows far superior values in the metropolitan municipalities than in the capital city, once again, probably because of the difficulty to install the facilities in the historical centre (Figure 8).

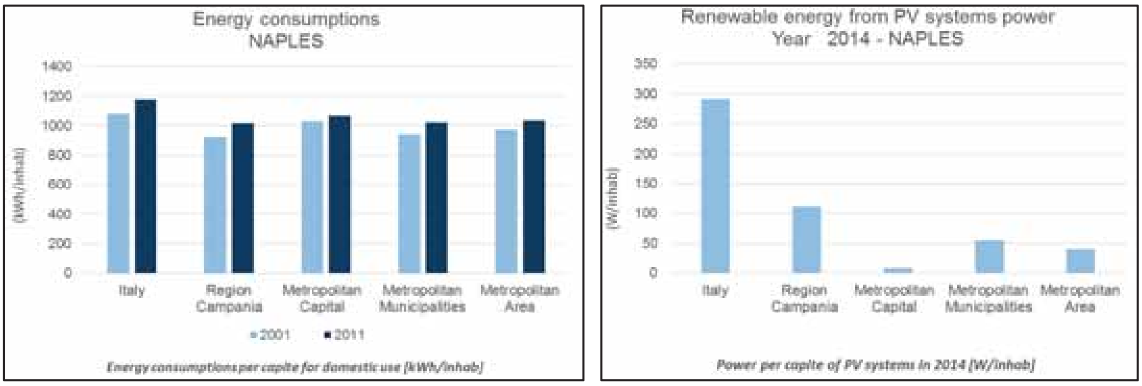

Fig. 8 Graphs related to energy consumption and renewable energy indicators for Naples

As with Genoa, in Naples the number of actions aiming at the Smart Environment is clearly superior to all other actions (Figure 9).

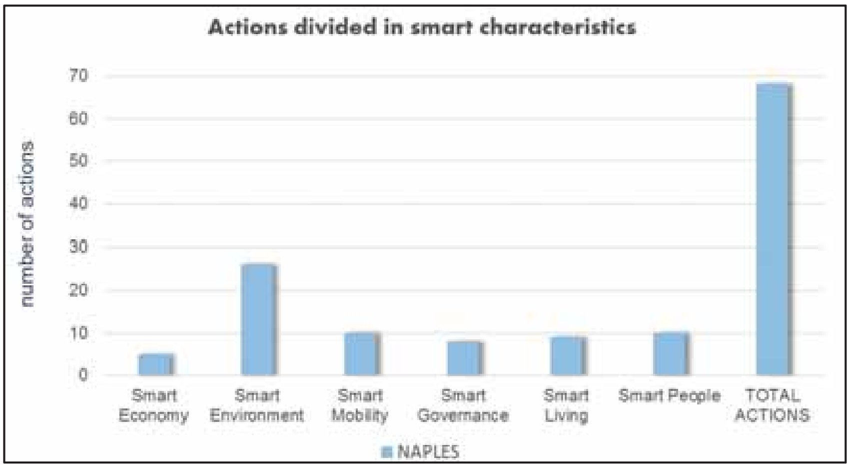

Fig. 9 Actions divided by characteristics in the metropolitan area of Naples

Regarding the type of actions that have been tested in the city, the first graph in Figure 10 shows that Naples is investing in promotion and awareness (47.4%), and this may refer to the need to "enhance attentiveness to the conservation of environmental resources". Companies and associations emerge strongly as the drivers of the actions, followed by research bodies, local authorities and institutions. Intersecting this information with the one above, we can derive a picture of how companies and associations are active in this field, especially through awareness raising and promotion activities (Figure 10, second part).

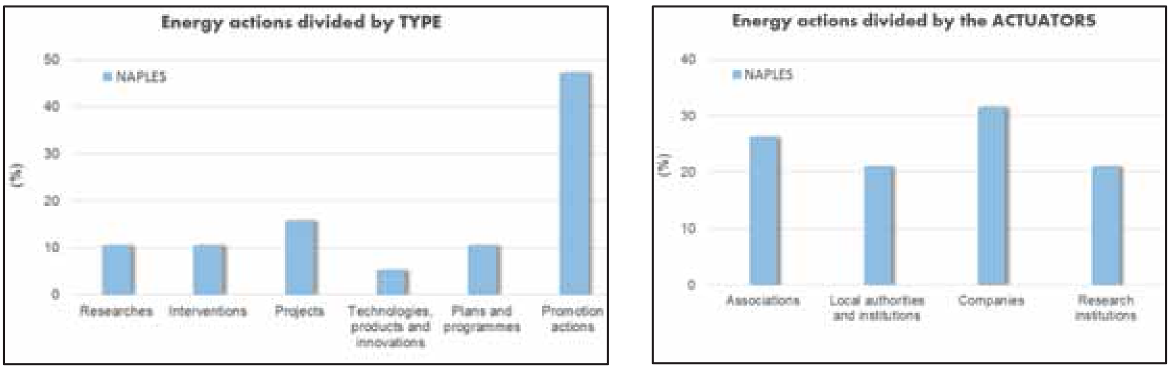

Fig. 10 Energy actions divided by type and actuators for Napoli.

Finally, the last graph shows the amount of energy actions compared to the total. As in the case of the Capital of Liguria, they are a very significant number (26%) (Figure 11).

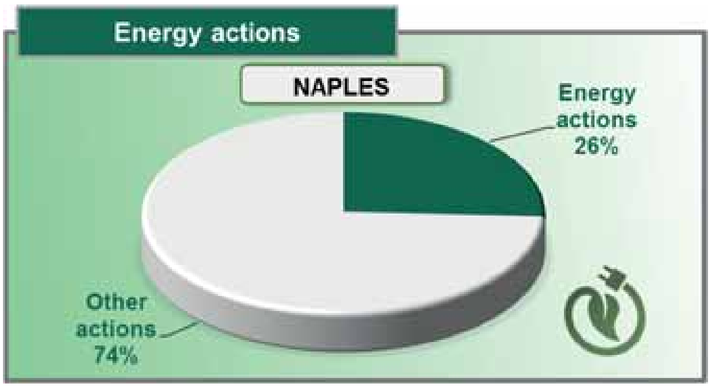

Fig. 11 Share of energy actions on the total actions for Naples

4.3 ACTIONS DEVELOPED IN BOTH CITIES IN THE ENERGY FIELD

The in-depth field analysis of ongoing actions has allowed the completion of the picture of the path undertaken by the two cities on the Smart City subject and, at the same time, the verification of their effective implementation. From the meetings with the different stakeholders consulted, the fact that Genoa represents a reference for Naples emerged, for its capacity to bring together different actors to initiate the actions in the fields of: energy efficiency, sustainable mobility, implementation of digital infrastructures, promotion of citizens awareness.

In 2010 in the capital of Liguria, Genoa Smart City Association (GSCA) was constituted, with the task of coordinating sustainable actions and supporting the "information society" and also, especially, with the purpose of coordinating workshops with stakeholders (Local Authorities, companies, citizens associations, research institutions and universities). Another purpose is to activate actions by means of public/private partnership, in order to be more effective thanks to their joint participation and to accelerate the activation processes of actions in the city. More than twenty projects have been developed in the last three years thanks to the support of Genoa Smart City Association which, in this way, has represented a useful governance instrument, free from the traditional and sometimes muddled administrative procedures.

Based on the Association's success, in 2012 Naples followed its example, creating the premises to fund Naples Smart City Association (NSCA), born at the end of 2014. Taking example explicitly from the Genoese association, NSCA has among its objectives the creation of a forum where local stakeholders could debate on innovative projects and discuss about common issues to create critical mass and share experiences as confirmed by the stakeholders' interviews.

In Genoa and in Naples, some actions have been independently developed, to reduce energy consumption in the residential sector. Two such actions, implemented in Genoa and Naples, are the "Elih-med" project, promoted by the EU, and "Condomini intelligenti" promoted by Muvita association, that aim to the efficiency of the residential stock.

In detail, Elih-med (Energy efficiency in Low Income Housing in the MEDiterrean) is an EU transnational cooperation programme among the "Territorial Cooperation objective" of the EU Cohesion Policy defined by the frame work of the Med Programme – Objective 2.2. The project involves seven European countries Italy, Spain, Greece, Slovenia, Cyprus, Malta and France and was tested in four Italian cities including Genoa and Frattamaggiore (a municipality in the Neapolitan metropolitan area). Its attention is focused on energy

efficiency in low income housing (LIH) in the Mediterranean area and on the involvement of the inhabitants in energy retrofits. Its objective is to identify and test, through large scale actions, the feasibility of innovative technical and economically efficient solutions by means of financing mechanisms supported by European Regional Development Fund (ERDF). The final aim is the completion of the maximum number of possible interventions with particular reference to the Local Authority's social housing patrimony now neglected and equipped with total inefficient cooling and heating systems and building envelops. Because of this, pilot buildings have been chosen as case studies, to involve inhabitants in choosing technical solutions.
The Genoese pilot project involved two buildings localized in Valbisagno, precisely Lungo Bisagno Dalmazia (9 dwellings on two floors) and Piazzale Adriatico (36 dwellings on six floors), entirely owned by the Local Authority and destined to social housing. The energy efficiency interventions chosen were external insulation, the substitution of window and door fixtures, the roof insulation, and the installation of cooling and heating systems. These improvements brought the energy class of the dwellings from G to B or C.
The pilot intervention in Frattamaggiore involved a multistory building with 18 dwellings. It included the substitution of window fixtures with triple glazing windows and thermal fixtures, the installation of a 1,4KW solar PV plant per dwelling, a 1,8 m^2 solar thermal collector per dwelling. The expected result of these operations was a 40 to 60% reduction of energy consumption; this is now verified.
The Condomini Intelligenti project is also focused on the reduction of energy consumption of residential multistory buildings. Nevertheless, unlike Elih-med, which uses European funds, Condomin Intelligenti takes advantages of the virtuous mechanism of ESCos (Energy Service Companies), which shoulder the economic risks of the interventions. This project started in 2011 from an initiative of the Muvita Foundation, (100% Province of Genoa), which developed an integrated system to evaluate the feasibility and manage the interventions, promoting, at the same time, citizens' awareness and involvement in the processes.
After the first intervention on a super-multistory building in Genoa, the system was structured through preliminary energy audits on condominiums all over the metropolitan area to identify a methodology to draft "guidelines" for the energy efficiency actions. The condominiums can independently apply to the public call submitting an agreement with an ESCo, which funds the operations. Annual saving obtained by the reduction of energy consumption of each building forms the ESCo's payback, until the total interventions costs are refunded (usually 10 years). The initiative's success is, on the one hand, in setting up a self-financing mechanism, thanks to ESCos, so that the only expense for Local Authority is the initial drafting of the energy audits; on the other hand, in improving citizens' awareness, by organizing seminars for specialists and apartment block administrators.
Once again, Naples chooses to start experiences successfully experimented in the capital of Liguria. Thus, in November 2013 an agreement was signed between the two cities to import the Condomini Intelligenti package within the Neapolitan boundaries. National Association of Building Constructors (ANCE) of Naples has promoted this initiative. The funding for the first step of energy audits was requested to the Economic Development Ministry in order to let the operations start as soon as possible.

5 TWO DIFFERENT PATHS FOR A COMMON GOAL

The general picture of the current propensity to smartness of Italian metropolitan areas has highlighted the existing similarities. Indeed, from the analysis of the experiences and policies initiated in the metropolitan areas of Genoa and Naples, among the many themes defining Smart City, the energy component emerges as a central subject. Findings showed that in both case studies, smart actions are primarily aimed at energy saving or, alternatively, at environmental protection. The analysis of the two case studies allowed us to draw a comparison on the state of the two cities. The Comparison of the indicators relating to the six characteristics of smartness showed that the metropolitan area of Genoa performs better than its Capital, while the situation is reversed for Naples, recording the best values for the capital city. In light of the analysis conducted, it seems possible to state that the two cities are undertaking a common path in the implementation of strategies to transform into a Smart City, focusing especially on the energy aspect.

On the one hand this development path begins also thanks to the EU's guidelines and funds, on the other, it is evident that the relationship between energy and the city becomes more and more crucial in the major European cities' agendas (Gargiulo, Pinto and Zucaro, 2013).

In spite of the relevance of this aspect, from the in-depth analysis of literature on the Smart City, it seems like indicators measuring the effectiveness of strategies are almost neglected.

Moreover, at least in Italy, though remarkable progress in terms of open data, finding up to date data related, for example, to energy consumption at different scales seems to be still very difficult.

Furthermore, while actions at building scale are numerous, they are few and isolated examples at the urban scale. Indeed, the most important Italian regulation introducing prescriptions on energy planning issues, is the Law n.10/1991 "*Regulations for the national energy plan for the rational use of energy, energy saving and development of renewable sources of energy"*. This law, rather outdated by now, introduced the drafting of plans that address the deployment of energy from renewable sources, the identification of territorial energy basins, the localization of the electric energy systems and the energy balance of territorial jurisdiction (Battarra, 2014). Although this regulation compels the municipalities with more than 50.000 inhabitants to draft specific Municipal Energy Plan (PEC), only few Italian municipalities have complied.

Only recently (indicatively from 2008) some cities, at least in theory, are performing actions improve energy efficiency and increase the use of renewable sources, which seem to be integrated, mostly after the voluntary adhesion to the Covenant of Mayors and the drafting of Sustainable Energy Action Plan (SEAP) (Verones, Zanon, 2012).

The importance of the Covenant of Mayors is in having brought to the local stakeholders' attention the energy issue and to government instruments such as the Town Plan.

As a matter of fact, the EU proposed the Covenant of Mayor as a bottom-up initiative for virtuous communities that intend to take part to a coherent implementation of European policies at a local scale. The operative instrument, represented by the SEAP, could realistically affect the local scale if it is mainstreamed in the regular urban planning, and could become an opportunity to initiate interventions and to evaluate the actions that has been proposed. Without these premises, even the adhesion to the Covenant of Mayors would not bring the expected results for the participant communities and would not influence the resource management procedures (De Pascali, 2015).

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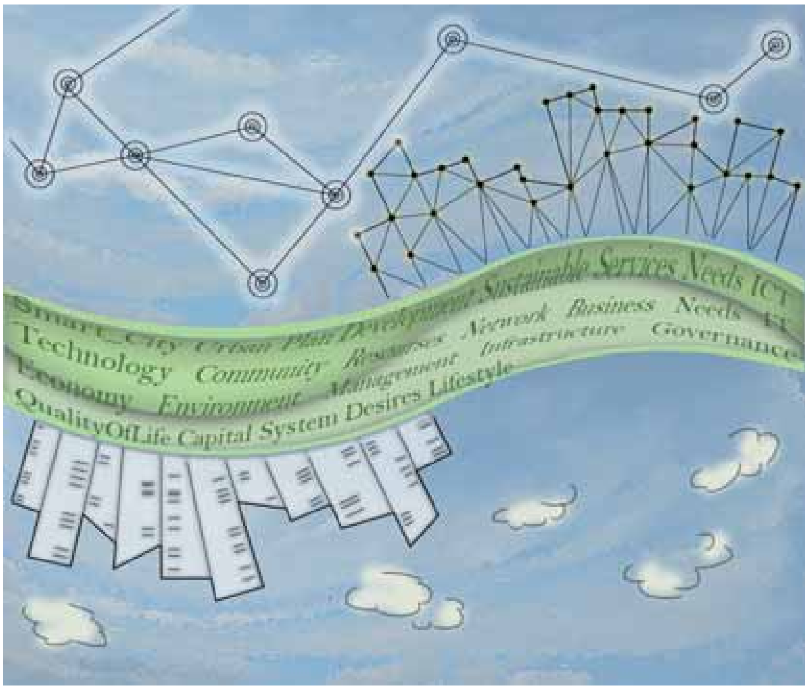

LESS SMART MORE CITY

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ABSTRACT

Smart is an expression used in recent years in science, and it refers to someone or something that shows a lively intelligence, with a quick learning curve and a fast response to external stimuli. The present scenario is dominated by the accelerated technological development that involves every aspect of life, enhancing the everyday tools through the use of information and digital processing: everything is smart, even cities. But when you pair the term smart to a complex organism such as the city the significance of the two together is open to a variety of interpretations, as shown by the vast and varied landscape of definitions that have occurred in recent years. Our contribution presents the results of research aimed at analyzing and interpreting this fragmented scene mainly, but not exclusively, through lexical analysis, applied to a textual corpus of 156 definitions of smart city. In particular, the study identified the main groups of stakeholders that have taken part in the debate, and investigated the differences and convergences that can be detected: Academic, Institutional, and Business worlds. It is undeniable that the term smart has been a veritable media vehicle that, on the one hand brought to the center of the discussion the issue of the city, of increasing strategic importance for the major challenges that humanity is going to face, and on the other has been a fertile ground on which to pour the interests of different groups and individuals. In a nutshell we can say that from the analysis the different approaches that each group has used and supported emerge clearly and another, alarming, consideration occurs: of the smart part of “Smart City” we clearly grasp the tools useful to the each group of stakeholders, and of the city part, as a collective aspiration, there is often little or nothing.

KEYWORDS:
smart city, urban challenges, definition, text analysis, trends

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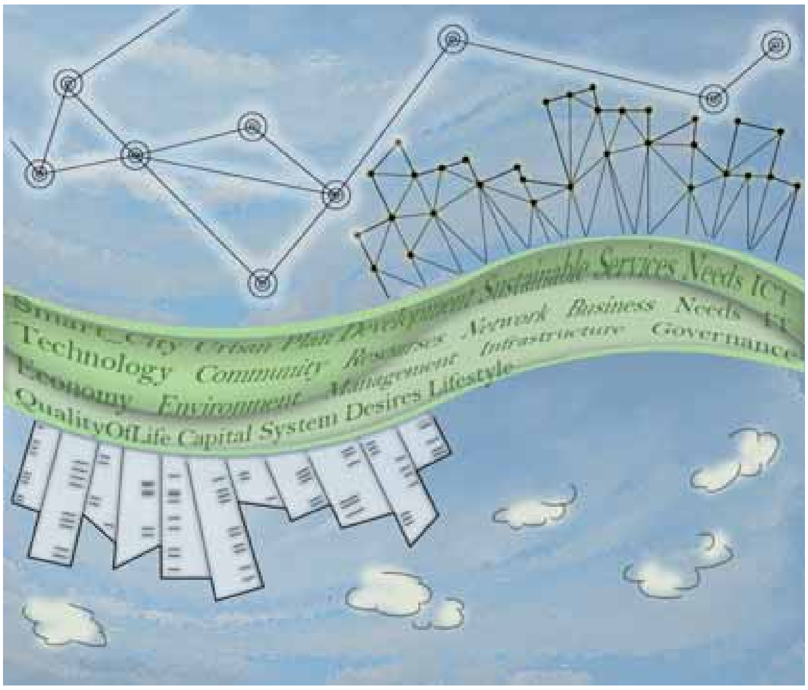

LESS SMART MORE CITY

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摘要

智能是近年来应用在科学领域的一个表达，它指的是拥有智慧、快速学习曲线和能够对外界刺激进行迅速反应的人或事。如今日益迅速的技术发展已经渗透到生活的各个方面中，通过利用信息和数字处理提升了日常工具的使用：所有的事物都是智能的，连城市也是。但是，当把智能与一个复杂的有机体——例如城市——结合在一起，这两者的叠加就有了很多开放的解释，正如这些年不断出现的各种定义和诠释一样。我们的研究呈现了调查结果，旨在分析并解释这种支离破碎的场景，但不完全是通过对智能城市的 156 个定义的语料库进行词法分析。研究特别发现，参与辩论并调查分歧和意见的主要利益相关群体为：学术圈、机构人员和商业界人士。不可否认的是，智能一词已经成为真正的媒介载体，一方面它让讨论的中心聚焦在城市问题和人类即将面临重大挑战时日益增加的战略重要性上，另一方面，它也成为不同团体和人士关注的焦点。简而言之，我们说从分析中可以看出，每个组别所使用和支持的方法不同，此外调查还惊奇地发现：对于“智能城市”的智能部分，我们可以清楚地掌握利益相关者所使用和借助工具，而有关城市这一群体愿望，我们获得的信息很少或者几乎没有。

关键词

智能城市，城市挑战，定义，文本分析，趋势

1 INTRODUCTION

In recent years the smart city model has established itself in the international scientific debate devoted to the study and the management of the evolution of the city. Initially born from the evolution of the studies on the effects of emerging digital technologies on the development of society, the Smart City has subsequently become a reference paradigm for the strategic growth and development choices of urban centers. A major novelty of this approach is the cross-cutting debate involving representatives of various groups, stakeholders with different objectives, which have aspired to define the content and purpose of this paradigm. The concept of Smart City, within a few years, has become a general term used to indicate positive processes of any kind related to urban areas: environmental, economic, social, transport, etc.

In this fragmented scenario, even the "experts" seem to be victims of confusion, so much so as to give rise to a question: What is a smart city? And especially what is a Smart City for an urban planner? To attribute the intelligence of a city to its technological equipment is certainly simplistic: a city, smart or not, can be a crossroads of technological knowledge, but it is chiefly the place in which man, environment and technology interact to improve quality of life. Any model of urban development, in this subject area, is linked to the development of tools of territorial knowledge and management, making it possible to design the urban organism based on new requirements (energy, waste, sustainability, etc.) placed on top of the increasingly pressing global challenges (climate change, land use, etc.).

Regardless, it is clear that the "smart city" is a crucial flywheel for the development of the city due to the vast amount of investments that it is able to convey; as shown by the presence of the term in many funding and development programs promoted by the European Union in recent years, from the Strategic Energy Technology Plan (SET) in 2009 to the most recent Horizon 2020 program of 2014, as well as EU strategy papers (Gargiulo, Pinto, & Zucaro, 2013)[1].

How useful, then, is the current debate on the Smart city to determine concretely a practice of urban development and what are the key elements of this "new?" urban model that emerge, free from sectorial interests?

This work intends to define on a purely scientific level and from a decidedly critical angle, some points that may help to answer the most frequently asked questions.

Given the heterogeneity of the ways to define what is, or what a smart city should be, the study of the documents on the subject has led to the identification of three main groups of stakeholders that have taken part in the debate: the scientific community, institutions, and businesses. Agreed that the role of the mass communication media, for its capacity to influence public opinion, plays an important part in the debate, and it could almost be considered a fourth group, it is not possible to evaluate its contribution separately; each group uses it to propose their vision. Through the textual analysis proposed, it is possible to determine the way each expresses itself using typically media language tools to attain its objectives; selling product for businesses, gaining consent for institutions, and proposing its critical point of view for the academic world.

We examined 156 "definitions" formulated in the last 15 years, analyzing, with lexical analysis techniques, differences and similarities between the methods of conceiving the smart city of the three groups, and especially its evolution over time.

The assumption from which this analysis starts is well summarized by statisticians (Lebart & Salem, 1988) that said "it is not always necessary to know what two people wanted to say, but to know that they have not

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1 "….Many of these characteristics are given in the three documents analyzed, and from an integrated interpretation the four main actions, listed below, that European cities should undertake in the near future in order to achieve smart, sustainable and inclusive growth: adopt multilevel governance models through the distribution of responsibilities between different government and institutional levels; promote integrated urban policies by adopting a holistic and strategic approach; focus on new information and communication technologies (ICT), in order to provide citizens with new media opportunities and easier access to public and cultural content; ensure sustainable territorial development, based on an efficient use of resource…"

said the same thing." By analyzing the different formulations that are made of the term smart city in our opinion it is, in fact, possible to highlight, to what extent the changes advocated in the individual "definitions" represent a "sincere" answer to major present urban challenges, or are mere media ploys, in defense of vested interests.

1.1 STATE OF THE ART

In recent years a number of often discordant definitions of smart cities have accumulated, fueling the risk of disorientation arising from the abuse of the term. In an attempt to clarify the concept, some studies have ventured in the analysis of the vast corpus of definitions produced, trying to identify the most representative or exemplifying.

The report "Smart City development projects and financing instruments" (Cassa depositi e prestiti, 2013) identifies 23 key definitions, while the document "Mapping Smart Cities in the EU" (European Union (EU) Directorate General for Internal Policies, 2014) 10 and the studies "Defining Smart City - A Conceptual Framework Based On Keyword Analysis" (Mosannenzadeh & Vettorato, 2014) and "Diversity Of Theoretical Approaches To The Concept Of Smart City" found respectively 22 and 12.

The most comprehensive collection of definitions is represented by the report "Smart Sustainable cities: An analysis of definitions" (ITU-T International Telecomunication Union, 2014) which categorizes and analyzes 116 unique ones, even if it includes a number that are not explicitly or exclusively linked to the concept of Smart City. Some of these studies such as (ITU-T International Telecomunication Union, 2014) and (Cassa depositi e prestiti, 2013) conclude the analysis of the vast variety of existing definitions with a synthesis effort, proposing their own composite definition.

For the same reason work groups were born, such as ANSI Network on Smart and Sustainable Cities (ANSSC) that from 2014 coordinates the standardization of metrics and procedures for evaluation of the Smart City. Because of course the assessment of the performance of an organism requires first a definition of the requirements to be met. The Smart City is therefore increasingly becoming an open container in which periodically we try to bring order among the many themes that are, from time to time, thrown inside in an attempt to outline the shared priorities for the future of cities. In this direction are some studies, such as the report "Mapping Smart Cities in the EU" (European Union (EU) Directorate General for Internal Policies, 2014) that identifies six themes that follow those described by (Giffinger, Fertner, Kramar, Pichler-Milanovic, & Meijers, 2007), to describe the main characteristics that can measure the smartness of the city; or the article by (Cavada, Hunt, & Rogers, 2014) that identifies three main nodes of urban development in a Smart way: Information and Communication Technologies (ICT), Resilience and Sustainability, Innovation and Business.

However, to identify the basic requirements of the urban organism it is necessary to start from a system of shared needs that should not be defined on the basis of individual interests. Keeping this in mind, some studies in literature have analyzed the concept of smart city considering the belonging of the proponents to discernible groups.

In the creation of their index "Modelling the Smart city performance" (Lombardi, Giordano, Farouh, & Yousef, 2012) identify four groups: University, Governement, Civil Society, Industry; the proposed distinction between civil society and government is not present instead in the study "Smart Cities: Contradicting Definitions and Unclear Measures" (Cavada, Hunt, & Rogers, 2014) that concisely specifies three groups: People, Governance, Companies. The same classification, albeit with different labels, is also present in the study "Defining Smart City - A Conceptual Framework Based On Keyword Analysis" (Mosannenzadeh & Vettorato, 2014), which identifies three main domains involved in decision making process related to the Smart City: Academic, Industrial and Governmental; This difference in approach to the issue of smart city is emphasized in the study "Smart cities: theoretical framework and measurement experiences" (Santis, Fasano, Mignolli, & Villa, 2013) which concluded that the world of institutions, academia and business In defining a Smart City, emphasize only some aspects.

This heterogeneity in the way of imagining the Smart City, where different specific interests fit, is favored by an additional factor of confusion: reading the definitions, it’s not clear whether the smart city is an ongoing phenomenon that we need to study, dominated by the use of new technologies, or a synonym of the city we should strive towards. The definitions go from the proclamation of absolutely general principles, as the one proposed by (Rios, 2012) which considers the city as an entity that inspires its citizens to improve themselves, to the most punctual in their indications, like the one proposed by the consortium The Climate Group (The Climate Group, ARUP, Accenture and The University of Nottingham, 2011) that identifies what issues will be promptly resolved through the use of ICT, or the study "The Vision of A Smart City" (Hall, 2000) that identifies in the technology apparatus of the city the tool to achieve the proposed objectives and describes the apparatus in its hardware and software sub-components.

These definitions highlight what is undoubtedly one of the central issues of the debate: the role of the information and communications technologies (ICT) as the main instrument of urban transformation to meet the challenges of the millennium. The range goes from the report of the Smart Cities Group (M.I.T., 2013) that considers the role of ICT hegemonic, to "Smart cities and the future internet: Towards cooperation frameworks for open innovation" (Schaffers, Komninos, Pallot, Trousse, & Nilsson, 2011) that considers the investment in ICT as only one of the tools necessary to obtain the Smart objectives; up to the studies such as "Digital Dimension of Smart City: Critical Analysis" (Jucevičius, Patašienė, & Patašius, 2014) that, in studying the digital dimension of Smart cities in the social field, asserts that " many social systems can be smart without necessarily basing their activities on Information and Communication Technologies (ICT)"; although the same study has also concluded that "even if it is true that ICT does not dominate any of the features essential for the Smart city, it is important to all."

It follows therefore that the different characteristics of those who have suggested their own definition of "Smart City", their multiple interests, and the complexity of their individual visions, have created an extremely complex field that has generated in recent years several attempts of analysis and synthesis.

The purpose of this study is to better outline the different approaches to the issue by the various groups that have taken part in the debate, defining their objectives, in order to return to the center of the discussion the city as an organism and not as the sum total of individual interests.

2 METHODOLOGY

To respond to the questions we posed we made use of lexical analysis tools, which allow us to highlight in a textual corpus the semantic dimensions and the themes underlining the same textual data to identify the views of the authors of the analyzed texts in a given time frame.

The assumptions made before undertaking the study involved the selection of appropriate methods to deal with content analysis to get answers to the questions posed, and thus the criteria for the collection of the material to form the textual corpus on which to apply them.

2.1 CHOICE OF ANALYSIS AND DATA COLLECTION METHODS

To analyze the textual corpus, three separate lexical analysis techniques were chosen, each returns different information:

- Network Text Analysis;
- Lexical Correspondence Analysis (LCA);
- Method of frequency analysis of lexical units classified in thematic categories.

The Network Text Analysis is an automatic elaboration system that clearly identifies the key words of a set of texts. Dividing the text corpus in function of the characteristics of the authors it was possible to identify, on the basis of a simple comparison, which concepts are the most representative of each group and, in particular, in our case, the main engines of development of a Smart City in the different visions. the Lexical Correspondence Analysis (LCA) is an analytical method capable of detecting the latent meaning in a set of texts; being an application of factor analysis to the study of texts, it is mainly based on "differences" and not on "measure" (Trobia, 2005); in other words, a word is all the more significant as it is specific to certain groups of texts. To determine the latent meaning, in our case, implies identifying the main processes that each group peruses in the debate on the Smart city also recognizing vocabulary differences that return information about the message recipients: Why do we talk about Smart City? And who is involved?

The method of frequency analysis of lexical units classified in thematic categories is a technique of textual analysis useful to study the temporal trends of predefined variables. This method is very effective in highlighting the evolution of a single form or group of forms (themes), and determining the weight of each variable compared to the total. Environmental challenges, the economic, social and technological development are the themes linked to the concept of Smart City that were examined. The same method was also used to test the role and the weight that each group assigns to issues relating to the specifics of urban planning, defined as the government of urban transformations.

The three analysis methods described have provided different information complementary to each other, which have been collected in two summary tables that can offer a more complete overall picture in relation to differences in vision between the groups of individuals who have spoken (Tab. 6) and the evolution of the concept of Smart City in time (Tab. 7).

For the application of these methods it was necessary to collate the corpus that, for our purposes, included the largest possible number of definitions of Smart City.

The collection of definitions took place according to the following selection criteria:

- Exclusion of all assertions for which there has not been an effort of synthesis which created a definition;
- Exclusion of texts not written in the language of the majority, namely English;
- Exclusion of all statements that do not exclusively reference the term “Smart City”, such as digital city, sustainable city smart, intelligent city;
- Exclusion of the statements that totally incorporate pre-existing definitions, preferring the original expressions.

With this method 156 unique definitions were collected; for each the following information: 1) Text, 2) source, 3) type of source, 4) author, 5) year 6) group of stakeholders (Fig. 1).

Text	Source	Type of source	Author	Year	Group of stakeholder
The phrase Smart is not new. It may have origins in the Smart Growth movement of the late 1990s, which advocated new policies for urban planning	Smart City Progetti di sviluppo e strumenti di finanziamento (distribuito da Cassa depositi e prestiti S.p.A)	Monographic Report	Harrison & Donnelly	2011	ACADEMIC
A smart city is, above all, a city capable to effectively meet citizens' needs	TOWARDS AN URBAN PLANNERS' PERSPECTIVE ON SMART CITY	Article on journal	PAPA, R.; GARGIULO ,C; GALDERISI, A	2013	ACADEMIC

Fig. 1 Extract of the definition collection table

Regarding the last point, the strong characterization of those who have proposed their definition has allowed the division into three classes: Academic, Institutional and Business. This division comes from the study of the scientific literature that almost universally recognized, albeit with different names, these three spheres of influence.

The discriminating element for the breakdown was the type of source from which the definitions were extracted, from:

- Scientific publications from magazines and conference proceedings, go to Academic;
- White papers, institutional documents, go to Institutional;
- Gray papers, documents published by industrial consortia, go to Business.

The entire corpus, thus selected, has also been normalized according to the most appropriate criteria for each method. The following describes in detail the procedures and decisions taken in relation to each of the three methods.

2.2 NETWORK TEXT ANALYSIS

The basic assumption from which this type of text analysis starts is that a text or a set of texts can be represented as a network of words in relation to each other and that the position of the concepts within this network allows to better understand the prominent themes of the text as a whole. In particular we decided to apply the software developed and made available by NodusLabs (Paranyushkin, 2011) that performs the encoding of the text from the proximity of the concepts and the density of their links. The program first automatically proceeds with the normalization of the text by removing meaningless words (stopwords), symbols, punctuation, and so on, and aggregating similar morphisms. Subsequently, the program processes the analytical data by counting the number of times that each word is located close to another within two words; after this stage a proximity analysis of individual words within groups of five words follows, in order to identify sets of local significance.

The information is then graphed using the Force Atlas algorithm (Fig. 2) and, to emphasize the representation, the size of the nodes is varied as a function of their "betweeness centrality", namely the measure for each node of how often it appears in shortest path between any two other network nodes. The higher the value, the greater the role the node has as a link between the different sets of meanings in the communication. The four link words (nodes) with highest values are the "most influential keywords", which have been the main subject of our analysis. This methodology has been applied automatically, first to the entire corpus of 156 definitions, and then dividing it in the three subgroups assigning each definition to the Academic, Business or Institution world.

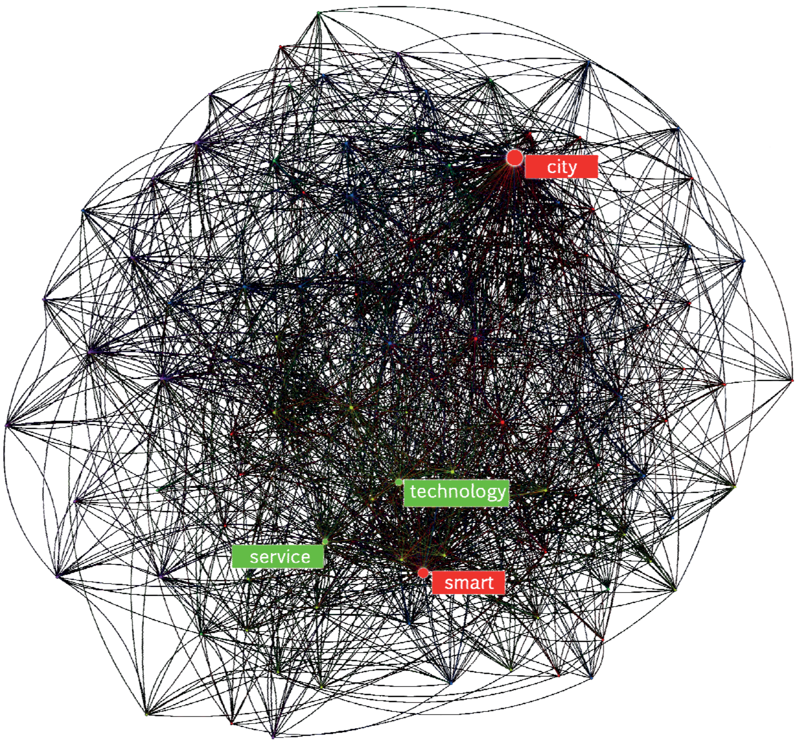

Fig. 2 Graphical representation of the network analysis of the total corpus

2.3 LEXICAL CORRESPONDENCE ANALYSIS

The process of analysis begins with the construction of a contingency table (lexical table), which presents terms in rows and in the columns the modes of the variables assigned to the texts, which in our case are the year of publication and the groups of stakeholders (Tab. 1). Plotting the joint frequencies matrix of the variables with specific calculations, we can determine significant associations between groups of words and modes, starting from a probabilistic hypothesis of regular distribution of the forms: when a word is distributed equally in all the sub-texts it is considered trivial; when, instead, it is over-represented in one of the sub-texts it is considered characteristic (Della Ratta, 2007).

LEMMA	ACADEMIC	BUSINESS	INSTITUTION
Access	2	7	1
Activity	7	2	2
Administration	7	6	0
Advanced	5	6	1
Area	6	10	4

Tab. 1 Extract from the contingency table of our lexical corpus. At intersections between rows and columns the occurrence of each lemma in all definitions belonging to the corresponding mode (in this case relating to groups of stakeholders).

The software called SPAD was used to analyze these connections, and to break down the lexical table in a series of factors, each of which represents an aspect of the latent type of association present in the data. Based on the results the software plots the two-dimensional dispersion graphics, representing the factorial space on which entries and modes are projected. The origin of the axes of the graph is the center of gravity of the cloud of points; the more the elements are far from the origin the more their profiles are far from marginal. Examining the entries that are located in periphery, it is therefore possible to attribute to the factorial axes their latent meaning and define the factor space, giving a name to the four quadrants. On the basis of the positioning of the mode in this space so defined, it is possible to describe the unique characteristics that distinguish them (Fig. 3). To create the vocabulary that has been analyzed the following steps were required:

- Normalization, which consists in the homogenization of the spelling used.
- Lemmatization, which consists in grouping of entries in graphic forms and involves, for example, that the forms of nouns and adjectives are traced to the masculine singular form.
- Selection of the forms on the basis of a minimum threshold frequency, in our case equal to 7.
- Elimination of the so-called empty forms that have only grammatical meaning in relation to other words[2].

The vocabulary thus obtained determines the row entries of the lexical table.

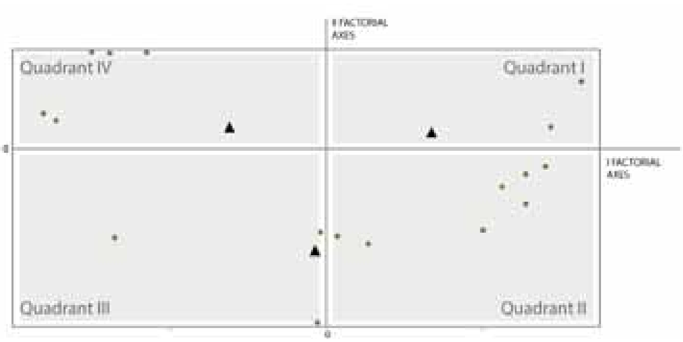

Fig. 3 Scatter chart prepared by Spad software. The two main axes represent the factors and divide the factorial space into four quadrants; black triangles and green circles represent respectively projections of modes and terms on the two factorial axes.

2 These are mainly instrumental forms (of, and, that, for, etc.), uninformative and present in all texts. More generically, in each context, all those words that do not report a content relevant for the analysis are defined as empty forms. For this reason, also some adverbs and adjectives that are not considered significant have been eliminated from the vocabulary.

2.4 METHOD OF FREQUENCY ANALYSIS OF LEXICAL UNITS CLASSIFIED IN THEMATIC CATEGORIES

The procedure, before the analysis and interpretation of the individual collected definitions, needs a step to break down the selected corpus in units of analysis, represented, in our case by [**k**] Keywords, and a step of classification of these units into thematic categories.

After the selection of the Keywords the categories were defined ex post[3]. *"What themes are prevalent in the new vision of the city?"* is the first question that has guided the analysis of the texts and the definition of the following thematic categories [4]: Business, Community, Resource e Network.

The definition of the first three categories derives from the consideration expressed by other authors such as (Papa, 2013), and confirmed by a first investigation of the entire corpus, that the Smart City represents an evolution of what has been defined sustainable city, whose functioning would result from a proper interaction of economy, society and environment.

Compared to the sustainable city, to describe the main topics of Smart City, another category has been inserted that we call Network, linked to the development and use, in recent years, of new information and communication technologies. The themes identified can be defined as follows:

- **[B]** *Business.* includes concepts that refer to a city that interacts with global challenges in terms of economy and investments such as: *economic growth, economic development, start-up, marketing*;
- **[C]** *Community.* Collects all aspects closely related to the organization, the development and the government of the city to provide services in order to achieve a better quality of life. Within this group keyword such as *needs, living, urban planning, security, and lifestyle*;
- **[R]** *Resource.* Considers a series of keywords that refer to a city that interacts with global challenges in environmental terms closely related to resources, natural and otherwise. Some keywords are *climate change, energy, resource, sustainability, resilience*;
- **[N]** *Network.* Collects keyword that relate to the use and implementation of both soft and hard infrastructure, thus promoting mobility, both physical and virtual of people, experience and knowledge; within this group we find keywords such as *infrastructures, ICT, mobility, technology*.

But in the new vision of the city 'What is the role of the town planning? '', and "What role and weight does each stakeholder assign to the specific topics of the discipline of urbanism? ".

To answer these questions, the study focused on the thematic category Community [C], which, in its definition contained elements not related to a specific discipline but generally attributable to collective aspirations; further analysis was carried out, therefore, splitting the category in question into two subcategories, taking as sole criterion the will to distinguish all the keywords related to social aspects, from those related exclusively to urban organization, to its development and its transformation: the first set, called [S] Social Priority, includes keywords such as *quality of life, living and people*, while the second, [U] Urban Planning, includes keywords such as *urban planning* and *urban development*.

To assign keywords to each category [B], [R], [N], [S] and [U] the following classification criteria was used: 1) completeness: no keyword is left out; 2) mutual exclusivity: no keyword is part of more than one category; 3) pairwise comparison: since there is no rule of unique assignment; 4) relevance: the categories identified are considered a priori useful; 5) homogeneity: cases with different characteristics do not fall into the same category.

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3 The choice of categories can be ex ante or ex post. Ex ante when we have pre-existing categories before the analysis of the corpus, when you want to compare the results with those of other studies, when the theories on a subject are widely established and there is no need to verify them. Ex post that relies on the texts of the corpus to define the concepts useful in describing the investigated phenomenon, when you have a fragmented and unclear vision of the phenomenon, when you want to develop new theories and conceptualizations.

4 Currently in the analysis of content it is possible to identify two types of categories: thematic (the unit of analysis relate to the same subject) and semantics (the unit of analysis have, in the unit of context, the same or similar meaning).

To ensure the principle of mutual exclusivity we used specifications, in most cases attributable to adjectives, which accompany the coding of keywords and help the correct assignment of each in thematic categories[5].
"Given the role of town planning" by what means is the new city preparing to face the transformation of the territory? To answer, all the keywords within the category theme **[U]** Urban Planning were examined, extrapolating the ones most representative both for meaning and for frequency, and analyzing the trend over time and by groups of stakeholders.
The data was summarized in a matrix considering all the variables (Groups of stakeholders: **Ac**ademic, **Ins**titutional and **Bus**iness and years: ≤2010, 2011, 2012, 2013 and 2014) as in the Tab. 2.
Completed the matrix it was possible to proceed with the combination of the variables coded in order to investigate the trends of categories and key concepts.

DEFINITION	KEYWORD	SPECIFICATION	U	S	B	N	R	AC	INS	BUS	YEAR
A city where information technology is being incorporated into services that affect urban problems	ICT					1		1			2013
	services		1					1			2013
	problems	Urban	1					1			2013
A real smart city develops the city to reach the aim of improving the quality of life. It needs sound and innovative economic development as a means to reach this aim. Uses ICT as a tool with a great potential for ameliorating daily life, public services and the economy.	Quality of life			1					1		≤2010
	development	economic			1				1		≤2010
	ICT					1			1		≤2010
	services	Public	1						1		≤2010
	economy				1				1		
Smart cities: Innovative urban developments that leverage ICT for the management of natural energy consumption at the community level and other technologies to balance environmental stewardship with comfortable living.	development	Urban	1							1	2014
	ICT					1				1	2014
	energy	consumption					1			1	2014
	technology					1				1	2014
	environment	stewardship					1			1	2014
	living	comfortable		1						1	2014

Tab. 2 Excerpt from the table used for the analysis

3 RESULTS

The analysis of the output provided by each of the three methods of lexical analysis described in the previous paragraph has produce several insights. Sifting through the different uses made of the term *smart city* we can, through these instruments, identify whether, and to what extent, the changes advocated in the individual definitions represent an effective response to major modern urban challenges, for example related to the use of land or rationalization of energy resources, or are media instruments in defense of vested interests. Such analysis techniques are, therefore, a useful tool to start a shared analysis of urban transformations necessary for the future of the city, without being blinded by misleading philanthropic claims.

5 An example of this operation is found in the characterization of the term "Development" that in the texts is intended with various meanings. Each of these has determined the appointment of the keyword to different categories: cultural development [C]; economic development [B]; technological development [N]; sustainable development [R].

3.1 NETWORK TEXT ANALYSIS

The main output of this analysis are the *most influential keywords* or node words that are common to the greatest number of contexts (Tab. 3).

TOTAL

Nodes (Words): 100
Edges (Co-Occurrences): 1483

Most influential keywords in this text:
city smart technology service

ACCADEMIC

Nodes (Words): 100
Edges (Co-Occurrences): 1250

Most influential keywords in this text:
city smart technology ICT

ISTITUTIONAL

Nodes (Words): 100,
Edges (Co-Occurrences): 626

Most influential keywords in this text:
city smart sustainable management

BUSINESS

Nodes (Words): 100,
Edges (Co-Occurrences): 1207

Most influential keywords in this text:
city smart service technology

Tab. 3 For each corpus the total number of co-occurrences that define the connections, the four node words that connect the stronger contextual themes.

LEMMA	TOTAL	ACADEMIC	BUSINESS	INSTITUTIONAL	SUM
City	1	1	1	1	4
S\1mart	1	1	1	1	4
Technologies	1	1	1		3
Service	1		1		2
ICT		1			1
Sustainable				1	1
Management				1	1

Tab. 4 Most influential keywords per sphere of influence

From the table above:

- The word ICT is central only to academia;
- The node word technology is present in the total corpus, business and academia;
- The institutional world uses unique words;
- The node words of all the definitions are the same as the corpus of the business world.

These words are not necessarily the most important for the themes found in the text but the ones that strategically link together many of the themes found. We, therefore, propose the following considerations:

- For academics the main interest is the use of new information technologies, which therefore represent the true discriminating character of this urban model.
- Although sharing the interest of technological development with the academic world, the image of the *Smart City* proposed by the business world is centered around the concept of services; for the business world, therefore, a *Smart City* is able to develop and use technology to serve the citizens; since they are manufacturers of devices and sensors we could wonder whether it is not instead a city at the service of technology.
- Institutions have a completely different vision where technology does not seem to play a central role, instead the issues of sustainability and management emerge strongly, in continuity with the previous city models: the smart city is a city that can manage change in a sustainable way. The

institutional world seems to not have the need to characterize this new model, but probably uses the brand to perpetuate already initiated policies[6].

- What is most striking is the exact correspondence between node words and totality of definitions and of the business world, demonstrating how companies are driving the debate on the smart city.

3.2 LEXICAL CORRESPONDENCE ANALYSIS

The LCA was applied twice on the same textual corpus, using as discriminating modes once the groups of stakeholders and then the year of publication. Following the procedure of analysis described in section 2.3, we proceeded to the interpretation of the scatter charts, with the support of numerical tables, processed by the software together with the graphics, which summarize the coordinates of each lemma for each factor (Tab. 2-3). The results analysis procedure is organized according to the following steps:
- Interpretation of the factorial axes
- Interpretation of the quadrants
- Positioning of the modes (groups of stakeholders, year of publication) within the factorial space

1) LEXICAL CORRESPONDENCE ANALYSIS PER GROUPS OF STAKEHOLDERS

INTERPRETATION OF FACTORIAL AXES

The first step consists in the interpretation of the two factorial axes, which in the specific case represent the 100% of the total variance.

The I^st factorial axis has two opposed groups of words that characterize the two semi axis:

- Positive semi axis: *Vision, Efficiency, Access, Sector, Operation, Solution*.
- Negative semi axis: *Governance, competitiveness, capital, human, policy, modern, transport*.

In the first group words such as *Efficiency, accessibility, solution, vision*, understandable concepts to a wide audience even of non-experts, evoking a fully functional urban dimension. Thus emerges a language, very close to the world of marketing, which focuses on an ideal view of the object (in our case the Smart City) rather than comment on specific processes and tools that describe it. On this basis, this semi axis was named "SUGGESTIONS".

The second group includes words such as *governance, competitiveness,* and *policy* related to a more specialized and less evocative language, that focus on the tools and processes of urban transformation. Words such as *human* and *social capital*, combined with *modern* and *transport* suggest a cross sectorial discussion that involves the field of humanistic and scientific research. This axis was therefore named "tools of transformation."

The II^nd factorial axis has two opposed groups of words that characterize the two semi axis:

- Positive semi axis: Policy, capital, human, living, administration, investment, intelligent
- Negative semi axis: Mobility, data, planning, competitiveness, communications, efficiency, reduce

On the positive semi-axis terms that seem to describe a vision of cities attentive to the management (*administration, policy, intelligent*) resources in economic terms (*capital, investment*) and social (*human, living*) emerge; on the negative semi axis instead urban issues are part of a wider path (*mobility*) where the exchange of information and best practices (*data, communications*) become the lifeblood in the resolution of global challenges (*reduce, efficiency, competitiveness*). The two semi axis have therefore been defined respectively "optimization of local resources" and "NETWORKING EXPERIENCES".

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[6] It’s important to point out that most of the definitions collected from the institutional world, and included in this category, belong to documents of the European community; for many of them environmental issues, particularly those related to resource management, whether energy or economy, are central.

INTERPRETATION OF THE QUADRANTS

The interpretation of the axis analyzed earlier, returns a description of the factorial space by assigning a specific meaning to the four quadrants. The first quadrant shows the image of a city in which the use of ICT and the increasing accessibility to these means is the real engine of development of urban areas in terms of management of economic and social resources. The development of new digital technologies takes on, in the second quadrant, a greater interest in relation to the possibility of exchange of experience, know-how, information, best practices between different realities to address common issues and global challenges. Unlike the previous one, the third quadrant, is more focused on the development of tools for urban governance and sharing of experiences becomes a necessary tool to optimize these processes. In the fourth quadrant, the development and implementation of policies and governance tools are more related to the optimization of local resources in economic and social terms.

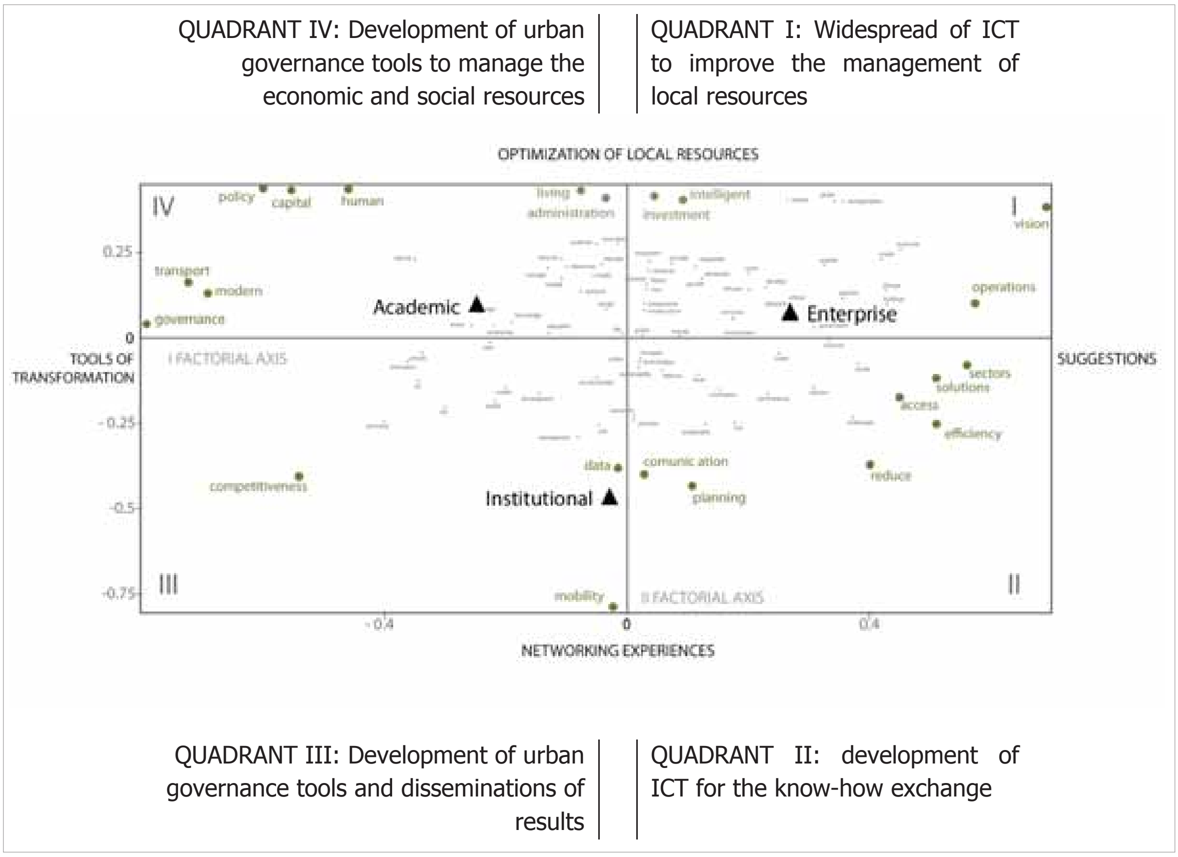

Fig. 4 Results of the LCA per groups of stakeholders

PLACEMENT OF THE GROUPS OF STAKEHOLDERS IN THE FACTORIAL SPACE

Starting from the considerations made above on the 4 quadrants, it is possible to detect differences in the approach of the three groups of stakeholders under consideration in addressing the issue of the Smart City by analyzing their placement on the factorial plane.

In particular, the opposition is very clear along the horizontal axis of the academic world with that of business, which are located respectively in the I and IV quadrant but is found "lying down" on the first axis. From the description above, it is clear that the development of ICT has led, in the academic world, to pay greater attention to the impact of this revolution in the human and social field and a reflection on the potential of these systems in the management policies of urban organism. On the one hand, therefore, interest of the branch of social sciences emerges, who see in a more or less critical way, the Smart City in

the new forms of social interaction, the other the increasing attention from more "technical" disciplines who see this technological revolution, new urban systems optimization tools. On the other side it is obvious that the business world insists more on the attractiveness of new technologies; while sharing with others a series of keywords of the concept of Smart City, it appears more interested in the construction of a language that can reach a wider section of the population, through the use of evocative words.
The institutional world is placed in Quadrant III, and is characterized mainly by the second axis. Its position denotes, therefore, a clear predominance of issues relating to mobility, considered as networking and dissemination of know-how and best practices; This is probably related to the high incidence of the main evaluation factors present in the program guidelines of European calls; they see in multiculturalism and sharing the main requirements for participation, as well as a greater interest in the global challenges in which cities play a decisive role.

2) LEXICAL CORRESPONDENCE ANALYSIS PER YEAR

INTERPRETATION OF FACTORIAL AXIS
In this case the first two factorial axes represent 65% of the total variance.
The Ist factorial axis has two opposed groups of words that characterize the two semi axis:

- Positive semi axis: *critical, administration, operations, physical, activities, sensor, optimize*
- Negative semi axis: *challenge, change, vision, development, policy reduce, energy*

In the first group there are terms related to the production processes (*operations, phisical, activities, sensor, optimize*) that, together with the words *critical* and *administration*, indicate the attention to the development of new technologies and their management. On the opposite axis instead attention is more focused on the socio environmental challenges, terms such *challenge, change,* and *vision* combined with *development policy, reduce,* and *energy* indicate greater interest to the global challenges with particular emphasis on the reduction of energy consumption. The two semi axis have therefore been defined respectively "TECHNOLOGICAL DEVELOPMENT" and "GLOBAL CHALLENGES".
The IInd factorial axis has two opposed groups of words that characterize the two semi axis:

- Positive semi axis*: work, increase, business, public, administration, efficiency, solutions, digital*
- Negative semi axis: *activities, capital, sensors, mobility, smarter, network*

The second axis has on the positive semi axis themes with big media appeal in these tough times, related to employment and management of public money (*work, public, administration*) which are accompanied by the need for economic investments (*solutions, Increase, business*) and related to the production and spread of digital technology (*efficiency, digital*). The negative semi-axis is characterized by terms that conjure the possibility of improving urban performance through the study and analysis of the habits of the inhabitants; the focus is on the potentiality of control (*sensors*) of human activities networks (*activities, mobility, network, capital*) for the creation of smarter cities (*smarter*). The two semi axis have therefore been defined respectively "investment in digital technology" and "BEHAVIOR ANALYSIS".

INTERPRETATION OF THE QUADRANTS
The interpretation of the axis analyzed earlier, returns a description of the factorial space by assigning a specific meaning to the four quadrants. In the first quadrant issues, related to the production, deployment and diffusion of new technologies, especially digital ones, emerge which turn out to be the real engine of economic development of the city.

Instead, in the second quadrant issues related to the development of new technologies for the implementation of the performance in terms of urban development of social networks and infrastructure emerge.

In the third quadrant, development and education of citizens become the real engine of change to address global challenges, a central theme in the fourth quadrant. In this case the challenges, are economic social and environmental: a city is smarter as it is prepared to face the major challenges of the future.

QUADRANT IV projections and investments aimed at confronting global challenges

QUADRANT I Investments in ICT

QUADRANT III weight of everyday habits in global challenges

QUADRANT II development of new technologies for the enhancement of urban performances

Fig. 5 Results of the LCA per year

PLACEMENT OF THE GROUPS OF STAKEHOLDERS IN THE FACTORIAL SPACE

Starting from the considerations made above on the 4 quadrants and analyzing the positioning of several years on the factorial plane, we can describe the evolutionary trajectory of the themes that have characterized the debate about the Smart City over time.

Based on the description of the interpretation of the factorial space the debate prior to 2010, located in quadrant II seems to be characterized by greater attention to the development of new technologies regardless of the possible fields of application. In 2011, located in the fourth quadrant, switching from a focus on the new tools provided by technology to a greater consideration of the role of cities within the global challenges: control of the new devices has a positive effect on the ability to cope with global challenges starting from city management. To achieve the goals set by the challenges the simple technological development is not enough: in 2012, located in the fourth quadrant, but more "lying" on the second axis than in 2010, the idea that a city to be smart should also implement its networks and social infrastructure seems to prevail. in 2013 the focus moves back to the challenges, but unlike in 2011 with a meaning slightly influenced by social as well as environmental aspects; Finally, in 2014 the development of new technologies is once again at the center of the debate, driven by strong economic interests it becomes the real engine of growth; addressing the major challenges by incorporating into the debate issues of great media impact such as work and the management of public resources. It does not appear coincidental that the strong media character emerges in this last year when, as we shall see in the next section, the main producers of smart devices are more present in the debate on the smart city.

3.3 METHOD OF FREQUENCY ANALYSIS OF LEXICAL UNITS CLASSIFIED IN THEMATIC CATEGORIES

TRENDS OF THE DEFINITIONS

Before proceeding with the application of the analysis, how much the three groups of stakeholders have debated on the issue of Smart City over time was verified. Besides being a useful reference to the study of the results of other analyses, this data has yielded the first important considerations: initially the debate on the smart city is the prerogative of the scientific community, while in 2013 we see a substantial increase in definition by the world of business, represented mainly by manufacturers of electronic devices and software; This probably is due to the spread that the concept of smart city reached just recently becoming a significant element of media appeal; it is no coincidence that in all the web pages of the leading manufacturers of electronic devices (Siemens, IBM, Hitachi etc.) there is a section dedicated to the Smart City. While, on the one side, the academic world seems to abandon the initial enthusiasm for the potential of a Smart City, on the other businesses, use the brand to launch their products in a market mature to accommodate them. How does this difference in approach translates into concrete terms? The frequency analysis of lexical categories has shown the trends of the main themes of a smart city identified by the various groups of stakeholders involved in the debate.

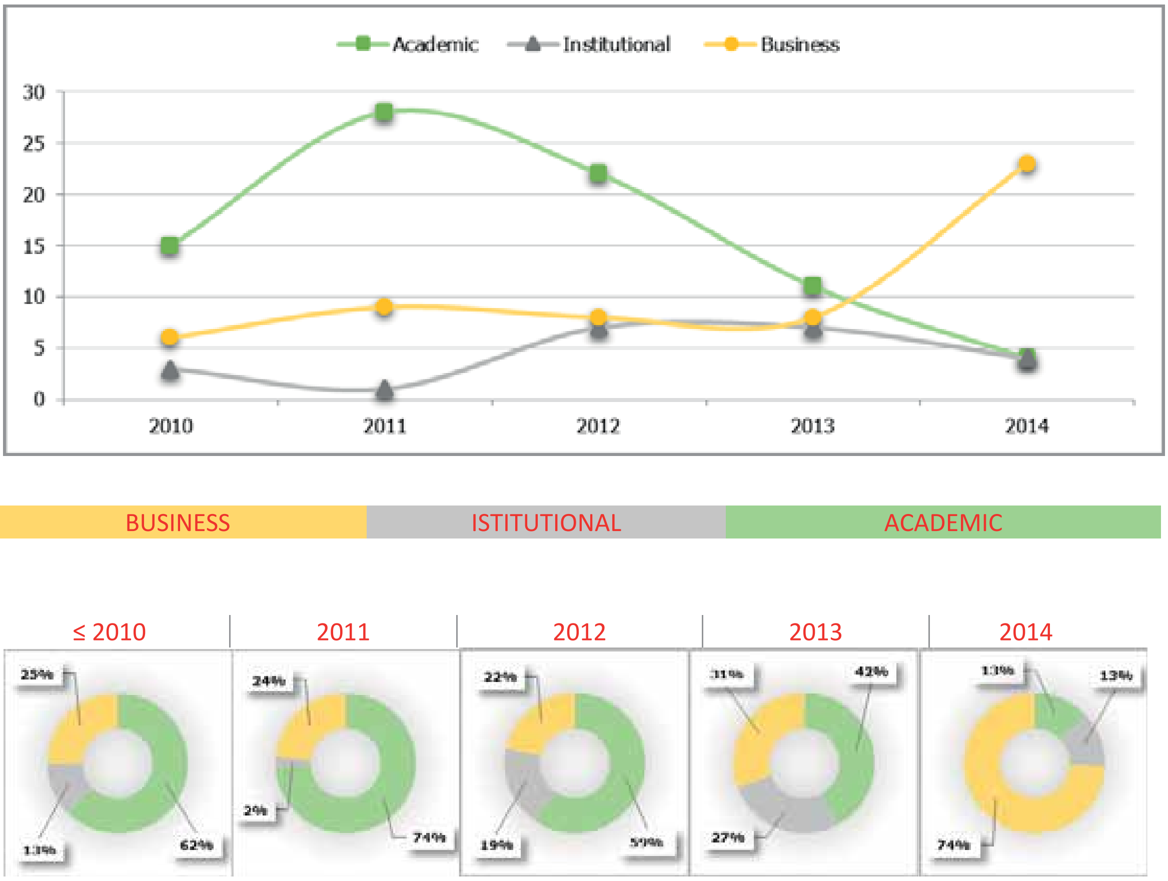

Fig. 5 Trends of groups of stakeholders and corresponding weights

From the subdivision of the keywords in thematic categories as described in section 2.4 the following graphics have been developed:

- Trends of the themes for the groups of stakeholders: is the weight that each thematic category plays in the debate within each groups of stakeholders over time;
- Trends of the groups of stakeholders by theme: shows the behavior and the relationship between groups of stakeholders with regard to a specific thematic category over time;
- Trends of the sub-themes [S] Social Priority and [U] Urban Planning: is a focus within the thematic category [C] Community in order to understand the weight of urban transformation in the debate for the three groups of stakeholders in time.
- Trends of the main keywords within the category [U] Urban Planning to understand in which terms the challenges of urban transformation are tackled by the three groups of stakeholders over time.

TRENDS OF THE THEMES FOR THE GROUPS OF STAKEHOLDERS

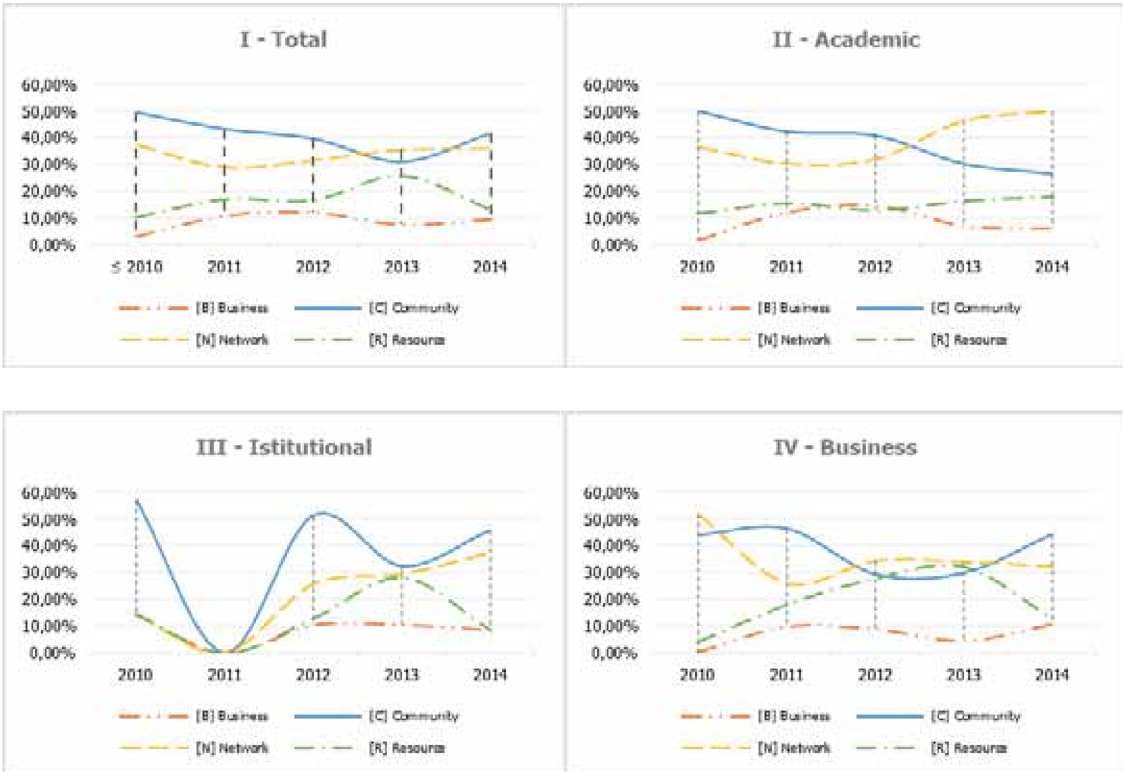

Fig. 6 Trends of the thematic categories per group of stakeholders

From the analysis of the quadrant I, relating to the 156 definitions, aspects related to global challenges in social and territorial terms and the use of new information and communication technologies are the main themes addressed in the new vision of the city emerge, in spite of a lack of importance given to issues related to economic and environmental aspects, except for a peak of the latter in 2013. The relevance of the topics covered changes within individual groups of stakeholders. The academic world, in the early years, discusses the theme of the Smart City privileging issues related to social and territorial government; by 2012, however, the focus is on the infrastructure system implemented by new technology and its physical and virtual interconnection ability. This change in vision may be due to a greater participation in the debate in the early years, by the branches of social science academics who give way to the scientific and experimental academics, more attracted by the potential of new technologies.

We see this change in the business world (see quadrant IV) albeit with inverse trends; this is probably due to marketing strategies: to a first phase in which the product itself is presented on the market follows a second linked to the need to effectively reach a wider audience, leveraging topics closer to individual aspirations. Institutions instead assign less weight to the technological aspects focusing on the social and giving much more weight than the other groups to environmental issues; This order of priorities is altered from 2013 when it seems to get closer to the positions of businesses.

TRENDS OF THE GROUPS OF STAKEHOLDERS PER THEMATIC CATEGORIES

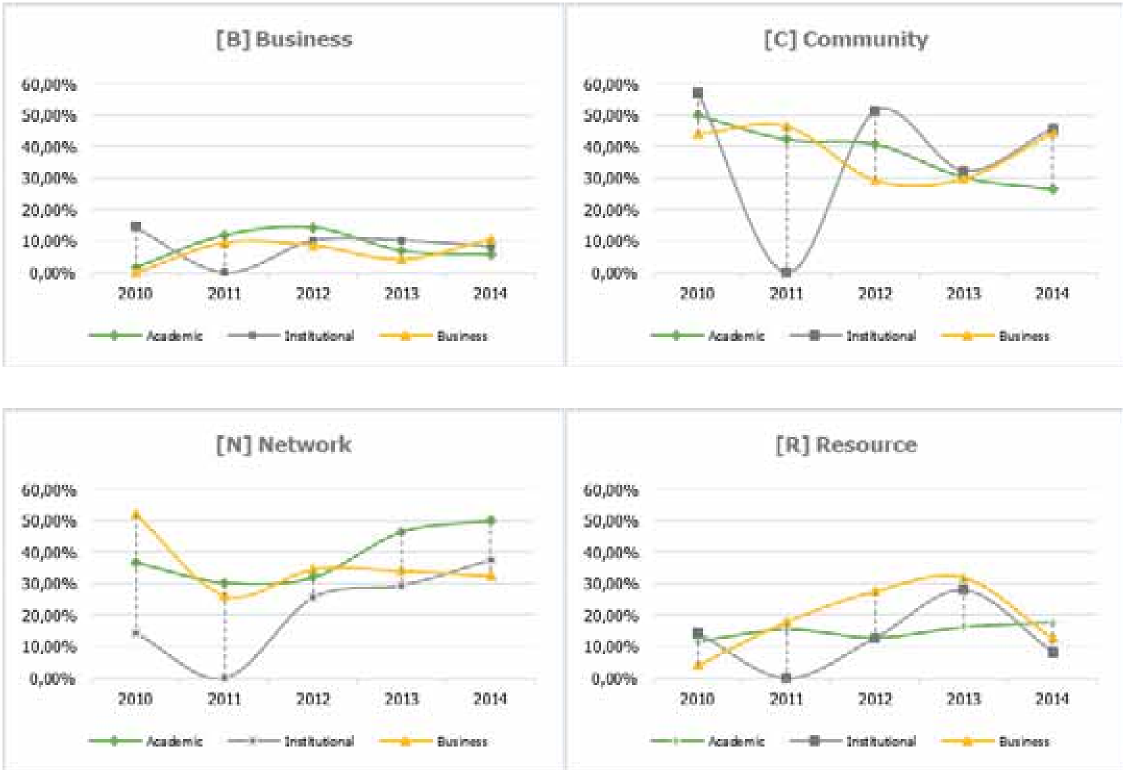

Fig. 7 The trends of the groups of stakeholders per thematic categories shows the relations amongst the groups.

Looking at the above charts we find confirmation of what we have alleged: in 2013, the curves relating to the business and the institutional world tend to coincide; at a time when the business world enters with more energy in the debate, it seems able to affect institutional priorities, that at the same time move away from the new themes discussed by the scientific community. Another hypothesis, perhaps more likely, is that companies have reformulated the vision of the smart city to tap into funding provided by the EU through programs such as Horizon 2020.

The following table provides a summary of what has been said so far:

	[B] Business	[C] Community	[N] Network	[R] Resource
1°	**Ist**ituzional	**Ist**ituzional	**Acc**ademic	**B**usiness
2°	**Acc**ademic	**B**usiness	**B**usiness	**Acc**ademic
3°	**B**usiness	**Acc**ademic	**Ist**ituzional	**Ist**ituzional

Tab. 5 ranking of the groups of stakeholders per thematic category

TRENDS OF THE THEMATIC SUB CATHEGORIES: SOCIAL PRIORITY [S] E URBAN PLANNING [U].

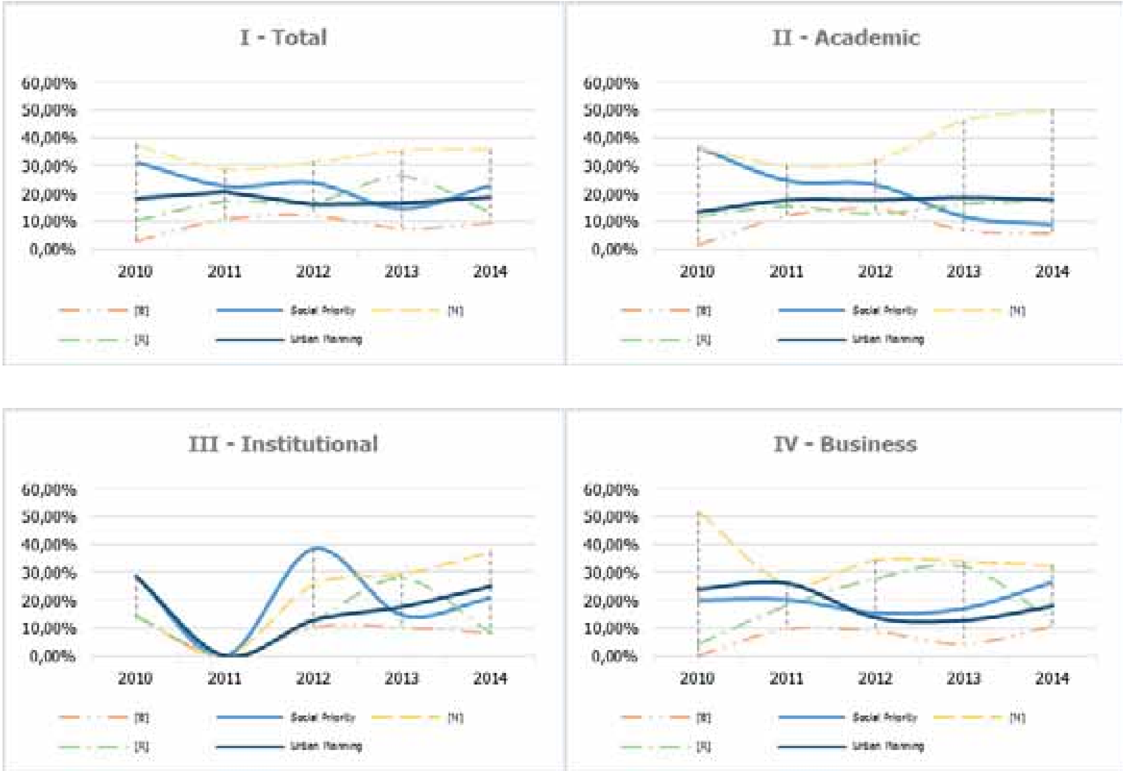

Fig. 8 Trends of [S] Social Priority and [U] Urban Planning

Given that new technologies both hard and soft, and environmental challenges that the economic and social world is facing will determine in fact a monumental change of urban environments, what vision of the city as a community of people who share a physical space arises from the debate on the smart city? To this end, the study focused on the analysis of a single thematic category, Community within which two spheres of influence of the urban / regional system coexist: one linked to the physical transformation of the city associated with the subcategory [U] Urban Planning, and one linked to socio-cultural aspirations of its people, collected in the sub-category [S] Social Priority. Looking at the box I – Total (Fig. 8) all those that place at the center of discussion aspirations and needs of the individual and groups are generally confirmed as central themes; visions and perspectives that imagine a city that invests in human and social capital and its development in terms of well-being, lifestyle and safety. A vision that is shared initially by the academic world but loses force over time, as shown by the descending curve [S] (Fig. 8, Box II). The constant trend of the curve [U] shows that the scientific community, in speaking of the city smart, does not abandon the traditional themes linked to the government of the territory but never assigns it a prominent place. The curve Social Priority [S] is interesting in the IV quadrant where the themes that take shape in the public interest objectives become key topics of discussion for the business world. This confirms what has been said in previous analyzes about the progressive shift of interest towards themes of greater media appeal. Also in this case, the positions of the business world tend to coincide with those of the institutions from 2013.

It is, therefore, evident that the role assumed by planning, understood as government of territorial transformations, is rather marginal in the debate on cities demonstrating little interest in an organic vision of the urban system, probably delegated to a more or less sincere trust in the potentiality of managing the complexity with new technologies.

TRENDS OF THE MAIN KEYWORDS WITHIN THE CATHEGORY URBAN PLANNING

A further study consists in the analysis of the sub-category Urban Planning, in order to understand in what terms, despite it not having a key role, city planning finds its place in the debate on the Smart City. The main keywords (in percentage terms) that emerged from the analysis are: services, which means the fulfillment of essential needs of the community; planning, related to the choices and strategies for transformation and organization of regional planning; governance which seek a governance model characterized by a greater degree of cooperation and interaction between the various actors.

Fig. 9 Trends of Services, Governance, Planning

Meeting the needs of the community by providing services to the citizens is to be, for all three groups of stakeholders, the priority in the new vision of the best way to conceive the urban system. In particular, such an aspiration involves the stakeholders' part of the business world, most likely because they are interested in reaching a wider audience. The concept of planning, in the traditional sense of the term has maintained a more or less constant trend with low percentages while the issue of governance has gained weight in recent years for all three groups of stakeholders. This is probably due to the fact that as (Rhodes, 1997) states "The concept of governance, now widely used to describe the many types of social and economic coordination, is a change in the meaning of government that refers to a new process and new ways of governing". The governance is, therefore, a new urban development model that takes into account different interests; this model is characterized by a mechanism of incremental growth of the social capital that is based on a greater degree of cooperation and interaction between the stakeholders in the cities.

3 CONCLUSIONS

The results of the analysis conducted, summarized in Tables 6 and 7, show that the different approaches to the issue of the smart city, by the three groups of stakeholders, are clear. Businesses, represented mainly by manufacturers of electronic devices and software, increasingly involved in the debate on the smart city, see in the spread of this model a significant element of media appeal for the sale of their products; studying the evolution of the concept in the years and the type of language used the marketing strategies employed, emerge: a first phase in which the product itself is presented on the market and a second phase has followed, linked to the need to effectively reach a wider audience, relying on topics closer to individual aspirations and focusing on topics of great media impact such as jobs and management of public resources. The institutions seem to be more interested in the themes of sustainability and cultural and social mobility, reducing the emphasis on new technologies, which only enhances the ability to circulate know-how; they do not appear to have the need to characterize this new model, but probably use the brand in favor of already initiated policies. The scientific community has rather more diverse views, originating from the different souls that constitute it, placing the focus of debate on the effects of the development of new information technologies on society; positions coming from the social sciences, that initially prevail, see, in a more or less critical way, the Smart City as new forms of social organization and cultural development, due to an increasing ability to interconnect both physically and virtually; while, at a later time, "technical" disciplines move into the debate, mostly attracted by the potential of new technological systems as a tool for managing the different components of the urban organism in all its forms. Beyond the differences that characterize the three groups, identified by the study, an alarming fact emerges: the almost complete absence in the debate of the inevitable challenges that cities will face in the near future. Issues such as the limitation of the use of land, the energy efficiency redevelopment of existing buildings, the preservation of the city from the consequences of climate change, etc., and especially the need for an organic vision of the urban system as a whole that addresses all these issues, are only marginally touched by this debate in favor of a, more or less shared, trust in the potentiality of management of complexity through the use of new technologies. In this context it is difficult to set priorities for interventions to be implemented in urban centers channeling investments in a strategic manner. It is not therefore secondary to figure out who "leads the game" and especially those who "follow": whether to offer solutions for the smart city are businessmen linked to business profits, or institutions crushed by the political election cycles, how can we avoid the risk that everything is conditioned by short term plans? From the various studies on the temporal evolution of the paradigm we see, in this apparently fragmented and inconsistent field, that the balance of power between the parties involved in the debate is consolidating. From the LCA, which identifies in the investment in the digital technologies the latent underlying significance in the recent debate, and the analysis of the frequency of lexical units, showing a clear convergence in the topics proposed by the business and institutions worlds, it is clear that the debate is increasingly in the hands of businesses, institutions taking a secondary role, while the scientific community tries to carve out their own space with difficulty within the themes promoted by research funding. Therefore ICT corporations have become the agents of the socio-cultural and technologic dynamics in their quest to determine how to turn their proprietary technology into something that can used in the physical world, selling networking devices to cities, governments, and even consumers to connect to, and to each other, the physical components of the cityscape. The idea perused is that the communication and control potential would allow for a "city operating system" where the city becomes a data-gathering machine collecting data from every object, and every person trough the sensor platform already embedded in our smartphones. This information could then be used by some other company to optimize the allocation of resources, both physical and human, and directly improve every aspect of the city with optimization algorithms. At first glance these elements create new opportunities, per quantity and quality of the available data, to comprehend the problems of the city and at the same time define new governance tools for the transformation of the city, seen as an innovation laboratory. However it is not conceivable that the city, whose development logic is primarily based on the equilibrium between elements of chaos and diversity (Greenfield, 2013) may commit its evolution to the logic of algorithms. The indicators that a city is "smart" cannot be just what kind of technologies are being used, or how much energy is being saved, but rather its' ability to act as an essential component of the complex extensive system, that requires participation, human capital, education and awareness of the urban development processes (Papa, 2014). In the timeless debate on how to govern the transformation of the cities, to ensure the maximum advantage for the citizens, which is the task of town planners, the introduction of ICT brought another component. The debate at some point has been waylaid moving it away from the discussion on how to improve the city and what makes it suitable to address users' needs, how do we instill in cities the capacity to develop and react to changing conditions; in a word how do we make cities "smart". Regarding ICT the discussion at first was: how do we use the potential of these technologies in the transformations we envision for the city? Later as other, more vocal, stakeholders joined the discussion town planners lost their central role and, as each ICT company vies for its market share, the theme has become what technology should I employ to make the city perfect. Media and the publicity machines of the ICT industry have blinded us with visions of utopian efficient cities of the future that relay entirely on their products to function, a simplistic view that ignores the basic facts that town planners know well. Cities are complex systems that project on the physical world the complexity and social structure of the human way of life. A system that is in constant state of flux as each individuals' and each groups' ambitions assert themselves briefly and then input in the cities long-term transformation process their desires. The debate should therefore focus once again on how to balance the aspirations of the users and how to interpret them in the physical world, also with the useful help of tools such as ICT, instead of following blindly promises of order and perfection that may come when companies have acquired omniscience. We shouldn't forget that all the ICT infrastructure that could make something "smart" are meaningless if we forget that the central point of the discussion is the "City".

STAKEHOLDER / METHOD	ACADEMIC	INSTITUTIONAL	BUSINESS
Network Analysis Most influential keywords	ICT	Sustainable Management	Services
LCA latent meaning	Transformation tools	Networking Experiences	Suggestions
Frequency Analysis Main thematic category	Network	Community	Community

Tab. 6 Summary table: different visions of smart city among the stakeholders

Year / Method	≤2010	2011	2012	2013	2014
LCA latent meaning	Technological development	Global Challenges	Implementation of technological and social networks	Social Challenges	Investments in digital technologies
Frequency Analysis					
academic	Community	Community	Community Network	Network	Network
institutional	Community	-	Community	Community Network Resource	Community Network
Business	Network Community	Community	Network Community Resource	Network Resource Community	Community

Tab. 7 Summary table: evolution of the concept of Smart city over the years

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IMAGE SOURCES

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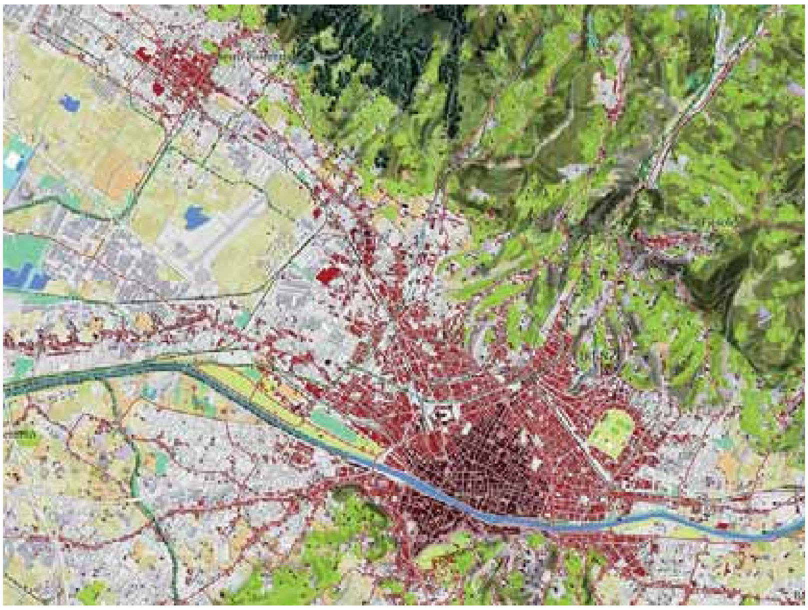

URBAN DEVELOPMENT IN TUSCANY

LAND UPTAKE AND LANDSCAPES CHANGES

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ABSTRACT

The phenomenon of urban sprawl has been already recognized as one of the major anthropic threats to natural ecosystems and landscapes while the negative aspects of the phenomenon are still only marginally taken into consideration in the scientific and local government circles. The recent decision of the European Parliament points out that the degradation, fragmentation and non-sustainable use of land in the EU is jeopardizing several important ecosystem services, threatening biodiversity and increasing Europe's vulnerability to climate change, natural disasters and desertification. The study regards the processing of data on urban land conversion over the past 50 years and the effects in the areas of high environmental vulnerability in one of the most important Italian region: Tuscany. The historical data were compared from a qualitative and quantitative viewpoint with the present-day geography of settlements, which showing changes found in today's settlement-territorial structure. The conclusion reports focuses on collated environmental criticalities and the margins for recovery of the compromised territories that still today receive little attention from central institutions and local authorities, in addition to data on landscape effects to be construed as signs of specific trends underway today and scarcely taken into account by land management tools.

KEYWORDS:
land uptake, GIS analysis, urbanization impact, land-use change, landscape

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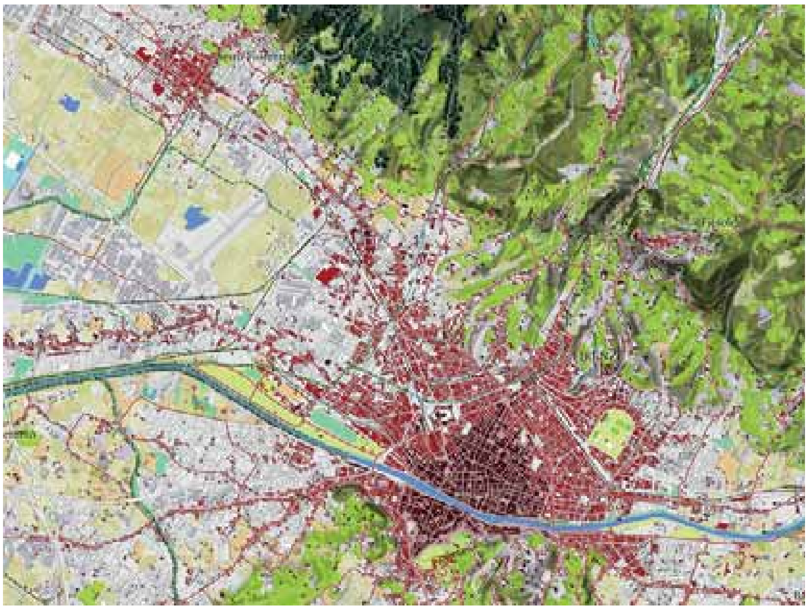

土地与景观摄取

托斯卡纳城市发展

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A 摘要

城市扩张早已被认为是自然生态系统和景观面临的主要人类威胁，而这种现象的消极方面却仍处于科学界和当地政府部门考虑范围的边缘位置。欧洲议会最近的决定指出，欧盟境内的土地退化、零碎化和不可持续使用正危及一些重要的生态系统服务，威胁着生物多样性，并增加了欧洲面对气候变化、自然灾害和荒漠化时的脆弱性。本研究将聚焦于对托斯卡纳这个最重要的意大利地区过去 50 年城市土地转化数据的处理以及高环境脆弱性地区所产生的影响。这些历史数据将从定量和定性角度与现在的居住区地理进行比较，展示在现在的居住区域结构中发现的变化。结论报告除了关注那些将被解读成当前具体趋势信号以及很少被土地管理工具重视的景观效应数据以外，还聚焦于那些现在仍未从中央机构和地方当局那里获得太多关注的受损地区所面临的环境危险程度和恢复空白。

关键词

土壤消费, 景观, 地理信息系统

1 INTRODUCTION

The research presented here was aimed at investigating the urban development as one of the more relevant factors of landscapes changes of one of the most famous Italian regions, Tuscany, and its effects over the period of half a century. The study was carried out by analysing the settlement condition during two distinct temporal periods: that immediately following the second world war and the first decade of 2000. Tuscany is one of the most well-known Italian regions in the world, with one of the highest international tourism rates thanks in part to Florence, which was one of the most important cities in Europe during the Renaissance period, and in part to other cities such as Pisa, Siena and Lucca, which are well-known for historical, architectural and cultural reasons. However the region is famous for its landscape those has become an Italian trademark in the world's collective imagination (Paolinelli and Valentini, 2009). Suffice it to say that Tuscany hosts seven of the more than fifty UNESCO sites established in Italy, and that the European Landscape Convention was signed in Florence on 20 October 2000. This latter, to date signed by six EU member countries and ratified by 32, recognises Tuscany as a substantial economic asset, as well as an aesthetic and cultural one (http://conventions.coe.int/Treaty/ita/Treaties/Html/176.htm). It is one of the largest regions of Italy (the fourth out of 20) and hosts more than 6% of the national population thanks to a wide range of economic opportunities in the agricultural, industrial and artisan sectors, but most especially in the tourist sector with its many centres of art, its aforementioned rural landscape, the vast architectural heritage and a long and beautiful coastline along the Tyrrhenian Sea (over 400 km – about one fifth of the entire western coastline of the peninsula). The latter includes some of the most famous Italian seaside resorts such as the Versilia, the island of Elba, the Grosseto coastline and the Argentario promontory. Regional bodies have estimated that were over 11m tourist in 2006 , a third of which were concentrated in the province of Florence, and about 40% of which came from outside of Europe (HTTP://IUS.REGIONE.TOSCANA.IT/CIF/PUBBLICA/TIC2007/ZIP_PDF/TURISMO.PDF). Tuscany's tourist influx accounts for almost a quarter of the national total and the related economic dynamics are further strengthened by an affluent real-estate market that has seen, for several decades now, wealthy international clients buy and renovate buildings in rural and historic centres (Geri et alii, 2010; Paolinelli, 2012; Rosignoli et alii, 2013; IRPET, 2014a; Falqui et al., 2014). The settlement-type transformations that occurred over time were influenced in ways and with impacts that were different from the regional geo-climatic characteristics and political choices that have affected the urban aspect and agricultural landscape. Regional agriculture has long been characterized by the sharecropping model (Reid and Joseph, 1975; Shaban, 1987; Singh, 1989), an agricultural practice that has produced profound changes in the regional landscape over time. Over the centuries the introduction of sharecropping created an increasingly dense mesh of small farm holdings in land thickly planted with trees, where a large proportion of the rural population lived in isolated houses (Rombai, 2002; Vos, 1993). Sharecropping characterized regional agricultural production until the 1960s when, thanks to an act prohibiting the possibility of entering into new sharecropping contracts (Act No. 756, 15 September 1964), the sharecroppers abandoned the small farms holdings and adapted the landscape to agricultural mechanization. It is important to stress that, at the end of the 1930s, 4,125 of the 5,666 estates surveyed in central Italy were located in Tuscany (particularly in the central-southern part of the region), and they covered 40.9% of the agricultural and forestry area, and united over 70,000 farm holdings. Most obviously prevalent were the small and medium-sized farms – the former were most numerous in the provinces of Massa Carrara, Lucca and Pistoia, and were the ones most geared to the intensive cultivation of vegetables and flowers; while the latter were most numerous in the provinces of Florence and Arezzo. The large farms, instead, were a prerogative principally of southern Tuscany (the provinces of Livorno, Pisa, Siena and Grosseto). On average a farm contained 18 hectares, but it varied between the six hectares of Lucca and the 68 of Grosseto, where the many large cultivated areas included vast forests and pastures, as well as arable land. Generally, the largest farms covered the extensive arable lands of Maremma as well as the mountainous areas (where the quantity of forest and pastureland was also significant), and the smaller ones covered the hill areas, which were the most marked by intensive farming (arable land with grapevines and olive trees). Urban conversion of the land in Tuscany is a territorial pathology resulting from economic dynamism and a population growth that, particularly over the past decade, has increased greatly. Although the international scientific world has highlighted the problems and environmental consequences of extended urban transformations for many years (Sala et al., 2000; Lambin et al., 2001; Ellis and Ramankutty, 2008), only a few studies of Italy published in international magazines have begun to provide more precise details on the character of the phenomenon of "land take" and of the artificialisation of the land (Pileri and Maggi, 2010; Romano and Zullo, 2012, 2014; Salvati et al., 2012). Very few regions (only three out of 20) have vectorial information on land consumption spanning 50 years, and there is even very limited data for smaller time frames between 1970-2000, both in terms of information on the overall expansion of urban areas and a historic series of statistically significant data, while in other countries there is much more data and there are many more articles (Hall et al., 1973; Mellor, 1983; Yanitsky, 1986; Irwin and Bockstael, 2007; Zaninetti, 2006; Garcia-Call, 2011; Hauri et al., 2006; Catalán et al., 2008; Illy et al., 2009). In addition, no local authorities (regional, provincial or municipal) have yet organised coordinated surveys, and although programs monitoring the phenomenon on a national scale have recently started to spread (Munafò and Tombolini, 2014), they are only on a small scale so we are still far from having any kind of systematic data collection that would allow us to make credible comparative evaluations (Sharma et al., 2012; Lowry, 1990). The negative aspects of the phenomenon are still only marginally taken into consideration in the scientific and local government circles (Grubler, 1994; Heilig, 1994), and for many years now the lack of a standard of reference for the protection of the land in all its uses has been highlighted (Pileri and Lanzani, 2007), while at the European level, the proposal for a framework directive on land (COM/(2006)/232) was recently withdrawn (Office Journal 22 October, 2014 C 153, dated 21 May 2014) by the European Parliament and Council, who have adopted Decision no. 1386 (20 November 2013) of the Union's 7th general programme of action regarding the environment until 2020: "Living well within the limits of our planet", which represents a binding declaration of intent from the environmental point of view. This decision points out that the degradation, fragmentation and non-sustainable use of land in the EU is jeopardizing several important ecosystem services, threatening biodiversity and increasing Europe's vulnerability to climate change, natural disasters and desertification. Only in 2013 did this issue appear on the Italian government's agenda, and it was followed by many legislative proposals (on 13 December 2013, the parliamentary bill presented by Minister Catania "Regulations relating to the utilization of agricultural areas and containment of land consumption", was approved by the Council of Ministers) aimed at curbing the negative effects of the urban land conversion phenomenon. In this sense, in order to understand its dynamics and causes and, based on these, to develop appropriate political-territorial strategies, it is essential to reconstruct the evolved dynamics of the settled areas over the entire national territory, based on standard data consistent throughout the country and with a level of accuracy that allows for an assessment of the extent of changes to the territory from the post-war period to the present day.

The objective of this paper is to provide a contribution in this direction by focusing on a significant area of the country, i.e. Tuscany. The description of the area of study outlines the socio-economic and territorial characteristics; the section on the methodology describes the origin of the data and the techniques used for their processing; and the section on the results illustrates the regional settlement conditions detected in the 1950s, and by comparing them to the conditions today, exposes the resulting changes found in today's settlement-territorial structure. The conclusion reports on and analyses the information that emerged during the study, focusing on collated environmental criticalities and the margins for recovery of the compromised territories that still today receive little attention from central institutions and local authorities.

2 AREA OF STUDY

Tuscany covers an area of approximately 23,000 km^2 (equal to about 8% of the whole national area) and is divided between 287 municipalities, each of a relatively large size and on average almost double that of national standards (8,000 ha compared to 3,600 ha), and stretching across ten provinces. without getting into detail about the vegetation, it is the region of Italy that has the highest forest coverage, with about half of its territory given over to woodland use (compared to 25% nationwide) and another 40% to agricultural use. the morphological features of the rest of Tuscany consist of hills (over 66%) and plains (about 8%). the mountain ranges of the Apuan Alps, Garfagnana and Pistoia are all located in the northern part of the region, next to the Tuscan-Romagna Apennine ridge, and occupy slightly more than 25% of the area with an altitude of almost 2,000m above sea level (Fig. 1a). The urbanized areas are largely concentrated in the plains, with a significant industrial production component. The regional council's resolution no. 69/2000 identifies 12 industrial districts, including the leather goods and footwear sectors that have for some time represented regional excellence (in the Santa Croce sull'Arno district and the leather and footwear district of Valdarno superiore).

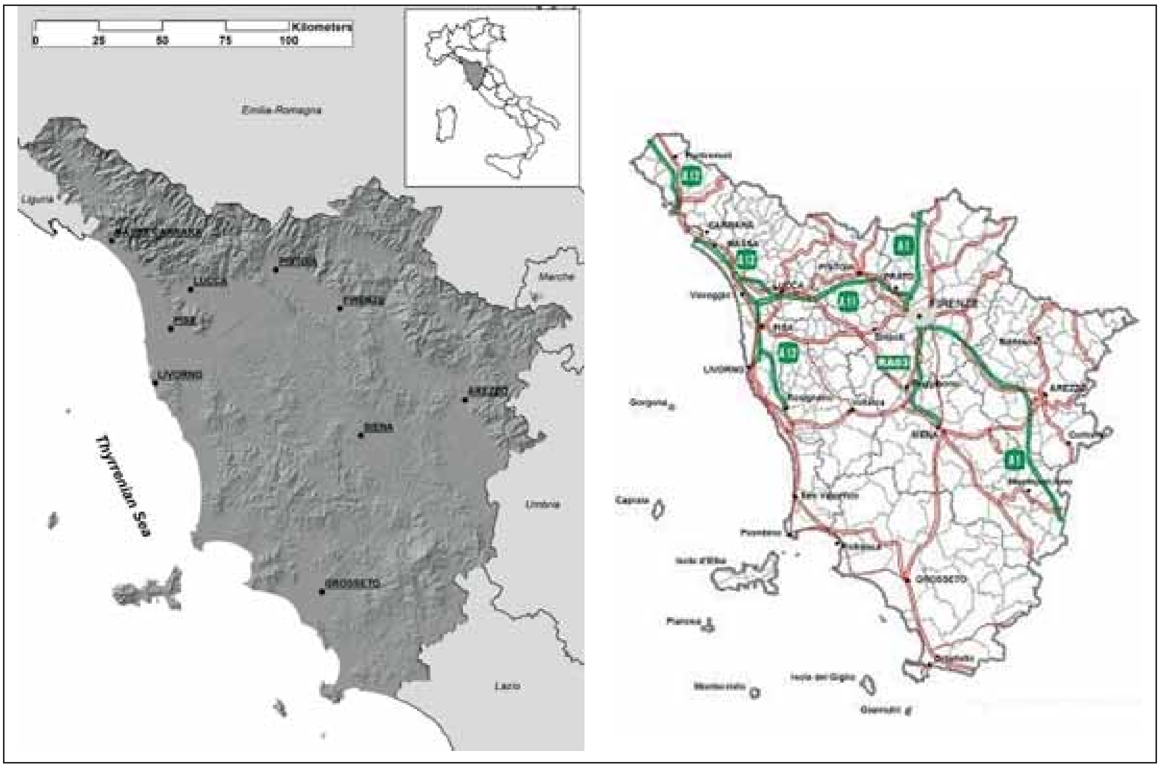

Fig. 1a/b Study area (on the left) and Tuscany Highways System (on the right)

The industrial development of Tuscany was largely founded on local systems of small and medium-sized enterprises, but today even more so on the role of big businesses, especially metalworking (in Florence, Pistoia, Pontedera). the gross domestic product (GDP) of Tuscany accounts for about 6.8% of the total italian GDP, although its per capita values are equal to other areas of the country (in particular Trentino, Lombardy, the Veneto and Friuli-Venezia Giulia). In recent years, Tuscany has arrived at between 8th and 10th place on the list based on its per capita wealth, with a figure that places it above the national average (http://www.irpet.it/index.php?page=infotoscana_economia). With over 10,000 km of roads and a density of approximately 0.5 km/km^2, the level of infrastructure in the territory (Fig.1b) is quite high compared to the Italian average of approximately 0.36 km/km^2 (data source http://www.openstreetmap.org) even if the roads have only been slightly extended (by about 500 km thanks to the A1, A11 and A12 roads).

The ISTAT (Central Institute of Statistics) census of 2011 indicates that there are over 3.6 million inhabitants in the region, equal to 6.2% of the national population, with an increase of nearly 500,000 compared to data collected at the 1951 census (about 3.15m or 6.6% of the Italian population of the time). Analyzing the demographic variation between 1951 and 2011 on a municipal basis (Fig. 2) it can be noted how all the coastal towns and the island of Elba show a marked population increase during the period indicated. The same phenomenon also happened in the inland municipalities of the provincial capitals, those along the Basso Valdarno (Livorno - Pisa - Florence) and along the A11 motorway axis (Florence, Prato, Pistoia, Lucca, Viareggio). By contrast, there was great fall in population in the Apennine area bordering Emilia-Romagna and Liguria, as well as in most of the municipalities located in the central area of the region. Among the provincial capitals, the only ones to show a demographic decline between 1951 and 2011 were Lucca (-1.2%) and Florence (-4.4%).

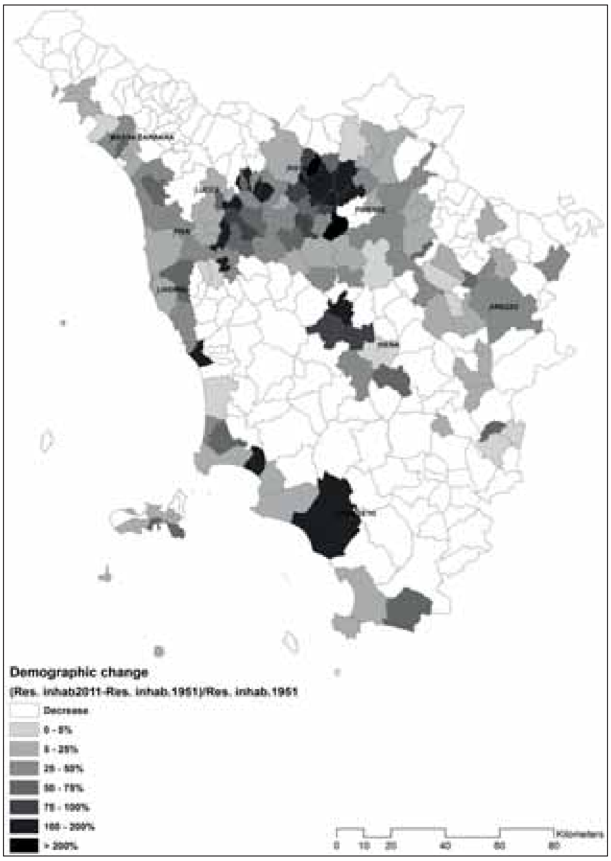

Fig. 2 Demographic change between 1951-2011

The curve of regional demographic dynamics (Fig. 3), analyzed over 60 years, shows continuous growth between 1951 and 1981 when the population increased by over 400,000, that is more than 13,000 inhabitants a year and about 60 inhabitants for every hectare of land surface. between the early 80s and until 2000, there was a significant demographic downturn leading to the loss of more than 80,000 inhabitants (4,000 per year). however a stark reversal has occurred over the past decade, with a rather rapid demographic recovery that resulted in the highest level of inhabitants in the region's recent history: more than 170,000 new residents in ten years (on average 1,700 new residents per year).

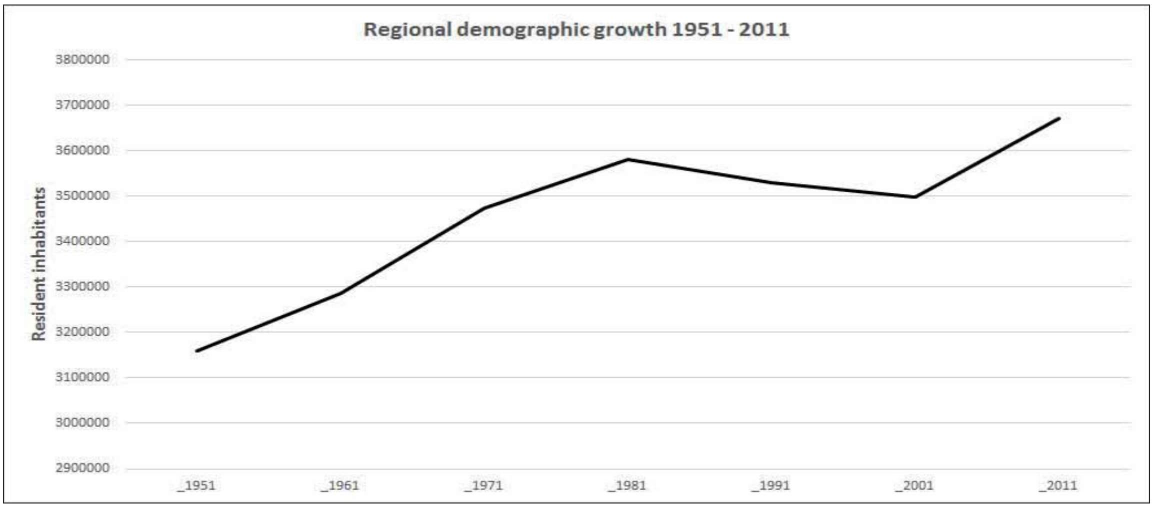

Fig. 3 Regional demographic growth between 1951-2011

Immigration data shows that this population increase is due almost exclusively to non-eu immigrants, with an increase of 226% between early 2000 and 2011, bringing immigrant levels up from 175,000 to an estimated almost 400,000 today (Cappellini, 2009). this accounts for 11% of the whole population, compared to 8.5% nationally, confirming that thanks to the economic characteristics that have been described, Tuscany is very attractive to immigrants, where even employment conditions seem to improve, despite the well-known crisis that has tormented italy for several years now (Caritas and Migrantes, 2011; Benassi and Porciani, 2010). The population density of the region of Tuscany has increased from 137 habitants per km^2 in 1951 (very close to the national one of same period, which was 157 habitants per km^2) to the current 160 habitants per km^2, which is more than 80% of the national value of 197 habitants per km^2.

3 MATERIALS AND METHODS

Analysis of the evolution of the settled areas in Tuscany was, for the historical period, carried out using maps published with a scale of 1:25,000 by the IGMI (Italian Military Geographic Institute) between 1949 and 1962. It is the 25v series, organised into 3,545 elements (panels) with dimensions of 7'30" longitude and 5' latitude, mapped to a scale of 1:20,000 according to the Gauss map representation and framed within the national geodetic system (the international ellipsoid oriented to Rome M. Mario – ED40) with a grid mileage in the projection consistent with the Universal Transverse Mercator system (European datum ED50). The areas urbanised in the 1950s, formed of those areas covered by main and ancillary buildings (such as car parks, internal roadways for the districts, storage areas, cargo-handling and various other buildings), can be extracted from these maps, which are only available as raster versions. The data from the research carried out on the 1:25,000 maps was then compared with that of the current urbanised areas (updated in 2007, http://www.regione.toscana.it/-/geoscopio), which are available in vector format from regional cartography created using photo-interpretation and the orthophoto mapping traverse methodology at the nominal scale of 1:10,000. In terms of urbanised areas, those destined for urban use with the replacement or maintenance of the natural soil were taken into consideration, including the built-up parts of the land and those destined for additional settlement uses, such as public and private gardens, sports facilities, unsurfaced roads and other waterproofed or non-waterproofed service areas (Romano and Zullo, 2013). Also included in the "urbanised" land were those areas with rural buildings and fixtures designed to support agricultural and zootechnic functions, even if their characteristics cannot strictly be called "urban". The method used for urbanized areas detection differs from that used by the Tuscany Region (2012) based on sampling points at 1: 10.000. This approach estimates the extension of the classes of land use on the basis of sampling points distributed according to a probabilistic scheme (region divided into square of 4 hectares inside of which was randomly select a point of survey according to the scheme of systematic sampling nonaligned). In the research described in the article the historical urban areas have been digitized by skirting the built environment shown in cartography IGM (urbanized perimeters extracts from cus Tuscany Region, Fig. 4). It should be noted that the historical cartography IGM does not report the "urbanised" areas, but only those "built", for which the data obtained has a level of precision tested order of ± 5%. The comparison between the extension of the historical and current urban areas, by statistical analysis, showed that some local determinants have affected more than others on the dynamic urban region. Further investigation later revealed the dynamics of conversion of urban areas susceptible to the effects such as protected areas, the landscape units and the flood risk areas.

Fig. 4 Detail of the representation of the Tuscany region on the IGM 1:25,000 map of the 1950s (in red actual urbanized areas, in brown urbanized area 50s)

4 RESULTS AND DISCUSSION

In the 1950s there was a sensitive modification of the age-old balance between the rural and urban worlds, thanks to the intensification of two phenomena: the growth of the larger urban settlements and the abandonment of rural areas, especially those of the Apennines.

The settled areas surveyed in the 1950s were found to amount to nearly 21,000 hectares, corresponding to a rate of regional urbanization of just under 1%. Analyses of the situation in 2007 shows an urbanisation nearly seven times greater (Fig. 5), with settled areas amounting to more than 135,000 hectares, a net loss of over 115,000 hectares of land and an urbanization rate that today is almost 6%. The average speed of transformation over the period studied is just over 6 hectares per day (equivalent to about 6% of the speed of the 90 hectares per day estimated for the national territory).

If compared with the other 17 Italian regions that have available data and cover about 88% of the national territory, the rate of increase recorded in Tuscany is the highest (550%) compared to that of the neighbouring Emilia-Romagna (510%), Puglia (475%) and Sardinia (510%) (Romano and Zullo, 2014b; Romano et al., 2015; Romano and Zullo, 2015).

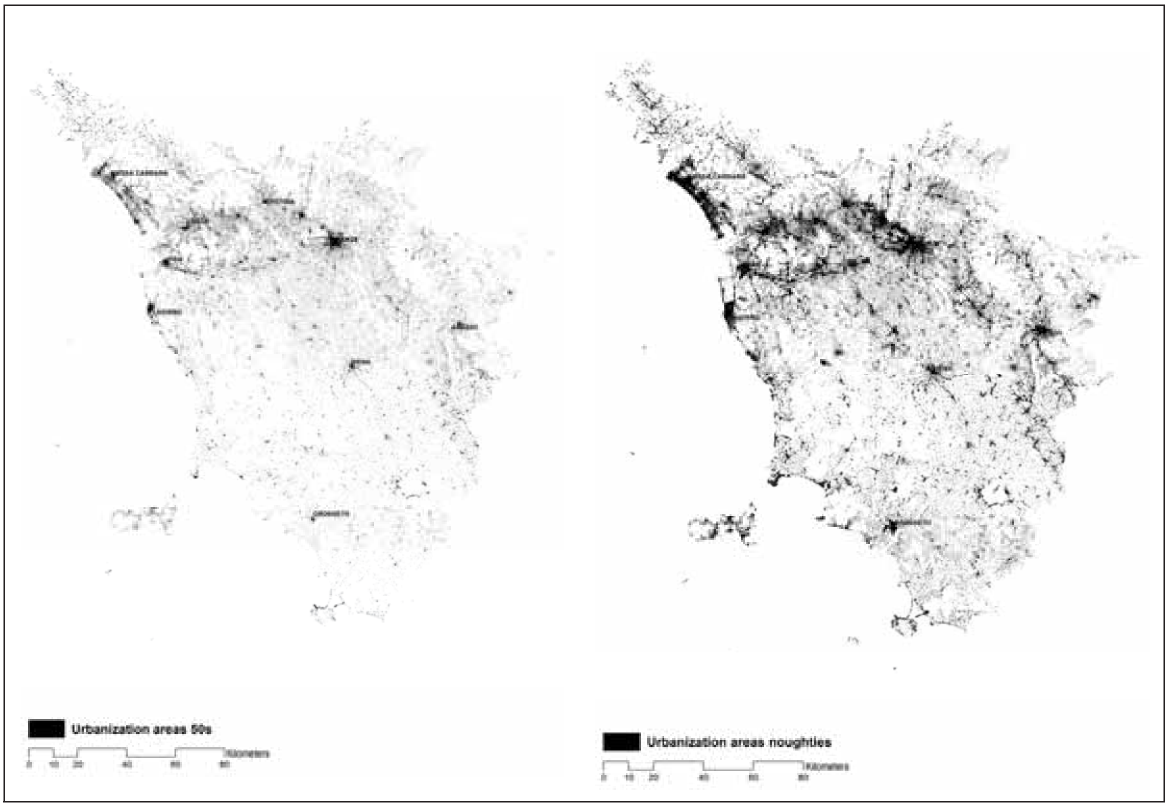

Fig. 5 Maps of the urbanization in the (a) 1950s and (b) noughties

A typical settlement behaviour index is the amount of urban area per-capita (UAPC), which was on average 66 m^2 per inhabitant in the 1950s, but which rose to 370 m^2 per inhabitant in 2007. It is important to observe the correspondence between this value and that of the nation and western European countries, in order to give evidence of a homogeneous alignment on similar models of the relationship between social communities and settlement forms.

The research carried out over most of the Italian regions showed how the UAPC indexes of up to 100 m^2 per inhabitant typified the rural economy realities, while values above 300 were typical of industrial economies and urban lifestyles.

The transition from a predominantly historic widespread rural and polycentric urban landscape to a predominantly widespread urban and post-rural agricultural landscape is also highlighted by the analysis effected by the density of urbanisation which, in the 1950s, was equal to or less than 5% for most of the municipalities. The situation changes dramatically after 2000, where only seven regional municipalities still have an index lower than 1%, 137 up to 5%, more than one-sixth a value between 10-25%, and 11 have urbanised between a quarter and half of their territory (Fig. 6).

While the municipality with the highest rate of urbanization is Forte dei Marmi, which is a Tyrrhenian coast town and whose territory is more than 70% covered by urban areas, figures 5 and 6 very clearly show the leaders in major urban density concentration along the coast and in the interior plains.

From this point of view an analysis of fig. 7 is especially effective, where some peak values of urban density emerge along the Tuscan Coast as part of a phenomenon that concerns all municipalities of this Mediterranean area with the same intensity (Romano and Zullo, 2013, 2014a).

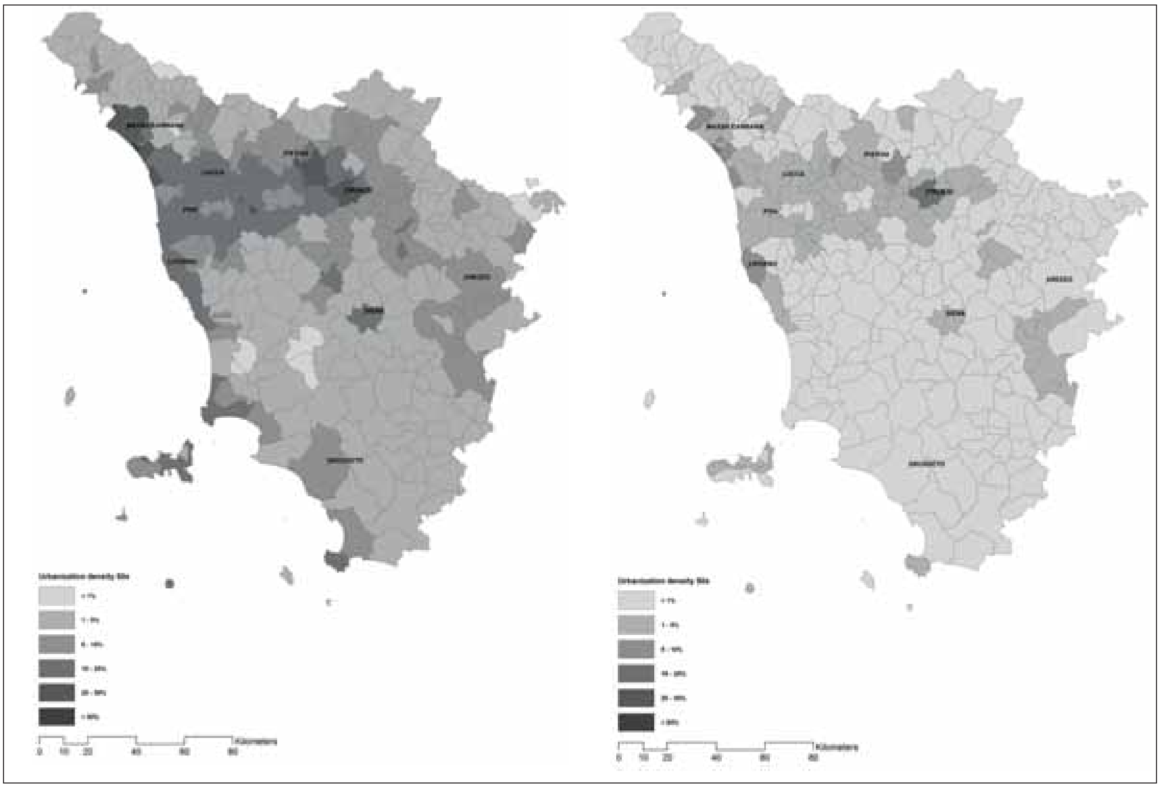

Fig. 6 Map of the percentage of urbanization in municipalities in the (a) 1950s and (b) noughties

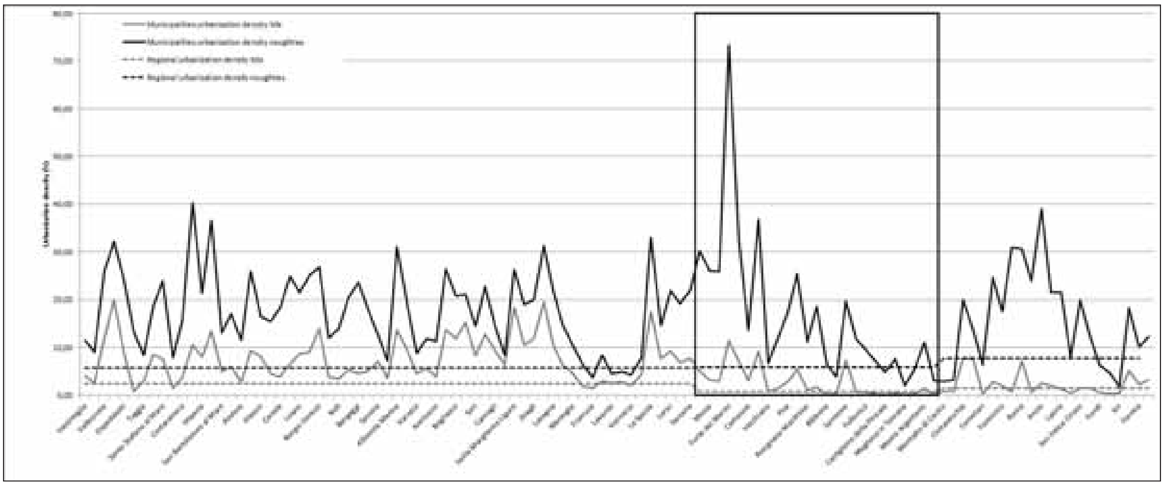

Fig. 7 Diagram of urban density in the Tyrrhenian coast municipalities during the 1950s and noughties, compared to regional averages (the Tuscany coastal municipalities are in the box)

In addition to the dynamics of the urbanised lands, from 2001 it is also possible to check those related to the growth of built-up areas, thanks to the ISTAT surveys, though the 2011 data is not yet available. The institute registers the number of buildings in inhabited areas, where the latter means a "more or less wide area of land, usually known by its own name, on which are located one or more grouped or scattered houses". The buildings are distinguished by their function and are grouped into two categories: the first consists of those for residential purposes while the second covers the buildings and complexes used for production, infrastructure, management, tourist and service purposes. Furthermore, the dates of when the buildings for residential use were built are also noted. For example, according to the data almost 367,000 buildings within the housing category were constructed in the 287 Tuscan municipalities between 1946 and 2000 (on average 18 per day). Considering the demographic increase of about 339,000 people during the same period (1951-2001 ISTAT data), to all intents and purposes just over one residential building was constructed for each new inhabitant. It is also interesting to note that until 1946 there were little more than 300,000 buildings in this area. In other words the residential building heritage has more than doubled compared to the period after the second world war. Fig. 8 fully confirms the phenomena already highlighted by Figures 5, 6 and 7, with the highest growth groups concentrated in the coastal areas and on the plains of Lucca, Pistoia and Florence. The cited data about growth of urbanized and built up spaces identify a relevant group of factors of landscapes changes. Transformation of urban and agricultural landscapes as also lost of rural landscapes are joined with socio-economic changes and produce environmental and cultural changes. Lost of soil, as also of biological and semiological diversity are the main ones.

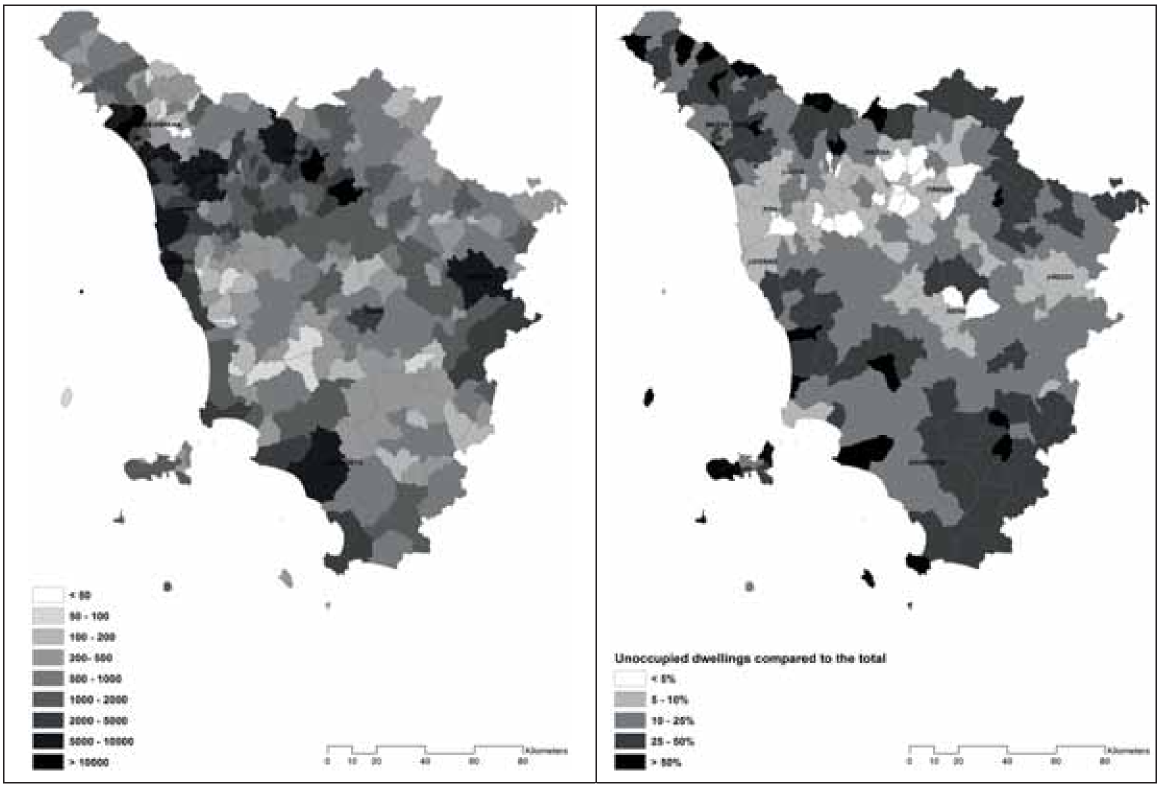

Fig. 8/9 The dynamic growth of residential buildings in the Tuscany municipalities between 1946 and 2000 (on the left); Percentage of unoccupied dwellings in 2000 (on the right)

Figures 8 and 9 show some processing of the ISTAT 2001 census data on residential buildings and housing. In particular, figure 8 confirms the urban nature of the northern sector of the region with the island of Siena and, to a lesser extent, Arezzo. It also provides interesting information about the coastal municipalities (from Massa to Capalbio) where the clearly considerable building development of these strong tourist areas has had significant repercussions on the extremely fragile coastal ecosystems. Figure 9 reinforces what has already been said by clearly showing that there is a large presence of empty homes along the Tuscan coastline that are, in all likelihood, accommodation used for tourist purposes and second homes (remembering also that ISTAT does not include accommodation facilities under the label of homes). A focus on the municipalities of the Tuscan coastline (about 25 out of a total of 287, making up 12% of the entire regional territory) shows the antinomy between population growth and increased urbanization. By analyzing the ISTAT data in detail is obvious how there was an increase of more than 160,000 people in this area between 1951 and 2001, concentrating slightly less than half of the total population increase of the whole region in a territory that covers only 12% of the whole of Tuscany. An increase that was also recorded by the 2011 census, showing over 15,000 more residents than in 2001. The number of buildings for residential use (Fig. 8) has more than tripled in the period between 1946 and 2000 (over 137,000 compared to the almost 43,000 present until 1946) with a net increase of more than 94,000 buildings, which amounts to about 1,750 new buildings each year. By comparing this figure to the regional one seen earlier for the same period, it is clear that a quarter of the residential buildings constructed in the region were built in these areas, significantly increasing the anthropic load on the coastal ecosystems, which are subject to pressures that have often compromised their equilibrium and stability.

It should also be highlighted again that of the more than 420,000 homes present in 2001, more than 94,000 are empty (roughly one house in four), as shown in Figure 9. High percentages of empty homes also are detected in the northern part of the region along the border with Emilia-Romagna and in the central part (Maremma), but this is mainly due to the abandonment and depopulation phenomena encountered frequently in the Apennine areas of the peninsula and in the rural areas that suffer a marked socio-economic marginalization (IRPET, 2012).

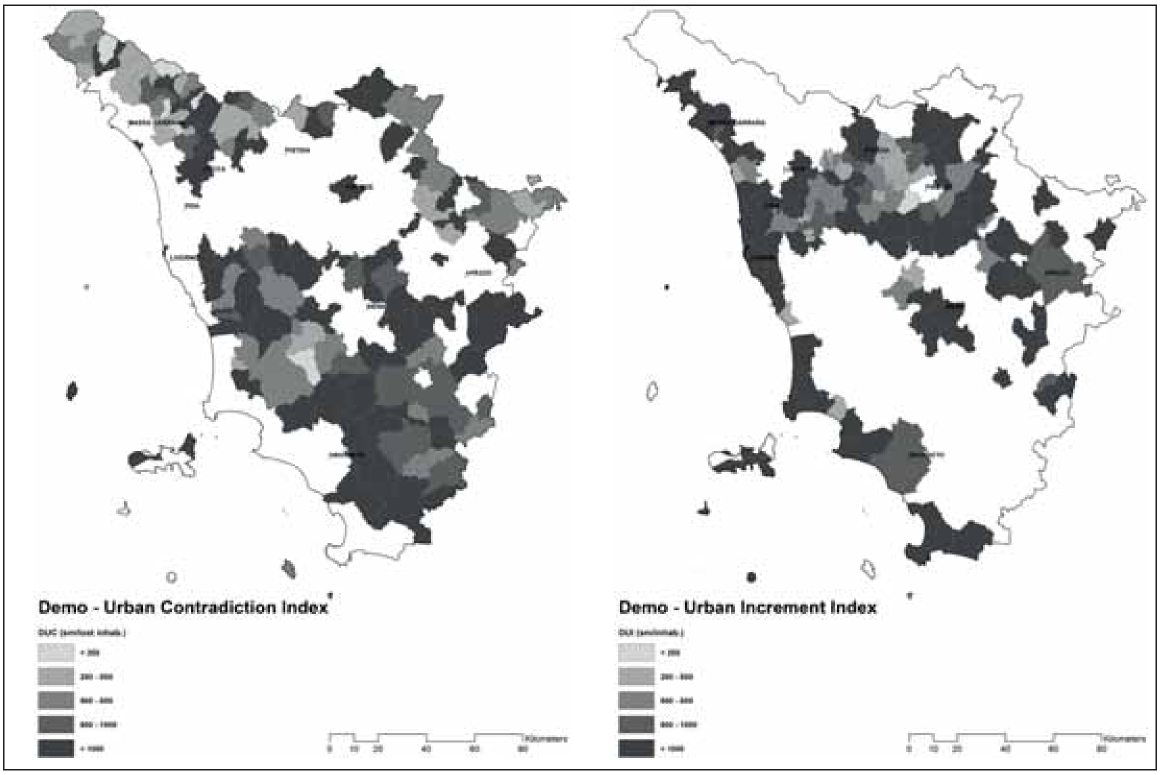

Fig. 10 Map to select the positive values of the urban-demographics increment index (on the left) and a map of the urban-demographic contradiction index (on the right)

The UDC (Urban-Demographic Contradiction Index) and its complementary UDI (Urban-Demographic Increment Index) can both connect and evaluate the population dynamics and urban growth (fig. 10). The UDC index shows the urbanised areas created for each inhabitant that has been lost by the city, while in contrast the UDI index shows the increase in urbanised area per inhabitant acquired by the municipality, irrespective of the territorial range of the municipality itself. This parameters has been obtained as follows:

$$UDI = \frac{\Delta URB(T1-T0)}{\Delta POP(T1-T0)} \qquad UDC = \frac{\Delta URB(T1-T0)}{-\Delta POP(01-51)}$$

Where:

- Δurb(t1-t0)=difference between urbanized areas in municipalities between the t1 (2007) and t0 (1954);
- Δpop(t1-t0)=variation in the population residing in municipalities between the t1 (2011) and t0 (1951);
- -Δpop(01-51)=demographic drop in municipalities between the t1 (2011) and t0 (1951);

All the municipalities in the Apennine range in the northern part of the region, together with those bordering the region of Liguria, most of those located in the Tuscan Maremma area can all be found under the conditions highlighted by the UDC index, with fairly high index values (over 800 m^2 per inhabitant lost). It must be said that high UDC index values can also be attributed to strong depopulation situations with limited variations in urbanized areas, so the information reported by this index must always be compared with the demographic dynamics. The geography of the UDI index (image on the right of figure 10) shows how the municipalities on the coastline (except Florence and Lucca), most of which are provincial capitals, and their hinterlands, as well as most of the territory of the island of Elba, can be found within this index. Over 60% of the municipal territories that emerged from this selection show a high UDI index value (over 1,000 m^2 per inhabitant).

			URBANIZED AREAS (KMQ)		URBANIZATION DENSITY	
ALTITUDE BELTS (M ASL)	AREA (KMQ)	TERRITORIAL PERCENTAGE DISTRIBUTION	50S	NOUGHTIES	50S	NOUGHTIES
<100	5,012.55	21.81	104.55	729.88	2.09	14.56
100-300	7,243.25	31.51	53.50	356.63	0.74	4.92
300-600	6,553.28	28.51	40.01	214.82	0.61	3.28
600-1000	3,214.24	13.98	10.83	54.74	0.34	1.70
1000-1500	871.10	3.79	0.51	5.91	0.06	0.68
1500-1800	87.18	0.38	0.01	0.55	0.01	0.63
>1800	4.96	0.02	0.00	0.01	0.00	0.17
Total	**22,986.56**	**100**	**209.41**	**1,362.53**	**0.91**	**5.93**

Tab. 1 Division of the Tuscan territory into altimetric bands (DEM 20 m). Related settlement values over the time-span of the study

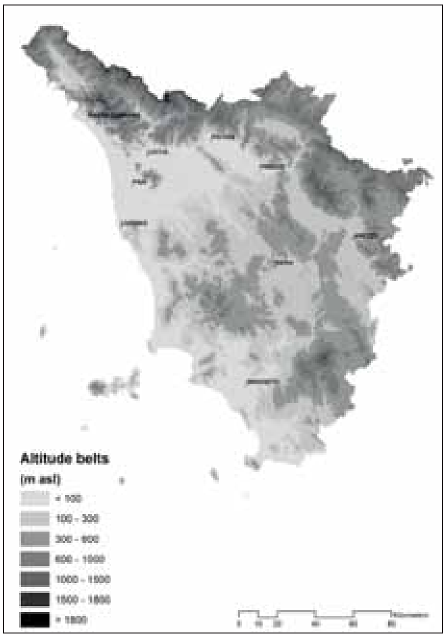

Fig. 11 Articulation of altitude belts in the Tuscany region

The data already shown indicates how morphology and altimetry have assumed a key role in influencing the dynamics of urbanisation growth. Half of the region lies between sea level and 300m above sea level, while a third lies between 300 and 600 m asl. By analysing the level of urban density within these bands in the 1950s, you can see how the portion of land lying at an altitude of less than 100 m is the one with the highest index value (2%) while all the remaining bands show settlements of less than 1%. The situation changes dramatically in 2007, where at altitudes of less than 100 m asl, the settled areas had grown seven times bigger compared to after the second world war, with a settlement conversion rate that is at almost 15% today. The same rate of increase was also recorded for the low hilly altrimetric band of 100-300 m asl, where the urbanization rate was 5%. The high-hilled bands, which hold the vast majority of the agricultural landscapes and, most especially, the valuable vineyards and olive groves (which are of fundamental importance from a social, economic and ecosystem point of view), have instead grown to five times the size of the historic settled area.

4.1 THE PHENOMENON IN THE AREAS OF HIGH ENVIRONMENTAL VULNERABILITY

PROTECTED AREAS AND LANDSCAPE UNITS

The Protected Areas in Tuscany stretch to just under 150,000 hectares, and include the National Park of the Apuan Alps, the National Park of the Casentinesi, Monte Falterona and Campigna forests, and the National Park of the Tuscan archipelago. The habitats protected by the EU directive 92/43/EEC (SCI), on the other hand, extend over nearly 306,000 hectares. However there is much overlap between the two areas, and between them they cover 350,000 hectares. To these must also be added the Special Protection Areas (SPA) introduced by the EU Directive 79/409/EEC, which occupy a total of nearly 132,000 hectares, most of which also fall under the Protected Areas classification. So putting the Protected Areas, SCI and SPA altogether, 15% of the total Tuscan region is protected. Through a comparison with the Physio-graphical Landscape Unit surveyed by the ISPRA (Advanced Institute for Environmental Protection and Research) in 2004, it can be observed how the most protected categories are the "terrigenous mountains," with a surface area of over 118,000 ha, and the "heterogeneous hilly landscapes," which stretch to over 85,000 ha. Far less represented in this analysis are the plains that fall within the protected areas and have a surface area of just over 8,000 ha. The landscape effects of urban proliferation can be better understood by analyzing the urban dynamics that have affected these areas over the past 50 years (Fig. 12).

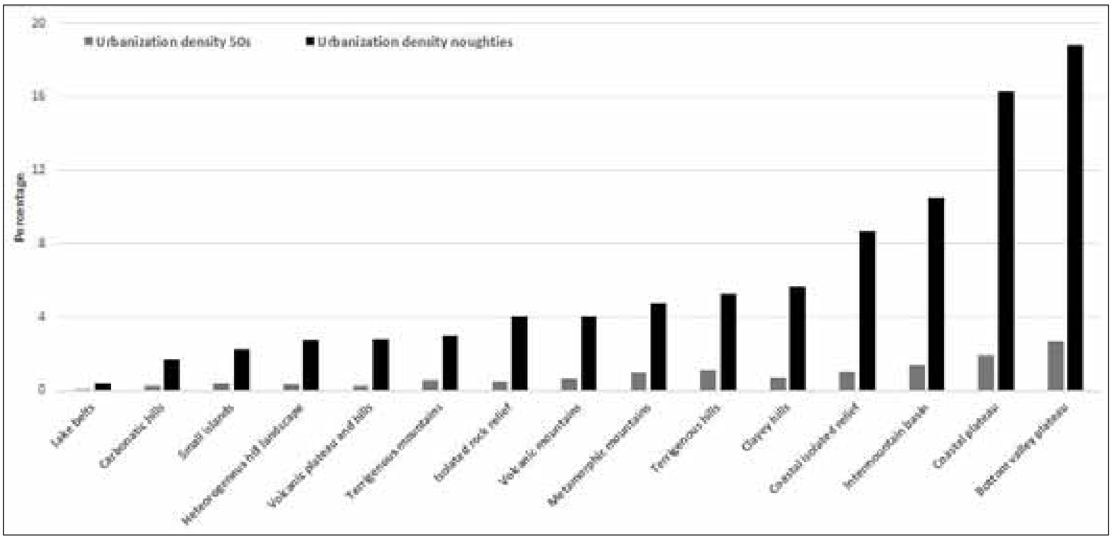

Fig. 12 Differences in the density of urbanization in the Tuscan landscape bands over the period studied

In the years after the second world war, both the coastal plains and the valley floors showed the highest rates of urbanization (about 2%), compared with the hilly categories which showed instead an increase of less than 1%. Analysing the situation in subsequent years shows that while the classification order remained unaltered, the percentages increased considerably: the urbanisation of the flat categories exceeded 15%, with nearly a fifth of the valley floors territory having been urbanised. The rates of urbanization of the hilly landscape band also increased from an average of 0.5% recorded after World War II, to an average of 3.5% – seven times more than the preceding temporal section, thereby testifying to a greater settlement pressure on the hilly morphologies with attendant effects on both local agricultural production and on Tuscan agro-ecosystems, which is important at an international level. By analysing the evolution of the settlement conversion phenomenon of the land within the regional protected areas during the two temporal periods, it seems clear a ten-fold increase in the settled areas, where the just over 500 ha of the 1950s (0.15% of the total of the N2000 Protected Areas) becomes more than 5,000 ha today (1.4%). A study conducted in a 1km sphere (as the crow flies) from the perimeter of these areas showed an equally intense phenomena: the areas covered by the current settlement in this area increased by more than seven times compared to those detected in the 1950s, passing from almost 4,000 ha (1.13% of the buffer area) to over 27,000 ha (8% of the buffer area) today (equivalent to a 16 km^2 area). By comparing these data with those relating to the settled areas surveyed in the two temporal periods across the entire study area, it becomes clear that there was and still is about one-fifth of the settled areas within the perimetry of the N2000 Protected Areas system, with an increase of approximately 23,500 ha – the equivalent to 460 ha of land being consumed every year, or over 12,000 m^2 each day. It's true that in the 50s protected areas were almost non-existent, however, the analysis conducted shows that in these areas the impact of settlement was still limited by the morphological and environmental conditions (high altitude, terrain roughness, climate, hydrogeology).

AREA THAT ARE AT THE RISK AND HAZARDOUS

The settlement changes in the areas identified by the Floods Directive 2007/60/EC adopted into Italian law by the Legislative Decree No. 49 of February 23, 2010 are analysed here. The areas covered by the decree are those that have been assessed as being at risk of flood based the likelihood of a flood occurrence within a fixed time interval (3 levels), which means that the areas at risk of flooding are those with the combination of the probability of the occurrence of a flood event and the potential negative consequences for human health, the land, goods, the environment, the cultural heritage, as well as the economic and social activities stemming from such an event (4 levels). The areas identified by the flood risk maps are a subset of those identified from the mapping of the flood-related hazardous areas, thus the latter will be taken into consideration during the processing of the urban dynamics that have affected these areas over the past 50 years. The areas with a degree of hazardousness stretch to over 223,000 hectares (10% of the regional area), most of which are situated along the coastline, while the remaining parts are located in the surrounding areas of the main river beds and in the northern section bordering Emilia-Romagna, along the regional Apennine stretch (Fig. 13).

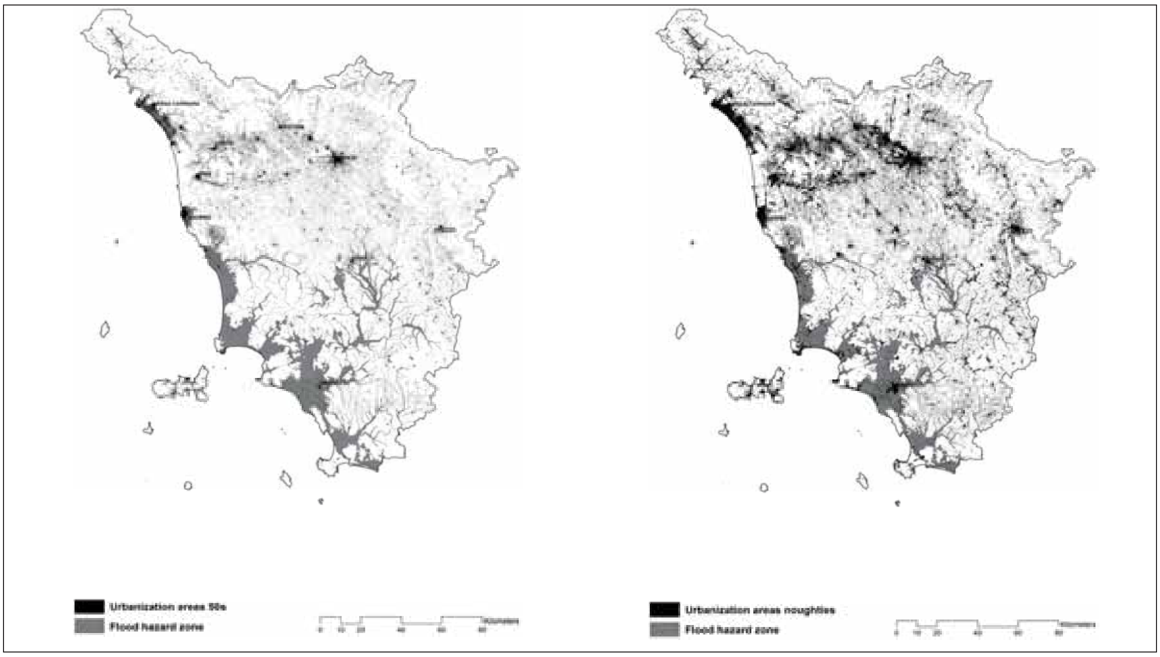

Fig. 13 The geography of the regional urbanized areas within the period studied, with a geographical indication of the flood hazard areas

An analyses of the situation of these areas in the years following the second world war, shows a settlement rate of 1.2%, however, it is interesting to note that 13% of the regional settled areas are concentrated in these territories identified as dangerous in terms of floods. After 2000 the settled areas in these zones covered approximately 24,000 ha (21,000 ha more than what was seen in 1950), which increased the settlement rate to over 10%. Of the more than 115,000 hectares of settled areas created in Tuscany between these two temporal periods, 20% were situated on those areas at risk of flood. These areas affect the territories of approximately 125 out of the total 287 municipalities, currently involving a population that now exceeds 1,200,000 people.

5 CONCLUSIONS

The data that has been presented testifies to the main socio-economic, settlement and infrastructural epochal transitions that have affected Tuscany over the past 50 years. Because of these, landscapes changed. Rural landscapes with widespread settlements often had transitions to industrialized agricultural landscapes and anyway to specialized ones. The polycentric urban settlements lost historical relationships with the rural landscapes matrix. This not only because the rural landscapes has been going to disappear, but first of all because urban settlements change socio-economic and spatial patterns from compact to fragmented and diffuse ones (IRPET, 2014b; Fregolent, 2012).From a quantitative point of view, even though the region registers a notable overall increase in population density (16.8%), it is still 8.7% below the national values of 25.5%. It should be noted that the natural structural diversity of the region - a major factor in its great scenic diversity - such as its biological, ecological, historical-archaeological, socio-economic and scenic aspects, has influenced the geographic distribution of these increments. Population concentrations have occurred in the internal territories at the foothills of the Apennine, with more marked values in the northern areas and with the sole exception of the Florence-Siena axis, and in the central-northern and central-southern coastal regions, where the positive changes almost weld them together. The reasons for these dynamics are many and their nature must be researched within the slow and progressive phenomenon of urbanization of the countryside, which has affected a vast area in the central-southern part of the region. At the same time these reasons may have influenced the different events, such as happened with the city of Florence (Magherini and Mencarini, 2001; Iommi, 2002; Regina et al., 2003), where the demographic decline was strongly influenced by the growth of real estate revenue due to the increasing outsourcing of accommodation and management control that, due to the ability to offer a competitive supply, caused the expulsion of significant numbers of residents. Population growth along almost all of the coastal municipalities is a phenomenon also seen in other Italian regions (Romano and Zullo, 2014), where the settlement pressure related to tourist and beach activities has also strongly influenced the demographic dynamics: at present about one-fifth of the entire population of Tuscany is concentrated in a territory that is only 12% of the whole regional area. It is also interesting to note how the demographic variation recorded for these coastal municipalities is distinctly higher (27%) than the regional one (16%) over the same period.

Even if Tuscany is considered to be one of Italy's regions most attuned to the conservation of its landscape and its historic centres, which supports an economically significant tourist stream, the past dynamics of land transformation do not differ much from those of other geographical areas notoriously less "careful" in this sense. In fact the regional urbanisation rate of 6%, proportional to the region's percentage impact on the national area (6% versus 7.5%) with a contribution to the average daily speed of national urban land conversion, and a rate of increase that is one of the highest in Italy (550%), together with a per capita urbanization equivalent to the national average, are all indicators of a territorial policy which looks with different sensitivities at the historical, artistic and monumental heritage and the environmental matrix.

The analysed data allow us to predict an evolutionary scenario for the regional settlement. As we have seen, over the past 60 years, the population has grown to 513,000 in the context of 1,154 km^2 of urbanised land

(2,250 m^2/inhabitant on average). The ten-year average rate of population growth in the 60 years analysed was 2.5%. Applying the rate of 2.5% for the next 10 years, there will be a further increase in population of about 92,000 inhabitants. The same standard applied to the level of urbanisation (2,250 m^2/inhabitant) would lead to a further 200 km^2 of urbanisation. This equates to a square with sides of 14 km, in addition to that with sides of over 37 km that represents current urbanisation.
The scenario would involve incremental proposed then, with high probability, those particular altitude belts that already showed a high vulnerability to land uptake. It is more than half of the region at altitudes between sea level and 300 m, in which the settlement has grown sevenfold over the past half century (actual urbanization rate is 10%). Such a perspective requires obviously a reflection in the headquarters of territorial governance, especially for a region highly vulnerable landscape in economic point of view.
Demographic data show that in the last ten years, the regional population increased by more than 170,000 units (5.3% more than in 2001, compared to 4.3% nationally calculated in the same period) and, if such a trend were to continue, it is probably that results in additional needs of urbanization and edification, maybe oriented social housing, with important consequences on the spatial changes in land use over time. To predict how these changes will affect the changes of the soil you can use different models and scenario analysis (Bibby e Sheperd, 2000; Nemmour et aliii, 2006; Villa et al., 2007; Mas, 2009; Mazzeo, 2012; Di Giacomo, 2015). Such models can be a useful tool both policies is territorial planning with important implications on future territorial and landscape asset.

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IMAGE SOURCES

Fig.1b http://www.greenreport.it/news/acqua/terza-corsia-sulla11-una-boccata-dossigeno-ma-per-uno-sviluppo-old-style/

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SMART CITY, METROPOLITAN AREAS AND COMPETITIVENESS

THE CASE STUDY OF FLORENCE

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ABSTRACT

The many challenges currently faced by cities around the world require the adoption of innovative strategies and actions. Among the various paradigms, many urban development processes have taken on board the paradigm of the Smart City, which is emerging strongly in the European context. Through the application of new technologies in different areas of the urban system, the paradigm aims to enhance quality of life and wellbeing of local communities and promote the creation of a more efficient, sustainable and competitive urban system. Furthermore, in Italy the major cities are also undergoing territorial and administrative reorganization, following approval of Law 56/2014 establishing the Metropolitan City as the governing authority of metropolitan areas. Research conducted on some of the Italian metropolitan areas has sought to ascertain whether and how the adoption of the Smart City paradigm could contribute to the constitution of metropolitan governance. Through a review of the scientific literature on the Smart City and territorial competitiveness and through the analysis of policies and initiatives implemented in some metropolitan areas, several relationships between the Smart City and territorial competitiveness have emerged. Above all, one of the cities that has invested more on increasing its own territorial competitiveness through the adoption of the Smart City paradigm is Florence. Hence this paper, after describing the relationships emerging from the scientific literature between Smart Cities and territorial competitiveness, examines the policies and measures adopted in Florence for the constitution of the Metropolitan City.

KEYWORDS:
smart city, competitiveness, metropolitan city of Florence, innovation and knowledge, tourism and cultural heritage

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智能城市，都市圈和竞争力

佛罗伦萨个案研究

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摘要

在一些城市中，对一种新型发展过程的定义开始出现，其重点是新科技在城镇体系不同领域中的使用和应用。这种新型发展过程旨在提高生活质量、当地社区的健康以及促进一种更加高效、可持续的城市系统的建立，使其更具竞争力。都市圈的重组问题就结合了这样的过程，响应了最近批准的德里奥法，该法将意大利的大都会作为都市地区的管理机构。智能城市、都市圈和竞争力是本文的三个主题，目标则是以佛罗伦萨为个案研究对象，结合这三个主题就佛罗伦萨大都会采用的最具创新性的政策和活动进行说明。

关键词
智能城市，竞争力，佛罗伦萨大都会，创新与知识，旅游与文化遗产

1 INTRODUCTION

Currently, cities have to face several challenges simultaneously, including rapid urbanisation and the effects of the economic and social crisis. In several urban contexts a new development process is being defined, focusing on the use and application of new technologies in different areas of the urban system. This new development process aims to improve the quality of life and wellbeing of local communities, besides seeking to promote the creation of a more efficient, sustainable and competitive urban system.

In addition to such challenges, the major Italian cities are also undergoing administrative and territorial reorganization under Law 56/2014 (called the Delrio Law) which envisages “Provisions on Metropolitan Cities, on Provinces, on unions and mergers of Municipalities”. In this regard, part of the research project entitled "SEM Project - Smart Energy Master for the energy management of territory", developed at the University of Naples (DICEA), analysed several metropolitan areas in Italy in order to ascertain whether and how the adoption of the "paradigm" of the Smart City could contribute to implementing the process of constituting the Metropolitan City in Italy.

Given the many definitions of the term Smart City, our points of reference for this study were the definition used by Giffinger et al. (2007) and that in the report "Mapping Smart Cities in the EU" (European Parliament, 2014). As regards the former, according to Giffinger et al., in the Smart City six dimensions can be identified. One of these is the Smart Economy, which refers to the activation of development processes that increase the competitiveness of urban systems. Indeed, it emerged from our research findings that some metropolitan areas, such as Florence, have invested in policies and actions aimed at implementing the Smart City in order to increase their competitiveness in key sectors of their economy.

Therefore, after describing the relationships identified in the scientific literature between the Smart City and territorial competitiveness, this paper describes the policies and measures adopted in Florence, regarding the sector of cultural heritage and tourism, for the constitution of the Metropolitan City. It is divided into three parts: the first provides a review of the scientific literature about the Smart City and territorial competitiveness; the second explains the research methods adopted in the study; finally, the third illustrates the case study of the Metropolitan City of Florence.

2 SMART CITY AND TERRITORIAL COMPETITIVENESS. THE COGNITIVE FRAMEWORK

There is a broad consensus in the scientific literature on territorial competitiveness that cities are central to the organization and leadership of economic growth and territorial development. Considering the profound changes in economic, social and technological processes caused by globalization and integration, cities around the world are facing the challenge to balance territorial competitiveness with environmental sustainability (Caragliu et al., 2009; Monfaredzadeh and Berardi, 2014; Paskaleva, 2014). In this context, one of the main paradigms that is becoming firmly established, namely the Smart City, could contribute to define strategies to address such a challenge. Yet the relationship between the Smart City and territorial competitiveness is not obvious, although analysis of their features and objectives shows overlaps and relations between these two topics.

Although the lack of a shared definition of the Smart City has been widely discussed (Angelidou, 2014; Allwinkle and Cruickshank, 2011; Chourabi et al., 2012; Komninos, 2011; Lombardi et al., 2012; Nam and Pardo, 2011; Papa et al., 2013; Wolfram, 2012), also due to the different nature of the subjects that have developed such definitions - academia, public institutions, multinational companies - (De Luca, 2014; Mosannenzadeh and Vettorato, 2014), a review of some definitions clearly shows the linkages with competitiveness, that can be considered one of the objectives of the Smart City (Table 1).

DEFINITION	REFERENCE
The 'smart city' has recently been introduced as a strategic device to encompass modern urban production factors in a common framework and, in particular, to highlight the importance of Information and Communication Technologies (ICTs) in the last 20 years for enhancing the competitive profile of a city.	Caragliu et al., 2009
The Smart Cities concept is connected to notions of global competiveness, sustainability, empowerment and quality of life, enabled by broadband networks and modern ICTs. Its implementation requires the development of migration paths regarding Internet infrastructures, test bed facilities, networked applications, and stakeholder partnerships.	Komninos et al., 2011
A smart city is a synthesis of hard infrastructure (or physical capital) with the availability and quality of knowledge communication and social infrastructure. The latter form of capital is decisive for urban competitiveness (…) Smart Cities are also instruments for improving competitiveness in such a way that community and quality of life are enhanced.	Batty et al., 2012
Smart cities are the result of knowledge-intensive and creative strategies aiming at enhancing the socio-economic, ecological, logistic and competitive performance of cities.	Kourit and Nijkamp, 2012
(The concept of) a 'smart city' represents a positively valued, multi-objective policy strategy of integrated urban and ICT development, promising to tackle problems of economic competitiveness, social equity and environmental performance - somehow. Such a strategy attracts stakeholders for its ability to reduce complexity and provide capacity.	Wolfram, 2012
Smart cities are all urban settlements that make a conscious effort to capitalize on the new Information and Communications Technology (ICT) landscape in a strategic way, seeking to achieve prosperity, effectiveness and competitiveness on multiple socio-economic levels.	Angelidou, 2014

Tab.1 Smart City definitions content references about competitiveness

In this regard, according to Giffinger et al. (2007), the Smart City is an opportunity to increase the competitive potential, above all, of the average size city, defined as "a city well-performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self decisive, independent, and aware citizens", where economy, people, governance, mobility, environment, and living are the six characteristics that can be recognized in the Smart City, based on the traditional theories on urban growth and development, such as economic competitiveness, intellectual capital and social participation in society, transport and ICT, natural resources and quality of life (Albino and Dangelico, 2015). The multiple dimensions within the Smart City are also stated in other studies (e.g., Barrionuevo et al., 2012; Batty et al., 2012; Chourabi et al., 2012; Schumann et al., 2012). In particular, the most common of these concern people's wellbeing and quality of life, as well as the economic development of the city.

The relationship between the Smart City and territorial competitiveness is more evident when analyzing the elements that characterise territorial competitiveness. As for the "paradigm" of Smart City, the scientific literature contains several definitions of territorial competitiveness, a subject borrowed from mainly economic studies. According to some authors, competitiveness is synonymous with productivity (Porter, 1996; Fagerberg, 1996; Boltho, 1996). With such a meaning, it is influenced by factors such as the effectiveness of institutions, sectoral specialisation, the spread and quality of infrastructure, and other factors that can support productivity, including the use of new technologies and investment in intellectual capital. The meaning of territorial competitiveness has evolved from one focusing on the ability of a region to attract investment (Cheshire and Gordon, 1996; D' Arcy and Keogh, 1999; Kresl and Singh, 1999) to another centred on the capacity to maintain high standards of living for inhabitants (Lever and Turok, 1999; Malecki, 2000) in a sustainable way (Begg, 2002; Constantin, 2006; Filo, 2014). Such a shift in the meaning of territorial competitiveness, considering what was stated by Giffinger et al. (2007) and other researchers of the Smart City, shows that regional competitiveness con be considered as one of its properties (Murray et al., 2011; Chourabi et al., 2012).

The study of the Smart City and territorial competitiveness features allows further relationships to be identified. According to a significant part of the literature dedicated to the Smart City, social and intellectual capital is, on the one hand, the basic condition for the implementation of the Smart City paradigm (Hollands, 2008; Paskaleva, 2014) and, on the other, an important endowment that, combined with the use of ICT (Alawadhi et al., 2012; Chourabi et al., 2012), can steer urban development. Indeed, it has been argued (see, amongst others, Caragliu et al., 2009; Touzar, 2011; Kourtit and Nijkamp, 2012) that investing in intellectual and social capital promotes sustainable economic growth, a high quality of life and the competitive performance of cities.

Social and intellectual capital is also a key aspect of territorial competitiveness. The study of the scientific literature also shows that territorial competitiveness is related not only to innovation, but also to the degree of knowledge and learning capability of a territory (Bramanti, 1998; Camagni, 2002; Benneworth, 2007; Murray et al., 2011). These elements are also common features of the Smart City (Abdoullaev, 2013; Sinkiene et al., 2014). For example, according to Hollands (2008) and Komninos (2011), Smart Cities "are territories with a high capacity for learning and innovation, which is built-in to the creativity of their population, their institutions of knowledge creation and their digital infrastructure for communication". Up to this point the relationships arising between Smart Cities and territorial competitiveness support the conclusion that a "smart" city is also competitive when it invests in social and intellectual capital in order to enhance the degree of knowledge and learning capability and promote the development of innovation within the region.

Another common element between the Smart City and territorial competitiveness concerns the form of governance to adopt. According to some authors (including, Caragliu et al., 2009; Nam and Pardo, 2011; Komninos et al., 2011), implementation of the Smart City necessarily requires the development of a particular form of governance. The scientific literature has mainly referred to a form based on the model of the "Triple Helix" of Etzkovitz and Leydesdorff (2000). This model is considered a selective environment for creating knowledge and innovation, which promotes strategies able to exploit intellectual and social capital to induce a "new urban vitality" (Lombardi et al., 2012) and it is characterised by the interaction of three different kinds of actors:

- University: it enhances the value of scientific research products on the market so as to increase the sources of funding for public research;
- Government: it increases the effectiveness of governance through administrative decentralization measures;
- Industry: it incentivises collaboration with universities in order to use the results of scientific research.

The above actors, who are in a perpetual evolution, interact flexibly on different territorial levels, seeking to achieve their own objectives, whilst satisfying those of the other two parties concerned (Fixari et al., 2009).

The authors of this model argue that the network formed by these actors creates necessary conditions to produce knowledge, create economic wealth and control development of urban regions (Leydesdorff and Deakin, 2011). Lombardi et al. (2011) recently proposed a review of this model that includes society as the fourth key actor. The innovation of this model consists in the four "helices" that operate in a complex urban context, where civil commitment with intellectual and social capital stimulates relations among the traditional "helices" - university, government and industry. The interaction between these actors and these forces allows the achievement not only of a "smart" but also competitive development of the city. Indeed, the necessity of governance that involves various subjects and institutions also represents one of the requisites to increase territorial competitiveness (Bramanti, 1998; Camagni, 2002), with the purpose to exploit the intellectual and social capital and promote the development of innovative systems based on knowledge and

learning. According to Fixari et al. (2009) there are two possible approaches to promoting the economic development of an area: the creation of industrial clusters (e.g., centres of competence); the adoption of the triple-helix model. The latter approach, rather than the former, would allow the creation of a structure, led by governments, to promote relations and cooperation between the research world and the business world to encourage innovation through the development of R&D projects. For these reasons, the "triple helix" (or "quadruple helix") model is also an efficient tool to increase the territorial competitiveness of the Smart City.
Hence, from the analysis of definitions and characteristics, it emerges that although the relationship between the Smart City and territorial competitiveness may seem somewhat stretched, the two elements are closely related. In particular, innovation and knowledge processes affecting territories, thanks to the opportunities offered by ICT, are a chance to increase the attractiveness and competitiveness of a region, but only if supported by *multi-actor governance*.

3 RESEARCH METHODS

From the review of the scientific literature, it emerges that the paradigm of the Smart City can be an effective strategy to increase the competitiveness of a territory. For the case study of the Metropolitan City of Florence it was necessary to choose a working definition of the Smart City. Among the several definitions provided by the literature, the one included in the report "Mapping Smart Cities in the EU" (European Parliament, 2014) was chosen as a reference point: "a Smart City is a city seeking to address public issues via ICT-based solutions on the basis of a multi-stakeholder, municipally based partnership". This definition highlights the key role that technology can play in resolving issues at the urban scale. At the metropolitan scale, ICTs should allow area connectivity and decrease the physical and functional gap between the metropolitan city and its hinterland. Furthermore, it highlights that implementation of the Smart City must be committed to a form of multi-actor governance involving the main stakeholders of local innovation processes: enterprises, research centres, governments and society.
The study of the "smartness" of the Metropolitan City of Florence was developed in three phases. The first entailed a survey of the physical, functional and settlement characteristics of the metropolitan area.
In order to draw up a profile of the metropolitan area and measure its potential level of "smartness", in the second phase, a set of indicators structured around the six characteristics (Economy, People, Environment, Living, Mobility and Governance) of the traditional model of the Smart City (Giffinger et al., 2007; Batty et al., 2012; Schuuman et al., 2012) was chosen. To select these indicators the criteria used were the following:

- significance of the indicator in describing metropolitan "smartness";
- use and recurrence of the indicator in the most relevant studies both on the national and the European scale;
- accessibility to official databases;
- availability of data at different territorial scales and temporal phases.

The last phase of the study entailed the screening of Smart City initiatives underway in the metropolitan area. At the beginning, the aim was to identify the initiatives promoted by the main area stakeholders – institutions, research centres and universities, enterprises and associations – through the use of indirect sources, such as instruments for urban and territorial government, web sites of the stakeholders potentially involved in the initiatives, as well as publications.
As regards the definition of the six characteristics of the Smart City (Giffinger et al., 2007), the measures selected in the metropolitan area were those focusing on ICT use and application in several sectors of the urban system (mobility, building, technological networks), but also in public administration and in the services provided to citizens and city users. These initiatives were then classified according to the Smart City characteristics by type and actor (Table 2).

Afterwards, the most significant initiatives of the metropolitan area were chosen among those studied, to carry out "fact checking". The criteria for the choice were:

- level of innovation related to the capacity to contribute to the institution of the Metropolitan City;
- replicability of the initiative in other territorial contexts;
- importance of the initiative in terms of impacts (economic, social and environmental) on the city.

CHARACTERISTIC	TYPOLOGY	IMPLEMENTING SUBJECT
Smart Economy	Research	Local Authorities/Institutions
Smart Environment	Works	Universities/Research Centers
Smart Governance	Projects	Enterprises
Smart Living	Technologies/Products	Associations
Smart Mobility	Plans and Programs	
Smart People	Promotion initiatives	

Tab.2 Classification criteria for Smart City initiatives

Through the collection of "field" data, it was possible to verify the implementation status of the initiatives and their consistency with urban policies adopted in the metropolitan area. A further contribution to the analysis of the initiatives was given by the study of land use policy of the Tuscany Regional Authority, focusing both on the local and metropolitan scale. It was thus possible to contextualise the current initiatives of the metropolitan area within a political strategy to increase territorial competitiveness through the implementation of the Smart City.

4 CASE STUDY: THE METROPOLITAN CITY OF FLORENCE

The Metropolitan City of Florence is located in the central part of Italy. With its population of 973,145 inhabitants, it is the 9th most populous Italian metropolitan area, including 42 municipalities over an area of 3,513.69 km^2. Its administrative centre is the City of Florence which occupies an area of over 103 km^2 and has a population of 358,079 (Fig. 1).

Tourism and cultural heritage play a strategic role in the local economy. Indeed, the Metropolitan City of Florence hosts 187 museums, 97 of which are in Florence. Among all the museums in Florence, the Uffizi Gallery and the Accademia Gallery are, respectively, the 3rd and 4th most visited museums in Italy (IRPET, 2011). Furthermore, Florence's cultural heritage is continuously expanding. Cultural heritage has given the opportunity to promote and sustain the tourism sector. According to the most recent available statistics (2013), accommodation in the Metropolitan City is supplied by 3,019 businesses with a total capacity of over 88,000 beds (Centro Studi Turistici, 2013). Half of such supply is concentrated in the city of Florence (1,095 businesses and 43,000 beds).

Several studies have revealed that cultural heritage has acquired increasing importance in different levels of the economy (Alberti and Giusti, 2012). In particular, there is an increasing awareness that areas might develop their competitiveness by taking advantage of their cultural heritage (Pereira Roders and Von Oers, 2011; Boix at al., 2012). In this context, tourism and cultural heritage play a key role because cultural assets produce tourism and tourism can attract new resources to the culture sector and enhance territorial competitiveness (Alberti and Giusti, 2012).

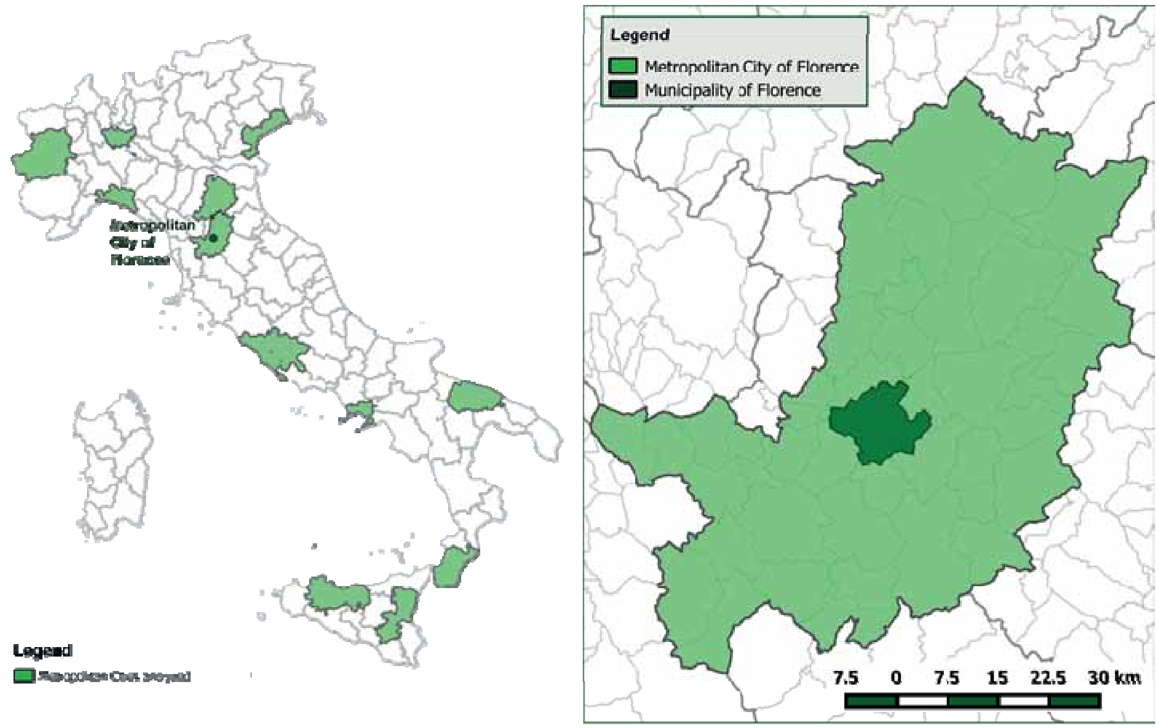

Fig. 1 The Metropolitan City of Florence map

Hence, the Metropolitan City of Florence has promoted processes for fostering knowledge and innovation - key elements for territorial competitiveness and the Smart City - in tourism and cultural heritage that constitute one of the key sectors of its economy. The adoption of "smart" solutions in this sector was also supported by Tuscany Regional Authority policies. One of the strategic directions of the "2011-2015 Regional Development Plan" drawn up by the Tuscany Regional Authority (2011a) concerns "competitiveness in the regional system and human capital". According to this strategic direction, the Plan sets out policies for tourism and culture that are based on innovation, research and development of new technologies. Such policies are also linked to the creation of technological districts and innovation poles (Table 3), which are clusters able to integrate small and medium enterprises and crafts related to tourism.

Clusters are "geographic concentrations of interconnected companies, specialised suppliers and service providers, firms in related industries and associated institutions (e.g., universities, standards agencies and trade associations) in particular fields that compete but also cooperate" (Alberti and Giusti, 2012). They can improve regional competitiveness because, supporting the relationships with institutions and addressing knowledge and information that are necessary for the development, they contribute to innovation processes (Ketels, 2011). In order to promote innovation, knowledge and technology transfer, according to Communication no. 323/2006 of the European Commission, since July 2011 the Tuscany Regional Authority has instituted several innovation poles and technological districts, including the *Tuscan Technological District for Cultural Heritage* and *POLIS (Innovation Pole of Technologies for a Sustainable City)*. The *Tuscan Technological District for Cultural Heritage and the Sustainable City* (*DiT-BeCS*) promotes the constitution and the strengthening of research, innovation and enterprise systems to create successful local products and services in the cultural and landscape heritage sector for international markets. One of the main objectives of the *DiT-BeCS* is involvement of all the actors able to support innovative processes in order to create a virtuous "triple helix" that could promote the economic and territorial development of the region. At present, the district involves several research actors (University of Florence, University of Siena, Normal School of Pisa, CNR) and enterprises (EL-EN, Archeologia, Hyperborea, Pacenti Restauri, Targetti), but also public administrations (Metropolitan City of Florence, Province of Prato, Province of Pistoia, Pistoia Futura, Municipality of Florence) and associations.

	TECHNOLOGY DISTRICT	INNOVATION POLE
Objectives	R&D with territorial impact	Exchange of knowledge, sharing of facilities and technology transfer among who adhere to the pole
Sustainability	Sustainability is guaranteed in the medium/long-term involvement of financial community and institutional investors who enter the governance of the District and replace public finance	Sustainability is guaranteed in the medium term from management of facilities and delivery/acquisition of qualified services to companies that adhere to the pole
Governance	It is representative of companies and research institutions	It is representative of firms and actors who provide services to businesses
Project activities	Few large projects and industrial research	Many acquisition activities of qualified services
Effects	Medium/long term	Medium/short term

Tab.3 Main Differences between technology districts and innovation poles (SOURCE: Tuscany Region, 2011b)

POLIS (Innovation Pole of Technologies for a Sustainable City) represents the technical secretariat of *DiT-BeCS* and was promoted by the Foundation for Research and Innovation (University of Florence with Province of Florence), in cooperation with other actors in the field of research and in the promotion of the technology transfer (I2T3, University of Pisa, University of Siena, Lucense, CNR and APSLO). It is a structured network of SMEs, large enterprises and research centres (about 500 subjects) and it develops actions and projects aimed at urban sustainability. Its main activities concern: cultural heritage and sustainable tourism; sustainable mobility; sustainable buildings. Moreover, it plays a key role in the "SmartCommunitiesTech" cluster promoted by the Ministry of Education, University and Research (MIUR) and coordinated by Torino Wireless Foundation. Specifically, POLIS is involved in one of the cluster's projects, namely the project concerning technologies for cultural heritage.
The City of Florence has implemented some initiatives in areas covered by the Technological District. One of these initiatives is the *Le Murate Urban Innovation Park. Le Murate* is located in the historic centre of Florence and is a former prison recovered to create spaces dedicated to innovative enterprises for cultural heritage and the sustainable city. The basic idea of *"Le Murate"* is to promote a model of incubation with pre-incubation services, incubation and enterprise aggregation, focusing on cultural heritage, artistic crafts and new technologies. Currently, nine ICT enterprises occupy special furnished spaces, which were created in the requalified complex as an *urban lab*. The *Urban Park* also contains the common services of the *Tuscan Technological District*, including: the Metalab University-Enterprise about cultural heritage; spaces to organise cultural events (SUC, Bookstore, Literary Café, etc.); locations for co-working. Furthermore, it operates in synergy with the network of Florentine incubators, which includes the *Technological Incubator of Brozzi* (City of Florence) and the *University Incubator of Sesto Fiorentino*.
Among the *prospective projects* supported by *DiT-BeCS* there is the promotion of the *Social Museum*. The *Social Museum* is integrated with the topic of the Smart City, especially in: the implementation and spread of ICT-based urban and territorial services; the effects on the quality of life generated by cultural opportunities, tourist attractiveness and security, mobility management, local accessibility; the relation between administration and citizens for the provision of services. Many of the Smart City initiatives regarding the sector of cultural heritage and tourism, promoted by local governments, can be framed within the *prospective project* and be interrelated.

Fig. 2 Piazza delle Murate, core of the Urban Park of Innovation "Le Murate"

One such project was the framework *MyFirenze*, promoted by the City of Florence and activated since 2014 in the Multimedia Centre for City Visitors to Santa Maria Novella train station. It is realized in collaboration with the Media Integration and Communication Centre (University of Florence) and its aim is to enable tourists to plan their trips and optimise their time to visit the city. At first, the tourist finds the information at the tourism information centre and he/she defines the trip itinerary using natural interaction systems (tabletop and wall); then the personal plan is visualized on his smart phone, enabling access to advanced services and for updating the itinerary.

Another initiative is *firenzeturismo.it*, promoted, instead, by the Metropolitan City (former Province) of Florence. Completed during 2013, this initiative consists in a back office to update the database of the cultural events organised in the local area and in an *app* that can be downloaded by all users in order to be updated on all the tourist attractions and the cultural events in the metropolitan area. The official tourist website of the Metropolitan City and the City of Florence was reorganised within the project. The key aspect of this initiative is the integration between the infomobility services (*imobi.fi.it*) and the synergies with the local wi-fi network. The database is connected with the framework of the Multimedia Centre for City Visitors as well.

The main aim of such initiatives is to provide innovative services to the tourists, whose profile is changing both rapidly and profoundly. Hence, it is necessary not only to implement measures to improve the city's image, but also to enhance the user's direct and perceived experience. Therefore, according to tourist demand, local authorities are especially aiming to integrate tourism development with measures for enhancement of cultural resources with the support of new ICTs which allow not only an improvement in quality of service, but also strengthen local identity.

Fig. 3 Wall and tabletop of framework MyFirenze at the Multimedia Center for City Visitors of Santa Maria Novella train station

5 CONCLUSION AND FUTURE WORK

From the *review* of the scientific literature, it emerged that although the relationship between the Smart City and territorial competitiveness may seem tenuous, the two topics are closely related. In the case study of Florence it was shown that knowledge and innovation not only increase competitiveness, but also allow the implementation of the Smart City. Through analysis of the initiatives, classified as "Smart Economy" and "Smart Living", concerning tourism and cultural heritage there emerged the presence of a well-structured network consisting of multiple stakeholders. As described in the sections above, their mutual interaction, inspired by the "triple helix" model, allows the development of innovation processes throughout the area concerned in one of the main economic sectors of the metropolitan territory. These processes are supported by the creation of shared platforms, both territorial (the Technological District and POLIS) and urban (the Urban Park of Innovation "Le Murate"). Thanks to such platforms, innovative and technological solutions can be designed and implemented to foster and promote cultural heritage so as to transform all cultural resources within the metropolitan area into a competitive advantage, thereby increasing the tourist attractiveness, improving quality of life and also promoting forms of sustainable economic development.

Therefore, if, on the one hand, the use of ICTs, connected with the potential of human and social capital, and *multi-actor governance* are key elements for the implementation of the Smart City, on the other, such elements contribute to increase local competitiveness. However, from the study of the Florentine initiatives it emerged that, despite the policies promoted at the regional level, there is a lack of planning for the promotion of culture and tourism at the metropolitan scale.

The scientific literature highlighted the relationship between territorial competitiveness and several strategic sectors (mobility, human capital, economy, production, research and training, environment) (Papa et al., 2014a; Papa et al., 2014b). At present, research concerns one of the aspects of *urban smartness*. According to the report "SMART CITIES STUDY: International study on the situation of ICT, innovation and knowledge in cities" (CDK-UCLG, 2012), in order to increase their territorial competitiveness cities should develop all the Smart City characteristics. Hence, in the future it would be preferable to evaluate the levels of territorial competitiveness in relation to the characteristics of the Smart City. This study could require the use of indicators to measure "smart competitiveness" of cities and in addition an analysis of the initiatives. Such an analysis could be structured on the basis of the three key aspects shared by the Smart City and territorial competitiveness: knowledge, innovation and governance. Thanks to these integrations, the development of this study could allow identification of the relations between the paradigm of the Smart City and territorial competitiveness.

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IMAGE SOURCES

Cover image: http://www.pescini.com/cms/wp-content/uploads/2015/06/firenze_duomo.jpg
Fig. 1, 2: elaborated by the authors
Fig. 3: D'Amico, Del Bimbo and Ercoli, 2014

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Shots of one of SEM Project dissemination activities for citizens about cities, smartness and energy efficiency topics, carried out in Naples.

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SUSTAINABLE URBAN MOBILITY TOWARDS SMART MOBILITY

THE CASE STUDY OF BARI AREA, ITALY

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ABSTRACT

In the last decades, sustainable mobility policies have seen a growing interest. Furthermore, in the international debate, this concept has increasingly been linked to the most innovative one of smart mobility, which is part of the more general paradigm of Smart City. This paper discusses primary findings of a Research Project conducted at University of Naples, DICEA, funded by EU (PON REC 04A2_00120 Asse II), “Smart Energy Master – Toward Energy-based approaches for Regional Planning”.
The primary goal of the work is to make a review of policies, programs, projects for sustainable urban mobility and of smart mobility solutions in Bari area. The second goal is to make an assessment on trends of urban mobility in order to evaluate its sustainability and smartness. A comforting picture, focused on matching the local strategies to European programs, is shown. Finally, a consideration on how the framework “smart” may improve urban mobility planning is proposed.

KEYWORDS:
sustainable urban mobility, smart mobility, Bari

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从可持续城市交通迈向智能交通

意大利巴里地区个案研究

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摘要

在过去的几十年中，可持续交通政策引发了日益密切的关注。此外，在国际辩论中，这个概念已经被越来越多地与最具创新性的智能交通相联系，这是智能城市更为普遍的模式的一部分。这项工作的首要目标是考察可持续城市交通的政策、计划和项目以及巴里地区的智能交通解决方案。第二个目标是对城市交通的趋势进行评估以评价其可持续性和智能性。如图所示集中体现了当地战略与欧洲计划的契合。最后一个目标就是，针对如何让“智能”框架改善城市交通规划进行提议。

关键词
可持续城市交通，智能交通，巴里

1 INTRODUCTION

This paper discusses primary findings of a Research Project conducted at University of Naples, DICEA, funded by EU (PON REC 04A2_00120 Asse II), "Smart Energy Master – Toward Energy-based approaches for Regional Planning".

The primary goal of the work is to make a review of policies, programs, projects for sustainable mobility and of smart mobility solutions which may be currently distinguished in Bari area. In Bari, which is the second metropolitan city in Southern Italy, a wide range of initiatives and solutions of urban transformation in which sustainability is the key element has recently been proposed.

The second goal is to make an assessment on the trends of descriptive parameters of urban mobility in order to evaluate its sustainability and smartness. Diffuse pollution, climate change and energy resources' crisis require cities of the future to increase their energy efficiency as a whole, improving performance and reducing consumption, primarily energy. Undoubtedly, the choices and behaviors in the field of mobility, transport modes and their characteristics, as well as, more generally, the way in which travel decision are made have a high impact on carbon footprint of cities.

In the case study of Bari, traffic measures and investigations driven for the strategic plan MTB show a strong imbalance towards private car. Considering 100 people moving, more than 70 use private car; public transport system, as a whole, captures only 30% of commuting. However since 2004, a coordinated and increasingly shared government program on urban mobility, put in place a wide range of actions aiming at reducing the use of private vehicles. These actions brought benefit to the circulation and livability of the city and a not negligible reversal trend was registered.

In the following section the main European policies on sustainable mobility, which affect both national and local development, are described; in the third section, structural characteristics of mobility in the metropolitan area of Bari are defined; in the fourth section, policies, programs, actions for sustainable mobility and solutions for smart mobility are outlined and effects and effectiveness are measured, where possible for this work, through the assessment of actual trends; in the fifth and final section we summarize the results of this first step of research.

2 SUSTAINABLE MOBILITY IN EUROPE AND ITALY: A BRIEF REVIEW

Sustainable mobility policies and transport planning at urban scale have seen an increasing interest by European Commission. The first policy proposals in the area of urban mobility, the "Citizens' Network", date back to 1995 and 1998. They resulted in the launch of a series of initiatives based upon a "best practice" approach. In 2001 Transport White Paper (EC, 2001) "European transport policy for 2010: time to decide" suggested 60 specific measures to be taken at EU level in the transport sector. In 2005, in order to reduce the energetic and environmental impact of transport, the European Commission adopted the Green Paper (EC, 2007) "Towards a new culture for urban mobility" whose key issues are: free-flowing and greener towns and cities, smarter mobility and urban transport which is accessible, safe and secure for all European citizens. In 2009 the European Commission adopted the Action Plan on urban mobility (EC, 2009). In 2011, Transport White Paper "Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system", had a vision for the future of European transport until 2050. It recommended profound changes in the strategic planning and proposed a series of objectives and concrete measures that focused on transport integration (EC, 2011). In these last two documents is explicitly invoked the Sustainable Urban Mobility Plan (SUMP) as a new planning instrument for solving energy and environmental problems and inefficiencies of transportation in cities with an integrated and sustainable approach (Socco, 2010).

The differences between SUMP and the traditional mobility plans are in the three principles that inspired the whole process of drawing up and implementation of the plan: integration, participation and evaluation in terms of increasing the efficiency, attractiveness and the overall quality of the urban transport system (http://www.bump-mobility.eu/). The different approach ensures that the focus moves from traffic to people, from mainly infrastructural measures to a combination of demand management actions and policies, from large investments projects to the introduction of the concept of limit in economic, energetic and land resources (EC, 2013). The benefits of the SUMP implementation are: better quality of life, SUMP means planning for people rather than cars and traffic; furthermore, health benefits due to the reduction of air polluting and noise and the promotion of active modes of transportation (walking and cycling); finally, economic benefits: a healthier environment and reduced congestion helps to substantially reduce costs to the local community and attract new businesses (Korver et al., 2012).

Moreover, a European Commission study on mobility plans, which were implemented in Europe, places Italy among the countries with a well-established transport planning with its regulatory support and availability of guidelines (Orchi, Valentini 2014). In Italy the Law 340/2000 (art. 22) (Legge 24 novembre 2000, n. 340) introduced the PUM (Plan for Urban Mobility) as a long term (10 years), systemic and integrated planning instrument for managing mobility in urban areas. This law did not become immediately operational for lack of both necessary funds and the inadequate definition of the approval procedures for plans. This law and the national guidelines, issued in 2005, promote sustainable approaches aimed at reducing levels of congestion, pollutant and noise emissions and energy consumption. In addition, they promote other more general issues like safety, accessibility and the use of sustainable modes of transport, focusing on land use-transport integration. Such scientific and regulatory efforts in the field of urban mobility appear to assume an increasing emphasis. They underline the need to limit the environmental impacts of transport systems and to encourage sustainable mobility policies.

3 THE CASE STUDY OF BARI AREA: RELEVANT FEATURES OF TRANSPORTS' SUPPLY AND DEMAND

The metropolitan city of Bari covers an area of more than 3,800 km² and includes 41 municipalities in which approximately 1,260,000 inhabitants live. It is a polycentric system wherein Bari represents the main but not dominant center because of the presence of three towns with a population exceeding 50,000 inhabitants (Altamura, Molfetta and Bitonto) and a dense network of surrounding medium-sized towns. The road network of the metropolitan city consists of two main routes: the first one is parallel to the coast whilst the second one goes inward the metropolitan area. With regard to the rail transport, Bari area is provided of sufficiently widespread infrastructures network but installations and rolling stocks are often obsolete. The railway network consists of a radial monocentric structure converging in the node of Bari Centrale, from which all the railway lines depart and arrive.

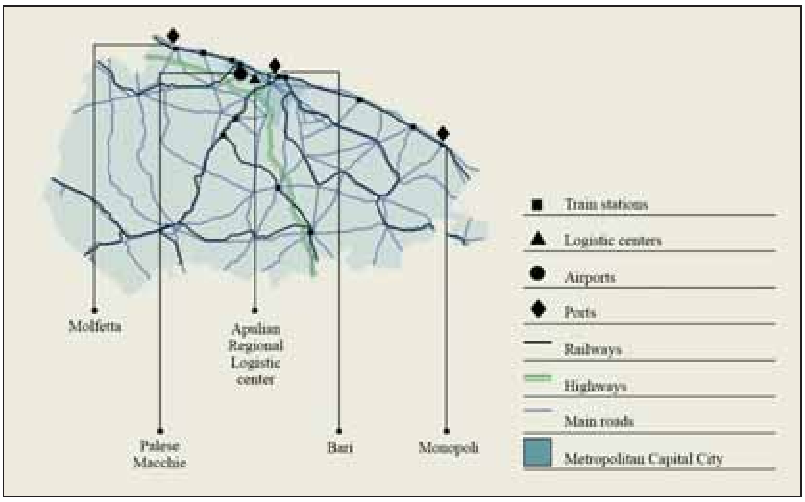

Fig. 1 Mobility infrastructures in Bari area. Source: Cittalia report on metropolitan cities, 2013

Considering public transport supply, four different rail operators act in the given area. Bari is the metropolitan city with the smallest amount (4%) of railway stations compared with the total number of stations in the 10 Italian metropolitan cities[1].

Road transport supply consists of about 60 buses that every day connect Bari with the other municipalities located in the metropolitan area with a total of around 6 million-km per year of road transport services. With reference to public transport, Bari has 38 public transport lines. Three of them (shuttles A, B and C) provide a "Park & Ride" service, connecting interchange parking areas, located next to the access routes with the highest levels of vehicular traffic, and the center of the city. In the following part, relevant data, that mainly characterize the qualitative and quantitative structure of the mobility, are shown. They also help to understand mobility problems. Apulian public transport system serves over 300,000 users a day, providing over 10,000 bus trips and 600 trains. This supply requires a public co-financing amount of about one million euros. It is delivered to the operators of the Local Public Transport who directly employ more than 6,000 people (approximately 1.2 % of the total of the region's workers).

The overwhelming majority of systematic daily travels, with origin and destination in the metropolitan city of Bari, use private car. In fact, daily travels by private car directed to or coming from the center of Bari are 675,000 out of a regional total of about 1,720,000. At same time, with respect to road transport, daily travels inside the city of Bari are more than 125,000. The average rate of car utilization, according to ISTAT 2001 data, scores nearly 1.4 passengers per vehicle. According to some surveys on vehicular flows, carried out by Tecnopolis in 2007 under the Implementation Plan 2009-2013 of the Regional Transport Plan, the total quantity of travels, both on entry and exit from the metropolitan area, is approximately 73,000 meanwhile those related only to the municipality of Bari their rate is respectively 134,000, for entering flows, and 140,000 for exiting flows.

4 POLICIES, PLANS, PROGRAMS, ACTIONS OF SUSTAINABLE MOBILITY AND SMART MOBILITY SOLUTIONS. EVALUATION OF ONGOING TRENDS

In the following section different geographic scales (regional, metropolitan and municipal) will be analysed as it is specifically stated in the title of each paragraph.

In 4.1 paragraph, regional strategies will be illustrated together with capital and current expenditure of Apulian municipalities. In 4.2 paragraph, plans and programs for the metropolitan area of Bari will be described and their effects on Supply of public transport by bus, Index of road accidents and Level of motorization and level of motorization Euro 4 or higher, will be analysed. In 4.3 paragraph, the measures implemented by the City of Bari, at a municipal scale, will be summarized and a first evaluation of their effects will be conducted through a set of performance indicators. In 4.4 paragraph, smart mobility solutions, underway and/or planned in Bari area, at a municipal scale, will be described and then their potential or effective success will be identified.

We are aware that trends in urban mobility are a consequence not only of implemented measures but also of a general change in urban mobility patterns in Italian cities. In this sense, a comparison with trends in other cities, through Istat indicators, will represent the second step of this research.

4.1 REGIONAL STRATEGIES

Regional policies in the field of sustainable mobility are contained primarily within the Regional Transport Plan (PRT) and in the Regional Plan for Space and Landscape (PPTR). Among the most important measures

[1] The list of stations derives from RFI source and relates to the year 2009. The stations here considered are the most important based upon the freights and passengers traffic as well as the services supplied.

identified in the transport network by the Implementation Plan of the PRT for the years 2009-2013, those that concern forms of "clean" mobility are:

- the construction of parking lots and facilities for modal shift;
- the introduction of a co-modal integration model;
- the implementation of measures to improve speed performance of railway lines;
- the promotion of integration between traditional and LRT systems;
- the creation of an integrated and safe network for cycle;
- the promotion of bike sharing and car sharing;
- the implementation of information systems;
- the promotion of alternative mobility services, such as carpooling, through the training of mobility manager.

The Implementation Plan of the PRT for the years 2015-2019 adds directions for the development of intelligent mobility infrastructure through:

- the deployment of ITS (Intelligent Transport Systems) to support the processes of integration between operators, services and users;
- the spread of grids for charging electric vehicles.

With regard to The Regional Plan for Space and Landscape (PPTR), approved in February 2015, it encourages soft mobility and the redevelopment of the railway system, through a "horizontal co-planning" process. A first measurement of the target implementation of regional policies can be made by analyzing the variable of total expenditure of all Apulian municipalities in the field of roads and transport.

In the first phase, current expenditure has been separated from capital expenditure, in order to identify how much money is allocated to roads and traffic sector and how much is destined to public transport; in the second phase, they are compared with the evolution of the demand for public and private transport.

Data regarding the expenditure values have been taken from a study carried out by the Foundation Caracciolo - ACI 2013 whilst data on transport demand come from an elaboration of the Ministry of Infrastructure and Transport on different sources' data.

Analyzing expenditure in the field of roads and transport[2], which includes both road traffic and local public transport, the amount of resources allocated to public transportation can be detected. Moreover not only the attention that municipalities have in regards of the topic but also the margins of intervention for the implementation of government policies of sustainable urban mobility can be consequently detected.

ITEM OF EXPENDITURE	2008	2011	VAR. % 2008-2011
Tot. Traffic and transport	160.259.060	331.959.170	107.14%
Road traffic	63.002.166	238.584.263	278.69%
Public transport	97.256.894	93.374.907	-3.99%

Tab. 1 Current expenditure of Apulian municipalities

Table 1 shows that current expenditure, which is aimed at fulfilling the momentary needs relating to mobility, is more than doubled in the period 2008-2011 but with an unequal distribution in the two sectors of road traffic (+ 279%) and public transport (- 4%). This trend could be a consequence of the relevant operations of maintenance and construction made for the road network or for the establishment of interchange parking and cycle paths. This happened in the city of Bari.

[2] For the analysis the item "functions in the field of roads and transport" of individual municipal budgets have been considered.

It is clear that the relationship between the two areas of spending is highly unbalanced. This relation markedly penalizes the offer of public transport whose effect could be the widespread dependence on private cars. Therefore this trend is confirmed, first of all, by the slight decrease of the public transport demand, which lowered about 1.5% between 2008 and 2010, and, secondly, by the increase of private transport demand by approximately 6% (Table 2).

TRANSPORT DEMAND	2008	2009	2010	VAR. % 2008-2010
Pass-km public transport	1.498.319.537	1.565.710.159	1.479.291.574	-1.27%
Pass-km motorized transport – private vehicles	45.745.587.029	49.852.414.803	48.511.618.008	6.05%

Tab. 2 Transport demand

Moving to capital expenditure, which is important for the development of a safer and more efficient mobility and to implement sustainable mobility policies, a dramatic decline of Apulian municipalities' investments can be seen in Table 3.

ITEM OF EXPENDITURE	2008	2011	VAR. % 2008-2011
Tot. Traffic and transport	206.395.756	149.715.646	-27.46%
Road traffic	204.261.127	149.431.194	-26.84%
Public transport	2.134.629	284.452	-86.67%

Tab. 3 Capital expenditure of Apulian municipalities

It is noticeable that public transport is still the most penalized field with a reduction of approximately 87% (Table 3). This cut on investments could be particularly dangerous and it could hinder the transition process to forms of "clean" mobility in Bari area and, more generally, in Apulia region.
To sum up, it can be said that actions in the field of road traffic, contained in the Implementation Plan of the PRT 2009-2013, have been prioritized in comparison to measures for the enhancement of local public transport. Similarly, the strong programmatic push toward creating intelligent infrastructure for mobility, contained in the Implementation Plan 2015-2019 of the PRT, does not seem to be supported by funds operated by municipalities.

4.2 PLANS AND PROGRAMS FOR THE METROPOLITAN AREA

At metropolitan scale, there are two governance instruments that suggest the main lines of action and intervention for mobility in the metropolitan area of Bari: the Urban Plan for Mobility of the metropolitan area (PUM) and the Sustainable Mobility Programme (PMS).
The specific goals of PUM, approved in 2009, are: the reduction of air polluting, the increase of the safety level of transport, the decrease of energy consumption, the improvement of the accessibility and, finally, the promotion of alternative modes of transport to private car. Furthermore, the main projects for the core of the metropolitan city include new rail transport infrastructures and a modal interchange terminal located next to the Central Station. It will allow modal change to trains, urban and extraurban buses (Papa, Nulli 2010). For those areas which stand outside the core, PUM includes, on one hand, the implementation of the rail transport network, which will enhance accessibility, interconnectivity and multimodality and, on the other hand, the managing measures to integrate schedules, fees and services of supply.

Also PMS, approved in 2009, focuses on rail network, parking and modal interchange, cycle and walk mobility, and, finally, road safety and tariff integration. Yet importantly, PMS indicate goals, related actions, indicators and quantitative targets to achieve in 2015 (Table 4).

GOAL	ACTION	INDICATOR	UNIT OF MEASUREMENT	TARGET
Increase public transport use	MTB Mobility Consortium	Increase of ticket sales	number	30%
	Multimodal station	Decrease of station access time	min.	30%
	Capruzzi Terminal bus	Increase of quality extraurban bus transport	respondent synthetic judgment	50%
	Tram-rail	Increase of rail-served residents in the center of Bari	resident	40%
	Coastal tram	Reduction of passenger cars in coast highways	passenger car	-20%
Ensure sweet mobility	Cycling Network (bike-sharing included)	Increase bicycle paths	km/resident	40%
Reduce car emissions	Car-sharing	Increase of car sharing vehicles	users/veh.	20%
	Transition to hydrogen and electric vehicles	Reduction of high pollution vehicles	vehicles	-20%
Increase quality and traffic safety	Suburban road network	Reduction of travel time	min.	-20%
	Infomobility	Quality of mobility information	respondent synthetic judgment	50%

Tab. 4. Goals, measures, indicators and targets to 2015 – PMS BA2015

Remarkable was the effort made by the municipalities' administrations of the metropolitan area to enhance public transport, in full accordance with the provisions of PUM and PMS. In fact, in Figure 2 it can be seen that supply of public transport by bus, in 2007-2013 time reference, increased of almost 20%.

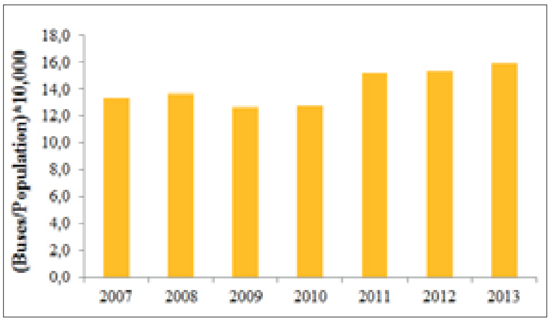

Fig. 2 Supply of public transport by bus

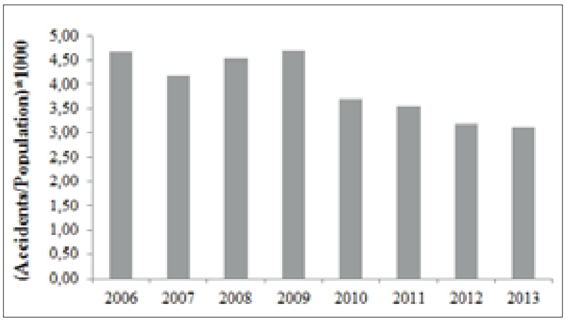

Fig. 3 Index of road accidents

Then we will analyze the trends of some sustainable mobility indicators over the years to evaluate the effectiveness of interventions suggested by plans and programs for the metropolitan area. According to a survey (Testa, 2013), between 2002 and 2013, the rate of motorization decreased by 15%, and in 2011 it is the lowest, after Genoa and Venice, among the 10 Italian metropolitan cities. Moreover Bari is the metropolitan city with the lowest percentage (36%) of ecological cars, followed by Naples (29%) and Reggio Calabria (32%). However, the growing trend of green cars (Figure 4) is probably due more to the replacement of old cars with new ones (Euro 4 or higher) than to the few traffic limitation actions in restricted traffic zones.

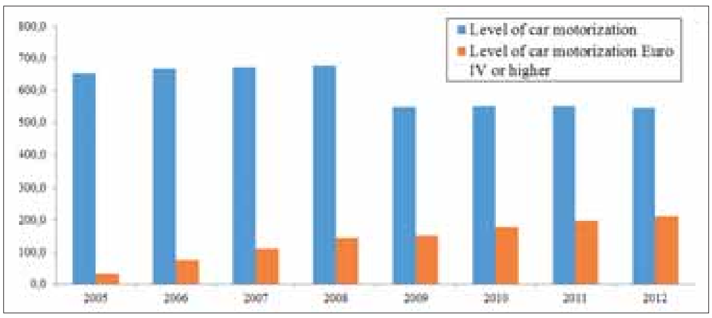

Fig. 4 Comparison between level of motorization and level of motorization Euro 4 or higher

Therefore, car use reduction can have affected on the decrease of road accidents' index; indeed, in the metropolitan area, between 2006 and 2013, accidents have decreased by nearly a third (Figure 3). Therefore, even if the trend towards sustainable mobility is positive there will be satisfactory results only when the planned measures will be implemented.

4.3 SUSTAINABLE MOBILITY MEASURES IN THE CITY OF BARI

Sustainable mobility measures implemented by the City of Bari since 2004 represent a good integration model for public transport and parking policies. This system has gradually reduced car flows within the city by promoting modal interchange (Gargiulo, 2014).

The main measures have been:

- the construction of 4 peripheral "park and ride" lots linked to the city centre by three bus lines served by electric shuttles;
- the implementation of an overall parking system through the development of an integration model which combines public transport and parking policies and the introduction of a parking pricing zones (ZSR);
- the introduction, in 2007, of restricted traffic zones (ZTL) in the city centre;
- the implementation since 2007 of bike sharing service. Today it counts 31 stations installed next to the main attractors.

Furthermore, in 2006 the Municipality of Bari adopted the Environmental Energy Plan; in 2010, the Municipality joined the Covenant of Mayors that entails the implementation of the Plan of Action for Sustainable Energy (PAES). This Plan sets targets to achieve in 2020 in terms of reduction of CO_2 emissions by 30% (328,698 tons CO_2), compared to 2002. The measures planned by the SEAP in the field of urban mobility were in particular:

- the increase of bike-sharing stations (1300 bikes in 2020);
- the expansion of the cycle paths network (90 km in 2020);
- the construction of new "park and ride" lots;
- the implementation of electric car sharing;
- the promotion of walk modes;
- the introduction of Zone 30, in which the vehicle's speed will be limited to 30 km/h;
- the enhancement of rail transport;
- the replacement of municipal vehicles with low-emission vehicles.

In the following part of this section, the evaluation of the effects of measures will be conducted through the construction of a set of control variables, which have been selected in order to understand whether measures have affected, and in which way, the sustainability of mobility. Istat databases (Indicators on urban transport) have been used for the selection of the indicators. Moreover, the time reference considered (2000-2011) is long enough to read the effects of practices on increasing sustainable mobility, particularly in reference to reducing vehicular congestion levels.

In Table 5, data referred to the control variables have been reported. Every column records data by year whilst the three last columns record the percentage variation of three time references:

- 2000-2005, before the implementation of measures, by the city administration, aimed at bringing benefit to circulation and livability of the city;
- 2006-2011, in which effects of technical solutions towards a more sustainable mobility can be registered;
- 2006-2011, in which the total variation is recorded.

CONTROL VARIABLE	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	VAR. % 2000-2005	VAR. % 2006-2011	VAR. % 2000-2011
Public Transport Demand (PT passengers per year per inhabitant)	56.2	57.8	61.1	58.5	57.6	53.5	55.1	64.9	70.0	76.1	79.2	61.5	-4.7	11.8	9.5
Density of bus networks (km per 100 sqm of municipal area)	234	234	234	234	234	234	234	225	238	251	242	242	0.0	3.3	3.3
Availability of buses (vehicles per 10,000 inhabitants)	6.5	6.7	7.1	6.9	5.4	5.2	4.4	5.5	6.6	7.3	7.3	7.3	-20.3	67.5	12.9
Places-km offered by buses (millions)	843	876	883	881	848	912	907	995	1001	1020	1017	1017	8.2	12.2	20.7
Density of bus stops	26.9	26.9	26.9	26.9	26.9	26.9	26.9	27.9	30.0	30.2	26.2	26.2	0.0	-2.4	-2.4
Availability of pedestrian areas (sqm per 100 inhabitants)	9.3	9.5	10.9	10.9	10.7	10.5	10.5	10.6	16.1	16.2	16.2	16.2	13.0	54.0	74.9
Parking lots with fee (for 1000 cars in use)	11.6	11.5	17.8	17.7	16.2	16.1	15.9	15.9	18.7	18.8	35.9	36.0	38.5	126.3	210.4
Density of cycle paths (km per 100 sqm of municipal area)	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	6.5	6.5	6.5	7.5	0.0	59.1	59.1
Level of car motorization (cars per 1.000 inhabitants)	536	556	577	580	555	549	557	561	564	566	566	565	2.4	1.5	5.4
Level of motorcycles' motorization (motorcycles per 1,000 inhabitants)	53.2	61.3	68.8	74.8	76.0	80.9	86.9	92.4	98.0	103.7	106.4	107.3	52.0	23.5	101.6
Vehicular density (vehicles per 1 sqm of municipal areae)	1874	1913	1951	1970	1932	1968	2002	2016	2032	2015	2022	2018	5.0	0.8	7.7

Tab. 5 Summary table of the control variables of sustainable mobility

Table 5 illustrates that in the first time reference, the demand for public transport (number of passengers who used the local public transport) had a decreasing trend (-4.7%), whereas since 2006, after the opening of the first park and ride lot, there was an increase of around + 12% with a peak in 2010. Consequently, also density of bus networks, which went up of +3.3% between 2006 and 2011, has been positively affected by measures, implemented by municipalities, to reduce vehicular congestion of central locations.

Therefore, the trend analysis on the availability of public buses demonstrates the institutional interest in promoting the use of the collective modes of transport carried out since the middle of the first years of 2000 (+ 67.5%); by contrast in the previous years, it scored a sharp decline (-20.3%). It is also clear that public transport supply in the City of Bari, expressed in terms of seat-kilometers, grew up with reference to the bus service, with a restrained pattern in the 2000-2005 time reference (+ 8.2%) and a more significant one in 2006-2011 (+ 12.2%). By contrast, density of bus stops recorded, in the first stage, a steady pattern and then a drop (-2.4%), probably due to the pedestrianization of some areas of the city centre.

Overall, it can be said that the goal of reducing emissions related to vehicle traffic has resulted in a wide range of measures to discourage car use, such as creating pedestrian areas, fixing fees for some parking areas of the city center or designing cycle paths in order to rehabilitate degraded roads and increase the number of systematic travels by bike for commuters.

Furthermore, the introduction of restricted traffic zones (ZTL) and the promotion of walk modes has led to a 54% increase in the availability of pedestrian areas within the City of Bari, between 2006 and 2011. Meanwhile the introduction of parking pricing zones (ZSR) has produced a noticeable increase by 126.3% of the parking areas: the rate of parking spaces per 1,000 inhabitants rose up from about 12 in 2000 to 36 in 2011. Table 5 shows also that the kilometers of urban cycle paths have increased by about 60%, thanks to the implementation of bike sharing service. However, in the city of Bari, the creation of park and ride lots, the introduction of the ZSR and ZTL had no significant effect on reducing the rate of motorization that remains almost constant, registering a slight increase of 2.4% between 2000 and 2005 and of 1.5% between 2006 and 2011. By contrast, a growth in motorcycles per capita can be stated; they grew in the first time reference (+ 52%) and lowered in the second one (+ 23.5%). This may be linked to the introduction of some "green streets" within the urban center, where only mopeds, motorcycles and bicycles are allowed to circulate. Finally, with regard to the vehicular density pattern in the decade analyzed, the relationship between the vehicles in circulation and the municipal area of Bari records a growth rate of + 5% until 2005 and of +0.8 % in the following five years.

After that, some of the variables analyzed have been standardized, according to the equation:

$$z = x_s = \frac{x - \bar{x}}{\sigma}$$

where $\bar{x}$ and σ are respectively the mean and standard deviation of the considered variable in 2001-2011 time reference.

First of all, by charting the standardized values of demand and supply of public transport in the city of Bari, it can be observed (Figure 5) that since 2000 to 2004, demand is greater than supply; since 2004 the public transport demand decreases until 2005 when it has a continuous and significant rise until 2010. With regard to public transport supply its rate considerably grows between 2004 and 2007, probably due to measures aimed at improving TPL service implemented by the municipality, and reaches a stable value over time since 2007 onwards.

Subsequently, by comparing the trends of the "positive" variables, pedestrian areas and density of cycle paths, with the "negative" one, which is the motorization rate, it can be said (Figure 6) that citizens of Bari since 2004 own substantially less cars than in the previous years and they probably make less use of private modes of transport. Since 2007, when ZTL was introduced and bike sharing was implemented, the amount of pedestrian areas and cycling routes, to be used to move within the city, has changed over time, starting with a medium-low trend until 2007 and having a considerable increase between 2007 and 2008.

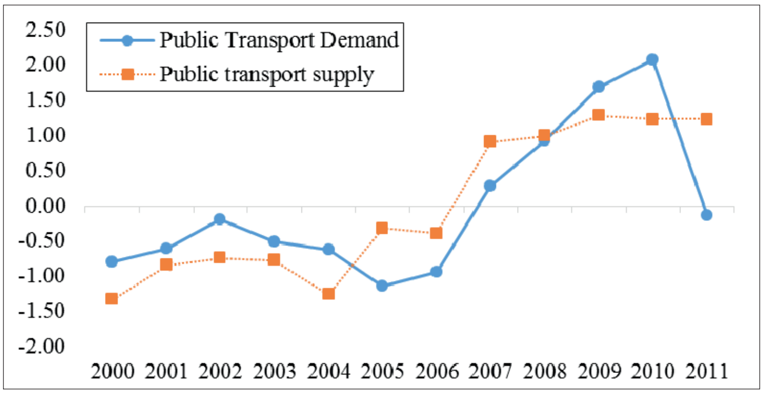

Fig. 5 Comparison between public transport

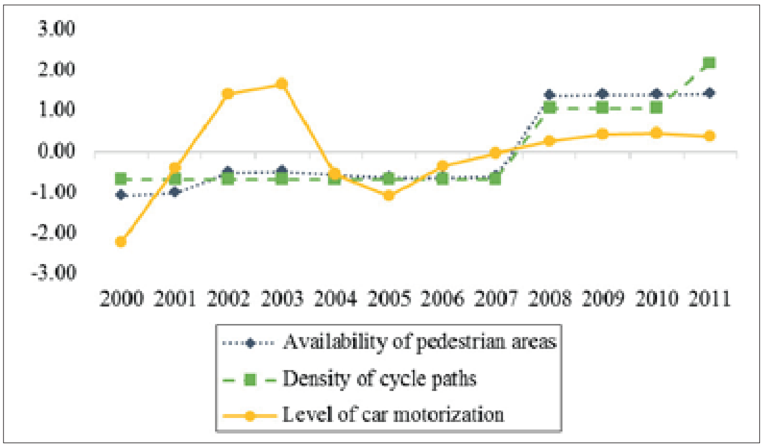

Fig. 6 Comparison between availability of demand and supply pedestrian areas, density of cycle paths and level of car motorization

Finally, by comparing two factors which help to understand some aspects about the evolution of the phenomenon of vehicular congestion, it can be seen that the trend of the supply of parking areas grows in the years 2000-2002, it is stable up to 2009, and, after the introduction of parking pricing zones (ZSR), it records a remarkable increase, between 2009 and 2011. Vehicular density, except for 2004, has a steady but significant rise until 2008, when it begins to decline (Fig. 7).

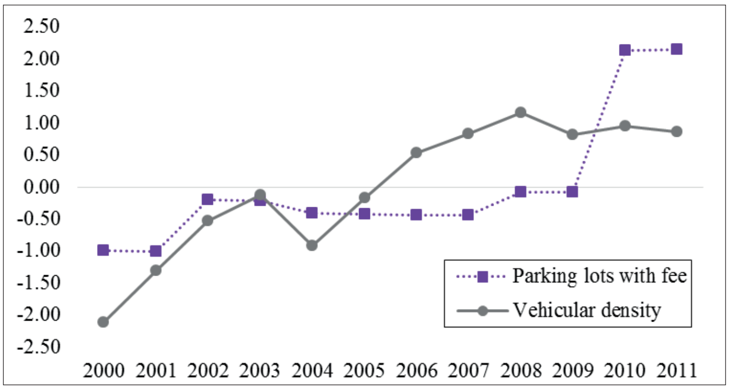

Fig. 7 Comparison between parking lots with fee and level vehicular density

To conclude, Bari instance shows that policies, which provide for measures aimed almost exclusively at implementing an overall parking strategy may promote behavioral changes for citizens, a more efficient use of the entire transport system, the reduction of traffic congestion and the gain of positive results in terms of environmental livability of urban spaces (Papa, De Caro 2009).

4.4 SMART MOBILITY SOLUTIONS IN THE CITY OF BARI

In recent years, the paradigm of sustainable mobility has gradually been linked to the most innovative smart mobility in the international debate. Smart mobility is part of the more general paradigm of Smart City, by which we mean the set of policies, plans and projects that aim at raising the quality of urban life by using ICT and forms of participatory governance (Papa, Niglio 2014). One of sectors of Smart City in which the city of Bari is more active is the Smart Mobility one.

By Smart Mobility (Manville et al., 2014) we mean ICT supported and integrated transport, which is also sustainable, safe, interconnected and multimodal. Smart can be considered a clean mobility, not motorized, supported by real-time information more accessible to users, in order to save time and improve commuting efficiency, save costs and reduce CO_2 emissions.

Moreover, smart mobility is able to give relevant information to the operators of transport networks as well as to users, who might also provide their own real-time data and contribute to long-term planning.

It is estimated that smart mobility technologies can increase energy efficiency by 20% and reduce vehicular congestion by 15% (TTS Italia, 2010).

More concretely, smart mobility solutions, underway and/or planned in Bari area, consist principally in technological innovative products and research projects, promoted by local authorities and municipal companies and implemented thanks to the technical and scientific support provided by local excellence companies. They are:

- SEMINA (Evolved Systems for Intelligent Mobility in Agile Networks), a research project aimed at developing an information system for the management of sustainable mobility in urban areas, provided through web portal, apps for smartphones and tablets, information panels and social network. Thanks to SEMINA, users can monitor the arrival time at the bus stops, technicians may reprogram the service, car users are able to control the traffic situation, municipal police can detect level of congestion and, finally, Mobility Office might manage actual and updated plans for urban mobility;

- Get Easy Bike, an experimental research project dedicated to the development of a new generation of bike sharing that allows a community of cyclists to share bikes, own or collective. By using Get Easy Bike people can move within a given urban area without the constraints (and the costs) generated by the presence of picking and release stations which characterize the traditional systems of bike sharing. Get Easy Bike represents a new model of user generated, virtual and interactive bike sharing. It is based on the balance of three distinct but linked components: technological innovation, mobility analysis and public participation;
- Bari Digital, a mobile ticketing system for public transport which allows to pay parking fees directly from your smartphone;
- Bari Smart, an app that provides a geo-location function, which is useful for orientation and to find the nearest bus stops. It also makes possible to consult timetables and bus lines;
- Project Summit - Sustainable Urban Mobility, a project that aims at creating a network among Apulian and Greek port cities. It also attempts to rise accessibility to urban centers through the introduction of innovative solutions for sustainable mobility;
- CiELo – City-port Eco Logistics, a project that aims at enhancing the accessibility of the city center of Bari, through the introduction of innovative solutions for mobility;
- BariMo, a car sharing service which is still in a pilot stage. It will provide electric, hybrid, LPG and CNG shared cars, available 24 hours a day.

Another important thing that needs to be taken into account is the installation, which has still not been completed, of infrastructures for recharging electric cars which can be used through prepaid cards.

According to the study "Mapping Smart Cities in the EU", published in 2014 (European Parliament's Committee on Industry, Research and Energy) (Manville et al., 2014), evaluating factors that contribute to the successful deployment of smart solutions are:

- a clear *vision* which sets high level principles and ensures measureable targets (*Vision*);
- participation of both relevant stakeholders and citizens. The first one ensures a high degree of coordination, the access to relevant information and the potential to influence processes and decisions on this issue while the second one means more opportunity for people to participate directly (*People*);
- an effective and successful process management of all the phases (information, guidance, practical support, evaluation and measurement of targets) provided for the implementation of solutions (*Process*).

In the following part of this section, we will focus on the described smart solutions to identify the potential or effective success by assigning different emphases, such as strong (+), average (o) and no emphases (-).

SOLUTION	SUCCESS FACTORS		
	VISION	PEOPLE	PROCESS
SEMINA	+	+	+
Get Easy Bike	+	0	+
Bari Digitale	+	+	0
Bari Smart	0	+	0
Progetto Summit	0	+	-
Cielo	0	0	-
Barimo	+	+	+

Tab. 6 Overview of success factors for the smart solutions implemented in Bari

Overall, it can be said that in Bari a business model, which includes the active involvement of citizens and all relevant stakeholders (governments, institutions, researchers, companies, professionals), has been put in place in order to test integrated systems of technologies and innovative methodologies to support smart mobility paradigm.

Although the case studies demonstrate that it is still early days for truly smart solutions, it is clear that some solutions, such as SEMINA, Get Easy Bike, Bari Digitale e BariMo, have considerable potential for success. This may be attributed to clear, shared and well defined objectives. Meanwhile other projects (Bari Smart, Project Summit, CiELo) appear to have less emphasis due to a low level of implementation of single process steps, to the reduced scale of reference, for the lack of financial instruments or to low level of technological and social innovation.

5 SUSTAINABLE URBAN MOBILITY TOWARDS SMART MOBILITY

The review of strategies, programs and measures aimed at improving the sustainable mobility of the case-study area, together with a short report of smart mobility solutions, shows a comforting picture. It is focused on matching the local strategies to European programs.

Regional policies, despite the uncertainty on funding perspectives, consider sustainable mobility as a priority area for measures, to be developed in all the different sectors of the transport system. At the metropolitan scale, the approval of two government instruments for mobility, such as PUM and PMS, has been the starting point for the transformation of Bari metropolitan area towards sustainability. Their first positive effects can be revealed by the analysis of recent years' trends for some relevant mobility indicators. The example of Bari shows how measures, aimed at reorganizing the transport system, may encourage behavioral changes for users, a more efficient use of the whole mobility system, and, finally, a reduction of traffic congestion. Yet it may positively affect both environmental protection and quality of life in urban areas. Moreover, smart solutions show that the use of high-technology devices for traffic control, to implement forms of share mobility and to provide info-mobility and mobile-ticketing, may represent a typical measure. Even though smart solutions have not yet measurable effects, they may trigger behavioral changes towards a smarter mobility.

Response times of "self-organized complex systems", to which contemporary cities may certainly be assimilated, do not allow to make scientifically recognized and above all stable considerations, in a too short time reference as that concerned in this work. However, by a preliminary qualitative and quantitative assessment, we can say that shared and coordinated strategies, as part of a global policy framework, seem to achieve significant improvements towards the sustainability of mobility, especially if they are pursued with determination and without interruption.

Conversely, we cannot say the same about "smart mobility" solutions. In most cases, they represent isolated initiatives, without indispensable scientific and disciplinary quality criteria. They seem to be promoted for "making headlines" rather than to find stable solutions in a coordinated framework of measures linked to programs and/or plans for urban mobility.

Even more worrying is the spread of the use of high-tech devices. They need sophisticated management systems and have operating costs which seem to be not comparable with the ephemeral benefits that they provide for. Undoubtedly, it is difficult to measure the real effectiveness of these solutions, if not in terms of the consensus achieved by the local authorities and in budget increase of sellers companies. However, smart mobility solutions may represent a valid support for sustainable mobility planning strategies only if they are coordinated and integrated with the urban transformation governance. Furthermore, they should be used as instrumental support to "traditional" strategies that so far have been developed and tested in the technical-scientific and professional background.

However, by the results of this work it can be said that the actual positive trends certainly represent a starting point for the next phases of the transition process toward a more sustainable mobility. This process ought to include:

- short, medium and long-term measures within mobility plans, with particular attention to land use-transport integration;
- the monitoring of positive and negative effects of choices in the transportation system on environment, safety, economic development, livability, equity and social acceptance;
- an efficient management of the mobility demand which takes into account change modal shares, in the short and long term;
- the development of policies promoting the use of public transport (Transit Oriented Development)
- the promotion of electric and hybrid cars through, for istance, the realization of preferential lanes and infrastructures for recharging electric cars;
- the use of information technologies, including info-mobility in order to maximize urban road network capacity.

The inclusion and integration of measures, which are already in place or still to be programmed, within general, achievable and assessable projects, may represent a valid response to manage mobility strategic priorities. From this perspective it is certainly desirable to introduce a central technical structure for sharing knowledge and monitoring results that also make an efficient use of European funds (Marletto, 2006; FCF, 2013).

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IMAGE SOURCES

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TeMA

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REVIEW PAGES

CITIES, ENERGY AND BUILT ENVIRONMENT

Starting from the relationship between urban planning and mobility management, TeMA has gradually expanded the view of the covered topics, always remaining in the groove of rigorous scientific in-depth analysis. During the last two years a particular attention has been paid on the Smart Cities theme and on the different meanings that come with it. The last section of the journal is formed by the Review Pages. They have different aims: to inform on the problems, trends and evolutionary processes; to investigate on the paths by highlighting the advanced relationships among apparently distant disciplinary fields; to explore the interaction's areas, experiences and potential applications; to underline interactions, disciplinary developments but also, if present, defeats and setbacks. Inside the journal the Review Pages have the task of stimulating as much as possible the circulation of ideas and the discovery of new points of view. For this reason the section is founded on a series of basic's references, required for the identification of new and more advanced interactions. These references are the research, the planning acts, the actions and the applications, analysed and investigated both for their ability to give a systematic response to questions concerning the urban and territorial planning, and for their attention to aspects such as the environmental sustainability and the innovation in the practices. For this purpose the Review Pages are formed by five sections (Web Resources; Books; Laws; Urban Practices; News and Events), each of which examines a specific aspect of the broader information storage of interest for TeMA.

01_WEB RESOURCES
The web report offers the readers web pages which are directly connected with the issue theme.

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02_BOOKS
The books review suggests brand new publications related with the theme of the journal number.

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03_LAWS
The law section proposes a critical synthesis of the normative aspect of the issue theme.

author: Laura Russo
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04_URBAN PRACTICES
Urban practices describes the most innovative application in practice of the journal theme.

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05_NEWS & EVENTS
News and events section keeps the readers up-to-date on congresses, events and exhibition related to the journal theme.

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TeMA 有关土地使用、交通和环境的杂志

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评述页

城市、能源和建築環境

TeMA从城市规划和流动性管理之间的关系入手，将涉及的论题逐步展开，并始终保持科学严谨的态度进行深入分析。在过去两年中，智能城市课题和随之而来的不同含义一直受到特别关注。学报的最后部分是评述页 这些评述页具有不同的目的：表明问题、趋势和演进过程；通过突出貌似不相关的学科领域之间的深度关系对途径进行调查；探索交互作用的领域、经验和潜在应用；强调交互作用、学科发展、同时还包括失败和挫折（如果存在的话）。评述页在学报中的任务是，尽可能地促进观点的不断传播并激发新视角。因此，该部分主要是一些基本参考文献，这些是鉴别新的和更加深入的交互作用所必需的。这些参考文献包括研究、规划法规、行动和应用，它们均已经过分析和探讨，能够对与城市和国土规划有关的问题作出有系统的响应，同时还对诸如环境可持续性和在实践中创新等方面有所注重。因此，评述页由五个部分组成（网络资源、书籍、法律、城市实务、新闻和事件），每个部分负责核查TeMA所关心的海量信息存储的一个具体方面。

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01

CITIES, ENERGY AND BUILT ENVIRONMENT

REVIEW PAGES: WEB RESOURCES

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In this number
TOWARDS ENERGY EFFICIENCY OF BUILT ENVIRONMENT

The world is becoming increasingly urbanized. In 1950, only 30% of the world's population lived in urban areas; currently the proportion is almost 50% and by 2030, it will reach 70%.
Moreover, net population growth of the next few decades will nearly all accrue in the urban centers of developing countries. With urban and industrial development comes growing demands for energy and rising expectations of material goods.
The built environment is where most human activity takes place, where most energy services are used, and where many of the advantages and disadvantages of energy use arise. It includes the buildings in which people live and work, and the spaces and infrastructure in cities, towns, and villages (Wilkinson et al., 2007). Managing built environment and its complex and interconnected systems requires an understanding of technology, financial planning, and even human behavior to create solutions that conserve resources, reduce energy and waste, save money and satisfy users. Many programs dealing with human behavior are being implemented all over the world in the form of pilots, because they rely on the assumption that humans act rationally and that they are willing to change their consumption habits (Salvati et al., 2013).
Implementing more building efficiency requires overcoming some critical barriers: lack of information and awareness for more efficiency; lack of technical knowledge to evaluate different options; uncertainty about how to measure or understand the energy efficiency performance; an inability to meet financial criteria (return on investment rates) (http://www.wri.org/).
In this issue, three websites are presented; they provide practical resources to help cities succeed with policies, technologies, and innovative investment strategies to deliver better buildings, cleaner air, and more efficient urban development.
The first website analyzed is the Sustainable Facility Tool: an online resource helps users understand and select environmentally preferable solutions for renovations, alterations and leases.
The second website proposed is that of Institute for Building Efficiency (IBE). It provides research on policies, high performance buildings and smart energy systems around the world.
In the end, the third and last website indicated is that of the Center for the Built Environment (CBE) of the University of California, Berkeley. CBE's mission is to improve the design, operation, and environmental quality of buildings by providing timely, unbiased information on building technologies and design techniques.

SUSTAINABLE FACILITIES TOOL
https://sftool.gov/

U.S. government officials and industry executives are under pressure to reduce energy consumption in an effort to save money and preserve the environment. For this reason, the U.S. General Services Administration (GSA) created in 2011 the GSA Sustainable Facilities Tool (SF Tool), a free web-based application that empowers any government or private sector user to identify and prioritize cost-effective green building and procurement strategies to improve environmental performance. The Sustainable Facilities Tool can be used for small projects or for larger remodels. The homepage of Sustainable Facilities Tool website provides an overview of all the opportunities offered by the tool, including green building best practices, guidelines to select sustainable materials, training materials, case studies, references and regulations. Thanks to a clear graphics, homepage takes users straight to the topics that interest them the most. The website consists of six sections: *learn*, *plan*, *explore*, *procure*, *practice*, *share* and by checking out summaries of each section users can start exploring.

Beyond a brief and general presentation about the sustainability topic and building CO2 emissions, the *learn* section offers a list of quick links to learn about the most relevant sustainability topics, from water efficiency to energy management systems. Users can click through annotated legislation, like Executive Order 13653, and understand the impact of policy on sustainability. Moreover, for each topic a related case study is described and the opportunity of sharing examples of successes and struggles is offered to user community. The *plan* section features strategies for building green or turning an existing space into a healthier environment. Users can choose among three groups of strategies: 1) Overall Strategies, 2) Project Types and 3) Plan for the Future. In the first one you can learn key strategies applicable to all planning activities, such as Integrative Design Process and Lifecycle Approach. In the second one, you can review strategies for specific project types through information about sustainable materials, furniture, space reconfiguration projects, building systems upgrades and building operations and maintenance. In the third one, you can learn strategies related to Net Zero Energy and Climate Adaptation topics. Many key references/resources are provided at the bottom of each page. In *explore* section users can explore interior office workspaces and learn about sustainable design best practices by comparing materials. For any room of the office: some green tips and design strategies, the opportunity to compare furniture/Furnishings options and some legal requirements are provided. In this way users can see how their role helps a team reduce costs and increase environmental sustainability. In *procure* section there is a list of all the products and services described into the website and for each of them a fact sheet, reporting the related legal requirements, principals and guidance, is given. The *practice* section features the "Green the Building" game that exposes the complex world of sustainable design, construction, and operations in a succinct and simplified context that allows you to grasp the whole system, learn technical concepts, and try out building strategies in a risk-free environment. It places user in the role of Team Lead, charged with greening buildings through strategic energy, waste, water, and occupant satisfaction improvements given a limited budget. The aim is to encourage moving beyond professional minimum compliance standards towards discovery of actions you can take to improve performance and address challenges.

Finally, the *share* page includes the social content tied to green building best practices. Here users can interact with us on Twitter, Facebook and Pinterest and can discover relevant sustainability news. SF Tool has a very easy to navigate user interface and it is currently being used by facility managers, real estate professionals, project managers from government agencies and private sector developers

INSTITUTE FOR BUILDING EFFICIENCY
http://www.institutebe.com/

The Institute for Building Efficiency is an initiative of Johnson Controls and World Resources Institute. The first one is a global leader in providing building efficiency solutions while the second one is an excellence research organization in the field of sustainable natural resource management. In October 2014 they joined into a partnership for the launch of a Building Efficiency Initiative.

The goal of IBE is to provide information and analysis of technologies, policies and practices for efficient, high performing buildings and smart energy systems around the world.

Moreover, its aim is to build market awareness and action on:

- local benchmarking and sustainable building certification and labeling approaches;
- innovative financing to support efficiency investments;
- distributed energy systems at the building and community scale.

Seven are the main sections of the website. In *Building Energy Retrofits* users can find more than fifteen articles about energy saving and energy performance contracting. Indeed the IBE comprehensive approach enables building owners to implement whole building retrofits and significantly lower energy consumption and operating costs. Moreover, this section provides also videos, recordings, academic papers, fact sheets and presentations focused on building efficiency.

Energy Efficiency Indicator section is dedicated to a survey about attitudes, priorities and concerns of people at the front lines of energy management in commercial buildings throughout the world. Here the results of the annual Energy Efficiency Indicator (EEI) global studies are presented. The surveys analyze energy efficiency and renewable energy plans, practices and investments among executive-level decision-makers responsible for energy and facility management in buildings.

The third section, *Building Performance Management*, addresses the opportunity to bring people and technology together to improve building performance. Effectively, a number of best practices and case studies to inspire, engage and promote energy efficiency are listed.

In *Smart Grids & Smart Buildings* users can find resources about energy grids, energy districts, intelligent buildings and demand response programs.

The *Clean Energy Finance* section includes many practical reports and documents that investigate the topic of Property Assessed Clean Energy (PACE) financing as a tool to add value to commercial buildings, in rental premiums, higher occupancy and lower operating cost.

Energy & Climate Policy section represents an important source of articles about three interlinked policy approaches: 1) energy policy that favors energy efficiency and distributed renewable energy sources, 2) climate policy that recognizes and internalizes the cost of carbon pollution; and 3) standards and performance criteria for the building envelope and the building components.

The last section of the website offers a series of issue briefs on net zero energy buildings covering definitions and case studies, opportunity and drivers, net zero for existing buildings, and net zero communities. Furthermore, some reports underline the benefits of building efficiency renovation projects on real market traction, particularly for Europe's economy recover.

In general, a collection of key resources and tools from a variety of sources can be found in IBE website. These videos, issue briefs, presentations, and tools shine the spotlight on need-to-know issues, provide big-picture perspective, and offer advice on how to develop winning strategies for establishing clean energy building systems and cutting carbon emissions.

CENTER FOR THE BUILT ENVIRONMENT
http://www.cbe.berkeley.edu/

The Center for the Built Environment was founded in 1997 under the National Science Foundation (NSF) Industry/University Cooperative Research Center (I/UCRC) program. Their mission is to improve the environmental quality and energy efficiency of buildings by providing timely, unbiased information on building technologies and design and operation techniques. Two are the broad program areas:

- tools for improving building performance, designed to serve those who manage buildings, as well as assist those who plan and design buildings;
- new technologies that make buildings more environmentally friendly, more productive to work in, and more economical to operate. These technologies are designed to help develop and target new product offerings, and allow facility management and designers to select and apply state of the art technologies effectively.

Both program areas are supported by fundamental research into human physiology, indoor airflow, thermal performance of building systems, and an extensive occupant-survey program. They participate in standards and guides for ASHRAE and USGBC in order to remove barriers to effective building technologies, and to speed their implementation. They also develop software for design, operation, and research.

CBE website has four main sections: *About us*; *Research*; *Membership*; *What's new*. But in the homepage users can get also quick links to some relevant information such as their industry partners, research staff, research portfolio, publications and membership information. Moreover, a guided browsing based on the user's profile (prospective partners, prospective students, visiting scholars, job seekers) is available. In *About us* section primary objectives and organizational structure are described. *Research* section shows an overview of research programs divided into five general topics: indoor environmental quality (IEQ), building HVAC systems, building envelope systems, human interactions, sustainability, whole building energy, and other topics. For each general topic you can get a link to a page including a list of all the research projects related to the topic. Hence, by picking one of the research project titles you will find a summary page in which the objective, the significance to industry, the research approach, the related publications and some project resources, such as the status of implementation, the funding sources and the primary contacts, are provided. In this collection there are 372 publications, published between 1980 and 2015. In *Membership* section you will find information on how you can get involved with CBE. *What's new* section includes up to date events about like new joint CBE partners, news about recently awarded grants and about the periodical issue of "centerline", the CBE semi-annual magazine focused on their research activity. The Center aims at being a place where a holistic and far-sighted research on buildings is addressed.

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IMAGE SOURCES

The images are from: https://sftool.gov/; http://www.institutebe.com/; http://www.cbe.berkeley.edu/.

02

CITIES, ENERGY AND BUILT ENVIRONMENT

REVIEW PAGES: BOOKS

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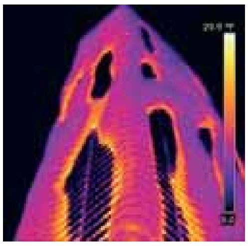


In this number

ENERGY EFFICIENCY AND LOW CARBON TECHNOLOGIES

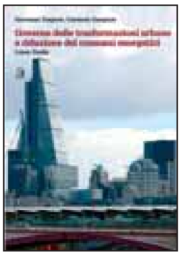
The crisis of the model of development without limits, that characterized the western societies in the last two centuries of the last millennium, has forced to reconsider the principles underlying of the model closely dependent on the use of fossil fuels. This cultural evolution of the development model based less on fossil fuels, it is an aspect to the base of the new concept of "smart city". This has been achieved also through the action of the European Community, which defined the new terms for the access at the funding to 2020 (EC, 2011). So EU puts at the center of European policies the city "smart" with actions on the urban environment and the containment of consumption energy (Gargiulo et al., 2013).

This focus on cities is certainly due to the awareness that large urban areas are complex organisms with a high degree of entropy. Therefore, the urban areas are among the most responsible for the greenhouse effect, or the warming of the atmosphere, caused by the excessive release of the carbon dioxide (EP, 2011).

The first results of these initiatives have been the competition between cities for nomination as Smart City, with membership of the Covenant of Mayors that sustains and supports the efforts of the local authorities of the European Union, and the subsequent drafting and implementation of the Action Plans Sustainable Energy (PAES), tools with which the city defines the goals of reducing emissions and how to reach them (Barresi and Pultrone, 2013). The energy efficiency presents a huge growth potential, but its characteristics and the market structure require the introduction of new business models – together with adequate policies and the development of new skills and competences – in order to achieve the impending targets.

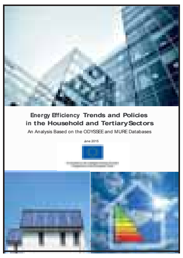
The civilian sector was characterized by continuous growth of energy consumption in past decades. Buildings account for about 40% of total final energy consumption and around 55% of electricity consumption in the EU-28 in 2012. Buildings are the largest end-use sector, followed by transport (32%), industry (26%) and agriculture (2%).

For this reason there are interesting opportunities to improve energy use and control demand. Despite this, several barriers have played a part in delaying the dissemination of energy-efficiency measures: the lack of resources for public buildings, the relatively low energy expenses in the services sector (if compared with total expenses), the minimal awareness and knowledge of the problem in the residential sector and in general. According to these brief considerations, this section proposes three documents that help to better understand the issue of this number: The Guidelines for the government of urban transformation and reducing energy consumption; The Energy Efficiency Trends and Policies in the Household and Tertiary Sectors; The Energy Efficiency in the building sector: skills, business models and public private partnerships.



Title: Governo delle trasformazioni urbane e riduzione dei consumi energetici Linee Guida
Author/editor: Giovanni Dispoto, Carmela Gargiulo
Publisher: CLEAN Edizioni
Download: http://smartenergymaster.unina.it/disseminazione/disseminazione/strumenti/linee-guida/download-linee-guida/
Publication year: 2015
ISBN code: 978-88-8497-523-2

The Smart Energy Master (SEM) Project for the energy management of the territory funded within the integrated action for sustainable development "Energy Efficiency and Low Carbon Technologies" PON the Smart Cities and Communities 04a2_E proposes best practices and governance solutions oriented towards energy savings that connect the characteristics of the city, the activities that take place and the behavior of the inhabitants. Among the main results of the project: the definition and dissemination of guidelines for the reduction of energy consumption by adapting behaviors of the different categories of users and improve efficiency energy efficiency of public facilities, infrastructure and networks of the city.
In this volume are collected the best practices of some European cities that are implementing projects on "smart building", sustainable mobility and smart grids with considerable EU and national funding. To make a city "smart", it means organizing through a coordinated set of interventions. That aim to make them more sustainable in terms of energy and environmental efficiency, the services offered to citizens.
These guidelines aimed to reduce energy consumption, contain the leanings and action criteria, to improve both the legal and technical instruments, at national and regional level, and the administrative and regulatory instruments, at the urban scale and/or neighbourhood.
The Guidelines identify a number of "leanings" that are particularly significant for sustainable urban planning at various levels (urban scale and / or neighbourhood) and the correct application of which the instruments of government of land use. That can increase the integration between the urban planning and the energy planning, through the introduction of energy aspects in the urban planning tools and the urban planning aspects in the energy instruments.
The "leanings" are divided into "action criteria", which starting from the general address, allow to apply concrete actions for reducing energy consumption, at different planning tools. For every "action criteria" is proposed a table, identified by an ID, which illustrates for each action criteria the possible measures that can be implemented at the different reference scales.
The collection and analysis of case studies, consisting in experience of planning and design made in Europe and ascribed to the category of so-called smart city. These case studies formed the starting point to define leanings and action criteria useful for preparing Guidelines. These are examples of the urban sustainability of the best practices, expression of the urban culture and territorial government, are aware of the limited natural resources of the planet.
To help the reading and understanding of the terms used, there is a synthetic glossary. It's useful to explore some issues if the user deems it necessary, complete the guidelines constitute an additional tool facilitating.
The guidelines may be used, for example, to help the technical designers in the selection at the reference scale of the design and the type of planning instrument to improve the energy efficiency. The technical can find a range of predefined leanings, easy to read, calibrated relative to the scale and type of instrument considered.
Thanks to the identification of leanings and action criteria, was built a matrix based on the instrumentation and technical regulations in force at national and regional level. So to frame and report the addresses and criteria defined in relation to instruments of government land at different scales. The matrix shows the scale of reference, the instrument of government of urban transformation in question, the guidelines and the action criteria concerned instrument.



Title: Energy Efficiency Trends and Policies in the Household and Tertiary Sectors
Author/editor: ODYSSEE-MURE project
Publisher: EU
Download: http://www.odyssee-mure.eu/publications/br/energy-efficiency-in-buildings.html
Publication year: 2015
ISBN code: n.d.

This study analyses energy efficiency in the household and tertiary sectors. The report summarises recent policies implemented to promote energy efficiency and renewable energy in buildings and pinpoints the most successful measures. The EU Member States have submitted their third National Energy Efficiency Action Plans (NEEAPs) in April 2014 and measures reported in them discussed.

The report analyses the trends since 2000 in energy use and energy efficiency and the use of renewable energy in buildings based on ODYSSEE data, with a separate analysis for residential buildings and non-residential buildings.

The ODYSSEE database contains data on energy efficiency indicators, energy consumption, activity indicators and energy-related CO2 emissions. It includes the following types of indicators in buildings: Specific energy consumption; Energy efficiency index to evaluate energy efficiency progress at sector level; Energy savings measuring the energy saved through energy efficiency improvements; Adjusted indicators to improve the comparisons of indicators across countries; Diffusion indicators to monitor the market penetration of energy-efficient technologies. Currently, energy efficiency data are available from the year 1990 to 2012.

This report analyses the theme of renewable energy in buildings. In particular, the Renewable Energy Directive establishes numerous requirements concerning the use of renewable energy buildings. However, there is still a need for national initiatives to promote local energy production and to remove the barriers to their large diffusion, which remain considerable.

In addition, to renewable energy policy, the report discusses some other specific themes such as behavioural change of consumers, the role of the public sector, city planning and co-benefits of energy efficiency and renewable energy. Some other policies and measures touched upon, but not with such a specific focus, are the use of smart meters and feedback programmes and resilience policies.

Consumer behaviour and measures addressing it get special attention. In addition to the traditional campaigns and energy advice, new energy services are empowering consumers.

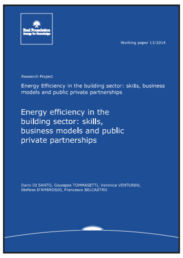
The exemplary role of the public sector receives some extra focus in the report. Its role is underpinned by EU legislation but there are also various voluntary measures and networks supporting sustainable development, particularly in the municipalities.

Good spatial planning is in the foundation of sustainability, including energy efficiency and use of renewable energies. This is also linked to growing digitalization, which, however, is not yet very visible in the measures loaded to the MURE (Mesures d'Utilisation Rationnelle de l'Energie) database.

The MURE database provides information on energy efficiency policies and measures that have been carried out in the EU Member States. The database is structured by end-use sector (household, tertiary, transport, industry) and allows browsing energy efficiency measures by sector. The database also contains information on general energy efficiency programmes and on general cross-cutting measures.

Recently, the co-benefits of energy efficiency have raised increasing attention, partly driven by recent work by the International Energy Agency on multiple benefits. The energy efficiency and renewable energy measures in the MURE database have been scanned for direct references to co-benefits.

In the report are collected many case studies from various countries are given based on information from the MURE database.



Title: Energy Efficiency in the building sector:
skills,business models and public private partnerships
Author/editor: Dario Di Santo, Giuseppe Tommasetti, Veronica Venturini, Stefano D'ambrosio and Francesco Belcastro
Publisher: Enel Foundation Working
Download: http://www.enel.com/it-IT/enel_foundation/library/working_papers/2014
Publication year: 2014
ISSN code: 2282-7412

The Enel Foundation periodically publishes reports, working papers and articles with the objective to exploit and disseminate the results of own research projects.
This working paper is the 13th of the 2014 and was published with the support of Italian Federation for the Rational use of Energy (FIRE).
The FIRE, in recent years, has collaborated with most associations that bear interest in energy efficiency at the Italian level and has conducted numerous studies regarding end-use energy efficiency, including incentive policies, existing barriers, the building sector, ESCOs, and third- party financing.
This study has aims to analyse innovative solutions, business models, and public support to promote energy efficiency in the public building sector, linking up with the development of an industrial policy in line with the Green Growth Strategy, also through the development of the energy service company model. In particular, the analyses concentrates on the Italian situation and is presented as a study structured in ten chapters, gathering interesting suggestions and solutions, even from major European countries.
The degree of integration of available technologies, the skills asked for and the skills necessary to manage this integration, and the interaction between the various players and the public and private parties concerned. The financial, administrative and legal barriers that are obstacles to the massive dissemination of efficient construction-industry technologies on a larger scale, and that impede an integrated and holistic approach. The actual implementation of innovative and successful business models to improve energy efficiency in the public building.
Based on experiences and analyses acquired from the above activities, the study proposes a series of recommendations for political decision makers and certain market operators, also suggesting possible solutions to accelerate and simplify the existing dynamics. The study also illustrates the best experiences and best practices with the public and private parties concerned and sets out to provide solutions to promote networking, associations, and partnerships for energy efficiency among the parties concerned n the building sector.

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03

CITIES, ENERGY AND BUILT ENVIRONMENT
REVIEW PAGES: LAWS

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In this issue
EUROPEAN AND ITALIAN STRATEGY FOR ENERGY EFFICIENCY IN THE BUILT ENVIRONMENT

Two possible solutions can effectively make the use of energy more sustainable: saving energy or using it more efficiently. Both solutions can be developed in the three economic sectors – buildings, transportation, industry – in order to achieve positive results, but the buildings sector, which is the largest end-use energy consumer in the industrialized countries (IEA, 2010), has the highest potentials for energy savings (Fig. 2).
Some data can help illustrating the phenomenon: the primary energy consumption of buildings on the global scale is almost 19 millions barrels of oil per day as much as the total OPEC production for a day (Santamouris, 2011) and 21% of greenhouse gas emissions come from this sector. The European Commission has calculated that by improving the energy efficiency of buildings it is possible to reduce total EU energy consumption by 5% to 6% and lower CO_2 emission by about 5%, as well as decreasing gas imports by 2.6% for every 1% improvement in energy efficiency.
For these reasons, in the last ten years, the European Commission has focus its attention on this issue and has promoted the reduction of energy consumption of buildings by adopting two fundamental Directives: the 2010 Energy Performance of Buildings Directive (2010/31/EU) and the 2012 Energy Efficiency Directive (2012/27/EU). These two documents are described in the following pages, together with the description of the Italian adoption texts. Indeed, each EU country has implemented the two Directives based on its social, economic and geographical context.

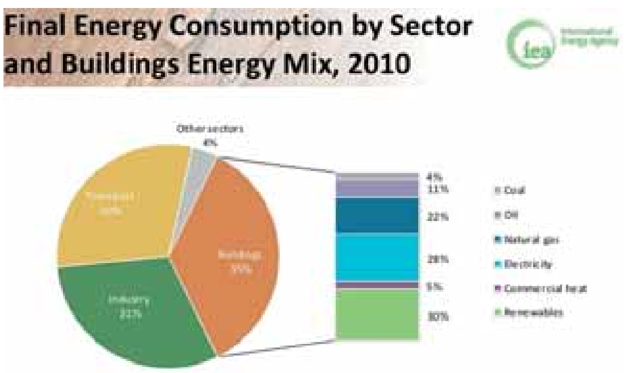
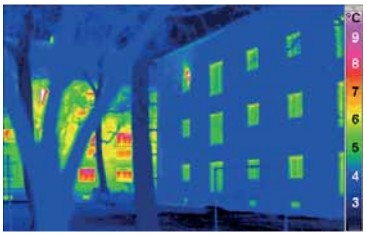


Fig. 2 Final Energy Consumption by sector (IEA, 2010)

Moreover, the EU Commission has introduced several practical support initiatives – Concerted Action EPDB, BUILD UP Skills, BUILD UP Portal – in order to help EU Member States properly adopt both Directives. These policies aim to achieve the energy efficiency targets the EU has set itself for 2020 (-20%) and 2030 (-27%).
Although last year it was calculated that the EU will miss the 2020 target by 1-2%, the implementation of all the measures contained in the legislation on energy efficiency could guarantee the achievement of these goals without additional actions.
The European commitment has already generated several important advantages in the last decades (www.ec.europa.eu/energy):

- the energy consumption of new buildings has decreased by about 50% compared to the 80s;
- in 1995 the number of A classes and above refrigerators was lower than 5%, while in 2010 was higher than 90%;
- EU countries have committed themselves to rolling out close to 200 million smart meters for electricity and 45 million for gas by 2020, leading to greater substantial benefits for consumers.

The great efforts all European Member States are making in order to develop a more sustainable urban environment represent an important commitment towards future generations because they have positive impacts on the ability of the urban system to adapt to climate change (Galderisi, 2012), and at the same time, they also represent an opportunity of economic growth: by investing in energy efficiency, indeed, it is possible to provide business opportunities for constructions firms and manufacturers of energy-using equipment, as well as encourage the creation of new jobs in several sectors that invest in energy efficiency.
In this context, Italy is doing its best even though it is lagging behind the best performing countries.



NEARLY-ZERO ENERGY BUILDINGS – EUROPEAN AND ITALIAN FRAMEWORK

The promotion of energy efficiency in the built environment represents one of the most important key strategies the EU Agenda is promoting because of the saving opportunities achievable in this sector as it accounts for a great amount of energy consumption.
Both existing and new buildings are the priorities of 2010/31/EU Directive, which "promotes the improvement of the energy performance of buildings within the Union, taking into account outdoor climatic and local conditions, as well as indoor climate requirement and cost-effectiveness".
According to 2010/31/EU Directive, all new public body's buildings have to be nearly zero-energy buildings (NZEB) by 31 December 2018, as well as all new buildings have to be NZEB by 31 December 2020. The definition of zero-energy buildings is provided within Article n.2: "nearly zero-energy buildings means a building that has a very high energy performance. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby".
Furthermore, the Directive has also introduced the energy performance certificate (EPC) – "a certificate recognised by a Member State or by a legal person designed by it, which indicates the energy performance of a building or building unit" – that must be included in all advertisements for selling or renting a building unit, and the *cost-optimal methodology* for calculating the minimum energy performance requirement for new buildings, the major renovation of buildings and for the replacement or retrofit of building elements. This calculation takes into account the benefits and costs of energy efficiency initiatives during the building's

expected life-cycle with the goal of stressing the importance of balancing the investment involved and the energy costs saved.

At national level, EU Member States have transposed and implemented the Directive based on their specific context. In Italy, 2010/31/EU has been adopted with 2013/90 Law that sets the new criteria for achieving the EU targets in a nearly energy-zero building perspective. The very high number of buildings in Italy – more than thirteen millions, 51.000 of which school buildings – certifies the importance of investing in the efficiency of this sector (Mazzeo, 2014), which accounts for more than 36% of national energy demand and in recent years it has recorded a constant increase in consumption, as reported by the National Energy Balance 2011.

In numbers, Italy's goal is to save 20 Mtep of primary energy and 15 Mtep of final energy per year by 2020, with a reduction of CO_2 emissions of 55 million tonnes.

These ambitious targets can represent a profit-making opportunities for both the country and individual consumers because the promotion of energy efficiency can positively affect production and employment and it can be a driver of innovation and research in the medium and long term, which in turn has a positive impact on growth.

COM(2012) 27 – DIRECTIVE 2012/27/EU FOR ENERGY EFFICIENCY AND THE ITALIAN ADOPTION

The 2012/27/EU Directive has established a common framework of measures for the promotion of energy efficiency within the EU in order to achieve the 20% energy efficiency target in 2020 and to inspire further energy efficiency improvements beyond that date.

Although the EU Directive emphasizes the critical role of the public bodies' buildings, which can represent the leading factor to encourage the transformation towards more efficient constructions, also the private sectors – industry and services – have been included within the actions provided for by Directive 2012/27.

These leanings significantly emerge also in the Italian adoption Decree, adopted in 2014, which has introduced important innovations, especially regarding the government's buildings sector. Strategies for the renovation of national public administration's building stocks have been developed, in agreement with the EU Directive which states that "each Member State shall ensure that, as from 1 January 2014, 3 % of the total floor area of heated and/or cooled buildings owned and occupied by its central government is renovated each year to meet at least the minimum energy performance requirements that it has set in application of Article 4 of Directive 2010/31/EU". The Ministry of Economic Development has signed a memorandum of understanding with the State Property Agency whose first objective will be the drafting of an inventory of buildings occupied by the central government, including floor area and energy data, a key step towards developing a comprehensive strategy for the upgrading of public buildings.

Moreover, the restriction for public bodies to purchase products and services with high energy efficiency standard has been consolidated.

The main measure regarding the industrial sector establishes that, as from 5 December 2015, large corporations and energy intensive businesses will be obliged to regularly carry out energy audits, which are useful for identifying the most effective interventions to reduce energy consumption. Moreover, in order to promote the development of energy efficiency projects based on the results of those audits, the Decree includes a further strengthening of the role of *white certificates*, also known as "Energy Efficiency

Securities", which certify the achievement of end-use energy saving through energy efficiency improvements initiatives and projects. Companies wishing to build new plants for the production of electricity or thermal energy, with power exceeding 20 MW, as well as new district heating grids, will have to perform a cost benefit analysis. At the same time, an analysis on the national territory to choose the best areas for the development of district heating will be carried out in order to better invest and simplify authorization procedures. Amongst the tools promoted by the EU Directive and also adopted by the Italian government, the "National Fund for Energy Efficiency" is one of the most innovative; it represents an important financial support system for the rehabilitation of public bodies' buildings and for the reduction of energy consumption in industry and services. A specific section of the Fund will support investment in district heating and cooling. The Italian Fund will be supplied with approximately 70 million euro per year in the period 2014-2020.

Further actions have been formulated in favor of energy end-users to raise their awareness of energy consumption through the promotion of individual measurement systems and more accurate billing, based on real consumption.

New important standards for the dissemination of information, as well as for the training of companies, public administrations, citizens and students have also been introduced by the Decree: a three-year program for training and information will be launched soon, counting on a sum up to one million euro per year.

The total financial resources for the implementation of the measures amount to over 800 million euro.

The 2012/27/EU Directive and its Italian adoption Decree formalize the exemplary role of energy efficiency to face a great number of challenges our planet has to deal with, such as the reduction of greenhouse gas emissions, the consequences of climate change, the need to boost economic growth and create new jobs. In this context, the construction industry represents a critical area of interest, especially that of public bodies'.

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Fig. 2: http://www.slideshare.net/internationalenergyagency/webinar-27-june-2013-launch-event-final
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04

CITIES, ENERGY AND BUILT ENVIRONMENT

REVIEW PAGES: URBAN PRACTICES

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In this number

SUSTAINABLE ENERGY ACTION PLANS: THREE CASE STUDIES

The challenges imposed by the changing climate and the energy-driven development have been traditionally addressed from international and national initiatives such as the United Nations Framework Convention on Climate Change and the Kyoto Protocol. However, in the last decade, there has been a considerable effort to reframe this debate towards the local scale and focus on local causes of climate change and local strategies to reduce C02 emission and energy consumption.

Indeed, since the growing recognition of the contribution of municipal areas to global environmental change (Santamouris, 2013), important initiatives and programs for the reallocation of planning actions from the global to the local scale took place, following the principle of "think globally and act locally" highlighted by the Agenda 21, the Global Action Plan for Sustainable Development for the 21st Century.

In the EU, the Covenant of Mayors represents the most important initiative in this direction. It is the mainstream European movement involving local and regional authorities, voluntarily committing to increasing energy efficiency and the use of renewable energy sources on their territories in order to reduce C02 emission and contribute to the achievement of energy and climate targets set at the European scale. By signing the Covenant of Mayors, local authorities engage to reach - or even exceed - the EU 20% CO2 reduction objective. Covenant of Mayors Signatories pledge to submit a Sustainable Energy Action Plan (SEAP) outlining how they will reach their targets.

The Covenant of Mayors now includes 6.450 signatory cities, which benefit from the help of numerous Covenant Coordinators, Supporters and Associated Partners. Through SEAPs cities can implement measures in a structured and integrated way, allowing them to systematically monitor their efforts in going beyond national legislation in these fields. A SEAP is also an instrument for cities to communicate to stakeholders – both locally and beyond – the importance of energy and climate protection, and to encourage citizens and other relevant actors to take a part in the city's ambitions.

In this section, I analyze three relevant case studies of European cities that has recently (2015) submit a SEAP to the European Commission's Joint Research Centre:

- Gent, Belgium;
- Glasgow, United Kingdom;
- Gothenburg, Sweden.

GENT

Gent, the capital of the East Flanders province, is the second largest municipality of Belgium with an urban population of approximately 250,000 inhabitants. With the country's highest share of young people and a strong presence of institutions for higher education, Ghent is an important centre of knowledge and innovation.

In January 2009, the city of Gent was the first Flemish city to sign the Covenant of Mayors. With it, the city committed to a reduction of local CO2 emissions by 20 percent by 2020 compared to 2007. This commitment was in line with the Belgian National Climate Strategy aimed to reduce national greenhouse gas emissions by 15 percent by 2020 (compared to 2005) and to achieve a share of energy from renewable sources of 13 percent. In 2014, when about half of this reduction was already accomplished, the city adopted a new Climate Plan. The plan contains actions intended to help achieve the remaining 10% of CO2 reduction by 2019 while establishing a roadmap towards carbon neutrality in 2050. This document has been submitted to European Commission as the city' SEAP in 2014 and approved by the EU Covenant of Mayor one year later. Actions in the Climate Plan are organized around five main themes.

Residential sector. Energy consumption in Gent households accounts for about 25 percent of total CO2 emissions. As for the majority of Belgian municipalities, the exiting residential buildings stock in Gent is relatively energy inefficient, especially if compared with that in neighbourhood countries. At the same time the refurbishment rate of existing residential building is currently very slow. In order to fulfil the climate target, the plan supports energy-saving refurbishments through several actions including awareness raising, incentives for energy-saving projects, knowledge building, and good examples. According to the plan, Gent inhabitants can benefit of a wide range of tools such as on-line tailored support for drawing up energy-efficiency assessments, finding and contacting contractors or comparing quotations. Furthermore, depending on income, they may have access to a range of premiums up to 1,500 or 2,500 Euros for energy-efficient refurbishments. For the new buildings, the city will provide additionally incentive for energy efficiency, beyond those provided by The Flemish government. Finally, as the owner of many terrains and promoter of social-housing projects, the City will impose loftier ambitions relating to energy performance and renewable energy.

Role Model. The initiatives that fall within this theme are mainly target to reduce energy consumption of municipal-owned buildings, public lighting, sport infrastructure, city employee's commuting and city's vehicle fleet. To this aim, an energy performance contract will be concluded with an Energy Saving Company for a number of city buildings, public lighting and sport infrastructures. Finally, the city will draw up a sustainable company transportation plan for its employee while the whole municipal vehicle fleet will be gradually replaced by electric vehicles.

Service sector. The City of Ghent wishes to accelerate green economic growth in the city by increasing the share of sustainable entrepreneurs who handle energy efficiently. In this context, the City of Ghent will create a local framework to structurally anchor sustainability in the companies' operation in order to gives entrepreneurs the necessary legal security and incentives to handle energy rationally.

Renewable Energy. In addition to a reduction in the demand for energy, the city intend to achieve its climate objectives trough sustainable energy production. In this sense, the plan support several actions aimed to achieve a 15% of (green) domestic energy production in 2019. Action in this theme are target to new wind turbines, developing a district heating strategy, pushing urban development projects towards climate neutrality, raise awareness among citizens and companies and support them in their investments in renewable energy.

Mobility. Mobility is responsible for about the 30 percent of total C02 emission. In order to reduce the environmental footprint of mobility the city is working on the following strategies: ensuring proximity, lowering the number of required kilometres, enhancing steps, stairs, and public transportation, and greening modes of transportation.

GLASGOW

Glasgow is the largest city in Scotland, and the third largest in the United Kingdom. It has a total urban population of 1,750,000. The city has experienced economic growth and development in recent years, bolstered by careful planning, a growing and young population and a business growth in high-tech, service and export orientated manufacturing sectors.

In 2015, the City Council approved the Energy & Carbon Masterplan (ECM). This plan is an enhanced SEAP for Glasgow which builds on the first SEAP produced by Glasgow City Council and approved by the EU Covenant of Mayors in November 2010. The ECM provides a single, coordinated strategy and plan of actions and projects across the city to meet a target of reducing Glasgow's C02 emissions by 30 percent by 2020 from 2006 levels. The plan contributes to the objectives defined in the Scottish Climate Act aimed to reduce Scottish greenhouse gas emissions by 42 percent by 2020 (compared to 1990). The ECM also sets out a vision of a transformed energy economy for Glasgow that is based on low carbon and increasingly decentralized energy sources that are better able to meet Glasgow's energy needs and help Glasgow tackle climate change. The plan contains a panel of actions grouped around four main themes..

Buildings. The initiatives that fall within this theme are target to both private and municipality-owned buildings. In this regards, strictly energy standards, based on the LEED rating system (www.usgbc.org), have been set, differentiated according to building use and ownership. For the municipal properties, internal energy audits will be conducted in order to identify those that will benefit most from energy efficiency measures and projects. For private properties, the coordination and enhancement of existing energy schemes will be target to improve energy efficiency and reduce energy consumption and fuel poverty in social housing.

Transport. Action in this domain are target to encourage a reduction in personal motorized transport and an increase in the use of public transport, walking, and cycling. In order to meet these objectives, the plan supports the formation of Quality Partnerships with bus and train operators and with regional authorities. These partnerships are target to make public transport provision more efficient in terms of operational costs and more attractive for citizens, in particular for car users. Furthermore, in order to encourage active travel Glasgow City Council is increasing provision of cycling infrastructures.

Local Energy Production. Given the small amount of local electricity generation in Glasgow, promoting decentralised generation is a key issue in the city plan. The four generators currently operational in and around the Glasgow city boundary only account for a minor part of the total energy supply. Furthermore only wind and solar energy production has been developed so far. Thus, the plan recognizes the need to increase renewable energy production and diversify the sources of energy supply. For this reason, the plan contains a panel of measures aimed at promoting local production of renewable electricity through city-led projects that bring a return on investment. Beyond this city-led initiatives, also bottom-up approaches are encouraged. In particular, the city promotes local production of renewable electricity through community-based projects.

Local Heat/Cold Production. The provision of district heating is another key policy issue. In this regard, the plan contains actions that promote the installation of district heating infrastructure, targeted at areas of fuel poverty. These projects will be carried out in tandem with building renovations allowing for improvements in energy efficiency to be achieved at the same time.

GOTHENBURG

Gothenburg is the second-largest city in Sweden and the fifth-largest in the Nordic countries. It has a total urban population of 543,045. Due to the Gothenburg's advantageous location in the centre of Scandinavia, industry, trade and shipping have always played a major role in the city's economy.

In January 2014, the City Council approved the Strategic Climate Programme. With it, the city committed to a reduction of local CO_2 emissions by 21 percent through to 2020, using 1990 as the base year. The plan contributes to the objectives defined in the Swedish Climate Strategy aimed to reduce Swedish greenhouse gas emissions by 20 percent by 2020 (compared to 2008). The Climate Programme embodies Gothenburg's long-term climate work, which includes not only the municipal organisation but also industry and the people of the city. It also establishes a roadmap towards carbon neutrality in 2050. The actions contained in the plan are grouped in four main themes.

Climate Smart Citizen. The initiatives that fall within this theme are aimed to support citizens to reduce their climate impact through a change in social behaviour and greater awareness. To this aim, the plan provides a set of tool including energy and climate advices to private individuals, organisations and small and medium-sized enterprises; campaigns, events and communication with various target groups and contribute and technical assistance.

Resource-Efficient Urban Planning. The basic idea behind this strategy is the creation of a resource-efficient social structure through densification and planning for more people in the same area and with a reduced need for transport. The location of new construction and new infrastructure will be oriented in a way to make it easier and obvious to walk, cycle or use public transport. Finally, by creating conditions for efficient forms of energy and promoting energy-efficient construction, the urban planning will have a strong contribution in the optimization of the energy supply system.

Efficient Energy Use and Conversion to Renewables. Actions grouped in this theme are aimed at increasing resource efficiency in district heating This strategy can be implemented in a variety of ways, including the creation of new district heating sources by means of a comprehensive, efficient and regionally optimised district heating system, utilising more surplus heat and adapting the grid to achieve as much residual heat as possible. In this theme also fall those strategies aimed at improving the energy efficiency of Gothenburg's privately owned and municipal-owned property holdings. Other actions include the promotion of energy efficiency in industry.

Reduced Climate Stress from Travel and Transport. Gothenburg is also a transport-intensive metropolitan area and is facing major challenges to reduce greenhouse gas emissions resulting from transport. The plan provides a complete set of measure to be implemented in order to invert this trend. They include: prioritise and invest in the travel modes walking, cycling and public transport, working towards a more energy-efficient vehicle fleet and promote the use of fuels with low climate impact, becoming a world leader in climate-smart cargo handling, encourage shipping that is energy efficient and fossil free.

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IMAGE SOURCES

The image shown in the first page is from http://www.covenantofmayors.eu; the image shown in the second page is from http://lozie.com; the image shown in the third page is from http://www.arcadenw.org; the image in the fourth page is from http://www.panoramio.com.

05

CITIES, ENERGY AND BUILT ENVIRONMENT

REVIEW PAGES: NEWS AND EVENTS

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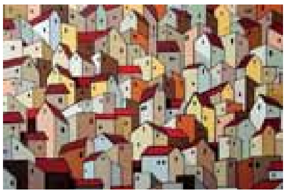

In this number

SUSTAINABLE BUILT ENVIRONMENT: THE RISK OF TOWN CRAMMING

A large share (40%) of European CO_2 emissions are produced in order to heat and service buildings. Even though newly built homes and buildings are achieving increasingly high levels of energy standards, many older and historical buildings do not yet meet modern energy requirements. If we consider that today the new buildings represent a small fraction compared to the totality of the building interventions (less than 1%), it is therefore clear that only a common intervention on the existing could guarantee the possibility of having, on a large scale, significant results in relation to the control of energy consumption. However, in these economically tumultuous times, it is not always easy for cities to face with this challenge; they are actively looking for effective, efficient and proactive new solutions and methods that can help them improve the energy performance of their building stock.

In this context, one of the main topic is that related to the management of energy and environmental resources in urban centers characterized by a growing densification; it is the phenomenon common to many centers of contemporary cities: the town cramming. A building density, mismanaged, can have a negative impact on the urban environment and the living comfort (Hall, 2001): a poor access to natural lighting and solar radiation in the home, the lack of green spaces and the thermal energy storage effect are just some of the effects of this phenomenon. For this reason, higher density developments require a careful attention to design quality, in respect of both individual buildings and the layout of developments. A proper planning should guarantee that homes meet modern standards and expectations for internal space, private and public open space, natural light and ventilation.

In the debate on how to govern properly the transformation of the cities to ensure the maximum advantage for the citizens, the "smart" revolution brought new tools for managing the urban complexity so much that many experts consider smartness and urban sustainability as running on the same track.

This scenario calls for a more conscious awareness to the issues of the territorial government and requires a multi-scale and cross-sectorial approach (Bourdic & Salat, 2012) as well as innovative forms of governance and financing models: from the building's efficiency to the urban morphology, from the individual behaviors of citizens to good practices in public administration.

That's why the international debate on energy issues at urban scale is increasingly less sectorial; it is not a case if the *leitmotiv* of the conferences discussed in this contribution lies in the intention of pooling experiences and skills of different disciplines broadening the debate to the civil society.

UPPD - ANNUAL INTERNATIONAL CONFERENCE ON URBAN PLANNING AND PROPERTY DEVELOPMENT

Where: Bologna - Italy

When: 5 - 6 October 2015

http://www.urban-ppd.org/

The Annual International Conference on Urban Planning and Property Development (UPPD), deals with the subject of building environment on a large scale and mainly from the point of view of urban and regional planning. It serves as a platform for academics, researchers, scientists, consultants and policy makers to share experiences and explore science, methods, tools, analysis as applied to different aspects of the cities in order to improve urban planning and property development and to enhance the lifestyle of the community. The main topics are related to the field of urban planning, urban design, real estate and property development but also to energy use and its implications.

UPADSD - URBAN PLANNING AND ARCHITECTURAL DESIGN FOR SUSTAINABLE DEVELOPMENT

Where: Lecce – Italy

When: 14-16 October 2015

http://www.ierek.com/events/urban-planning-architecture-design-sustainable-development/

The aim of "Urban Planning and Architecture Design for Sustainable Development Conference" is to create a table of discussion and debate around the sustainable development especially in terms of resource consumption. The conference deals with all aspects of development and planning and brings together scientists and other stakeholders from across the globe to discuss the latest advances in the field aiming to highlight developments in managerial strategies and assessment tools for policy and decision makers. There are certain topics related to architectural and urban design with the aim to identify the principles of proper and efficient design to address sustainable and energetic cities. The main topics strictly connected with the energy and build environment issues are the following:

- Planning Approaches for Sustainable Development.
- Energy and the environment.
- Building Physics and Technology.
- Sustainable design and configuration of sustainable cities.

SASBE2015 - SMART AND SUSTAINABLE BUILD ENVIRONMENT

Where: Pretoria – South Africa
When: 9 -11 December 2015
http://sasbe2015.com/

The smart revolution opens other fields of investigation to face with energy challenges connected with build environment thanks to the recent development of advanced smart systems for efficient use of resources. The conference provides the forum to define and test instruments and strategies of this technological revolution starting from the assumption that limited timeframes and resources need smarter ways of rapidly improving sustainability performance of the built environment. On this premise several subthemes branch:

- Smart, sustainable and resilient cities
- Smart and sustainable urban planning, design and management
- Responsive, regenerative and net positive design
- Biodiversity, landscaping and productive environments
- Intelligent buildings and smart technologies
- Smart and sustainable materials, technologies and techniques
- Productive and healthy working and living environments
- Smart and sustainable estate and facilities management
- Smart and sustainable energy, water, waste, transport and communications systems
- Performance assessment tools, indices and rating systems
- Strategies, systems, regulations, procedures, structures and community engagement for smart and sustainable transformation

SBE 16 - INTERNATIONAL CONFERENCE ON SUSTAINABLE BUILT ENVIRONMENT

Where: Hamburg – Germany
When: 8-11 March 2016
http://www.sbe16hamburg.org/

Strategies, stakeholder and success factor are the keywords of this conference. It means that it is now widely acknowledged that a real change for the urban sustainable development comes through a multi-sectorial approach that first involves citizens. The conference main topics are focused on issues connecting building environment, new as well as existing, and sustainability, both on a global and on a regional level but also on building and product level, in terms of strategies and legislation at the local level as zero emission, water management, mobility and environment, organizational efforts. The energy is one of the most important issues of the conference although it is tackled more on the implementation and integration of renewable energies in the urban environment, than on strategies for the reduction of energy consumption. One of the strengths of the conference lies on the location: the hosting city of Hamburg offers the opportunity to discuss the topics close to a number of best-practice buildings and urban-planning concepts developed in the last years with high-energy efficiency standards.

INTEP - INTERNATIONAL "SUSTAINABLE BUILT ENVIRONMENT REGIONAL CONFERENCE 2016"

Where: Zurich – Switzerland

When: 13-16 June 2016

http://www.intep.com/Aktuelles-236.html

The title of the conference, part of the "Sustainable Built Environment" series, confirms the trend line of the last years which identifies in the Systemic vision the main way to face with sustainable challenges related to the urban areas development: "Expanding Boundaries: System Thinking in the Built Environment". It offers a platform for exchange between researchers and practitioners from the construction sector to promote system thinking in sustainable building. The main topics related with energy issues are the following:

- integral approaches for energy and resource efficiency,
- decentralized energy supply and infrastructure for buildings and cities,
- life-cycle oriented buildings and construction materials.

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IMAGE SOURCES

The image shown in the first page is taken from: http://fineartamerica.com/featured/urban-crowding-john-chehak.html

AUTHORS' PROFILES

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Architect, she received a master's degree with honors from the University of Naples Federico II with a thesis in Architectural and Urban Design. She operates in the field of sustainable buildings and environments and since 2014 she works with the Department of Civil, Architectural and Environmental Engineering within the research project Smart Energy Master investigating the "smart" performance of the Metropolitan City of Bari, Italy.

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TeMA

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CITIES, ENERGY AND MOBILITY

STRATEGIES FOR CONSUMPTIONS' REDUCTION

3 (2015)

Urban mobility flows in London. Image is from https://www.pexels.com/photo/london-telephone-booth-long-exposure-lights-6618/

TeMA Journal of Land Use, Mobility and Environment

EDITORIAL PREFACE:

CITIES, ENERGY AND MOBILITY: STRATEGIES FOR CONSUMPTIONS' REDUCTION

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Transport energy consumption accounts for about one third of total energy consumption in the EU. Despite significant advances in technology, energy consumption in transport sector has increased in most EU countries in the last three decades. Long-term forecasts (up to 2030) estimate that energy consumption will further increase in all economic sectors, experiencing the most rapid growth in the transport one.

This issue of TeMA is focused on approaches, methods, techniques and tools related to urban and regional mobility with regards to energy consumption reduction and saving. In details the issues proposes articles on on strategies and practices for energy consumptions' reduction, low carbon emissions for public and individual transport modes.

The section "Focus" collects four articles. The first one, titled "A Markov Chain Model of Land Use Change" by Michael Iacono, David Levinson, Ahmed El-Geneidy, Rania Wasfi, presents an example of a modelling framework based on Markov chain approach. The model assumes that land use at any given time, which is viewed as a discrete state, can be considered a function of only its previous state. To illustrate this process, a Markov chain model is estimated for the Minneapolis-St. Paul, MN, USA (Twin Cities) metropolitan region. Using a unique set of historical land use data covering several years between 1958 and 2005, the model is tested using historical data to predict recent conditions, and is then used to forecast the future distribution of land use decades into the future.

The second article, titled "A Tool For Appraising Mobility Environment With A Percept Based Index Measure" by Abdulmajeed Olaremi Shittu and Muhammad Zaly Shah (Universiti Teknologi Malaysia) addresses the issues of complexities and data dirtiness in mobility analysis and proposes a new methodology to asses travelers' perception of "mobility environments". The proposed methodology involved a two-pronged survey of transport professionals and randomly sampled travelers. Authors propose an application to the metropolitan area of Ilorin in Nigeria. The results of the methodology's implementation reveals that a high activity mix, high road and pedestrian network density are perceived by travelers as a good mobility enhancing qualities a city should possess. However, aggregate indexing indicated that enhancing development characteristics, mode characteristics, travel and economic attributes, are the most important for the study area. The methodology laid out in this paper is targeted at facilitating the development of cost effective means of identifying urban mobility challenges by local authorities and can provide an alternate

assessments procedure aimed at simplifying mobility planning decision making, especially where the normal range of required data and information to run sophisticated mobility evaluations are lacking.
The third article, titled "A Land-Use Approach for Capturing Future Trip Generating Poles" by Iraklisis Stamos, Aifadopoulou Georgia, Evangelos Mitsakis, Maria Morfoulaki and Iasonas Tamiakis (Centre for Research and Technology, Hellas) deals with the integration of land-use and transportation planning and proposes an integrated methodology for estimating trip generating poles. The proposed methodology consists of three steps: i) the identification of trip-generating poles; ii) the development of scenarios related to the probability of these changes occurring and their potential magnitude and iii) an estimation of future trends in passenger flows. Authors apply the methodology to the Metropolitan area of Thessaloniki, Greece. Using a wide range of data obtained from different sources including development plans, national statistical services and research projects' and studies' findings, the study estimates trip-generation subsequent to land use changes within the study area. The results of the application in the case study of Thessaloniki reveals that the creation of new trip generating poles and the increase of trips' generation and distribution is correlated with the type of land use development and modifications as well as changes in provided transport services. The results of the study is assessed by local experts, representing various key-disciplines of the area's planning stakeholders, resulting in useful outcomes. The methodology laid out in this paper can be applied as a useful evaluation tool that can support planners and decision makers in the development of integrated land-use and transportation policies.
The fourth article titled "Tourism and Mobility. Best Practices and Conditions to Improve Urban Livability" presented by Rosa Anna La Rocca. This paper considers the relation between tourism and mobility and tries to highlight how tourism can act as a driving urban function in order to promote more sustainable lifestyles. Tourism and mobility are strictly connected: moving from the usual residential place for leisure or entertainment represents the essential condition of tourism. There is no tourism without physical displacements, as the WTO definition affirms, highlighting that the movement of people is connected to two different mobility forms.
The section "Land Use, Mobility and Environment" contains the article "Council tax policies and territorial governance: analysis and outlook of a difficult relationship" by Simone Rusci from University of Pisa in Italy. The article examines the connections between fiscal policies and urban planning, focusing on different types of taxes and discussing the aspects that have come to influence planning practice. In particular, the article analyzes from an urban planning viewpoint the consequences of new fiscal instruments on planning, paying special attention not only to problems, but also to unexpressed potential in management tools: urban equalization above all, transfer of development rights, and land consumption mitigation measures.
The section "Review Pages" defines the general framework of the issue's theme, with an updated focus on websites, publications, laws, urban practices and news and events on the subject of energy reduction consumption in the transport sector. In particular, the Web section by Raffaella Niglio describes three web resources: i) the Transport Research and Innovation Portal; ii) the Bump mobility website and iii) the Eltis portal. The Books section by Gerardo Carpentieri briefly reviews three relevant books related to the Issues' theme: i) "50 BIG IDEAS - Shaping the Future of Electric Mobility"; ii) "Urban Mobility in the Smart City Age" and iii) "Smart and Sustainable Logistics for a Competitive Europe". The Law section by Laura Russo keeps readers up to date with recent European directives on sustainable mobility. The Urban Practices section by Gennaro Angiello presents two relevant case studies of sustainable city logistic solutions: i) The Cityporto of Padova in Italy and ii) the Elcidis Urban Consolidation Center of La Rochelle in France. Finally, the News and Event section by Andrea Tulisi reports on five conferences related to the Issue's theme that will be held in 2016.

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A MARKOV CHAIN MODEL OF LAND USE CHANGE IN THE TWIN CITIES, 1958-2005

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ABSTRACT

The set of models available to predict land use change in urban regions has become increasingly complex in recent years. Despite their complexity, the predictive power of these models remains relatively weak. This paper presents an example of an alternative modeling framework based on the con- cept of a Markov chain. The model assumes that land use at any given time, which is viewed as a discrete state, can be considered a function of only its previous state. The probability of transition between each pair of states is recorded as an element of a transition probability matrix. Assuming that this matrix is stationary over time, it can be used to predict future land use distri- butions from current data. To illustrate this process, a Markov chain model is estimated for the Minneapolis-St. Paul, MN, USA (Twin Cities) metropoli- tan region. Using a unique set of historical land use data covering several years between 1958 and 2005, the model is tested using historical data to predict recent conditions, and is then used to forecast the future distribution of land use decades into the future. We also use the cell-level data set to estimate the fraction of regional land use devoted to transportation facili- ties, including major highways, airports, and railways. The paper concludes with some comments on the strengths and weaknesses of Markov chains as a land use modeling framework, and suggests some possible extensions of the model.

KEYWORDS:
land use, twin cities, statistical models, Markov chain, state dependence

TeMA

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土地利用变化的马尔可夫链模型

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ABSTRACT

用来预测城市地区土地利用变化的一套模型在近些年变得越发复杂。虽然很复杂，但这些模型的预测能力仍然相对较弱。文将介绍一个基于马尔可夫链概念的备选模型框架的例子。这个模型假设，任意给定时间的土地利用（被视为离散状态）可被理解成其前个状态的函数。每对状态之间的转换概率被记为转换概率矩阵的一个元素。假设这个矩阵随着时间变化是静止的，它可被用来根据当前数据预测未来的土地利用分布。为了演示这个过程，特用一个马尔可夫链模型来为美国明尼苏达州明尼阿波里斯圣保罗市做预测。通过使用涵盖1958年到2005年之间一些年份的一套独特的土地利用历史数据，可用历史数据对模型进行测试，然后再用来预测未来几十年的土地利用分布。我们还用元级数据集来估计被用于交通设施（包括主要的高速公路、机场和铁路）的区域土地的比例。本文得出结论，提出了关于将马尔可夫链用作土地利用模型框架优缺点的一些评论，并建议对该模型进行一些可能的扩展。

KEYWORDS:
土地利用，子城，统计模型，马尔可夫链，状态依赖

1 INTRODUCTION

Modelling the dynamics of land use change in urban regions is an inherently difficult task. Despite improvements to the theoretical and empirical frameworks within which the problem of land use change has been cast, few researchers have been able to produce operational models with the ability to predict land use change accurately. Those who have experienced modest successes have largely done so at the expense of tractability and ease of interpretation. Meanwhile, there has been an emerging consensus that models attempting to predict land use change ought to incorporate probabilistic elements in order to make them more realistic and to represent the significant uncertainty that surrounds land development decisions. This paper describes the application of one type of probabilistic land use change model based on the notion of a Markov process. Within this process, the study area (in this case the Minneapolis-St. Paul, MN metropolitan area) is divided into a regular lattice of cells, each of which may take on one of 10 discrete land use states at any given time. At the heart of the Markov process formulation is the notion that the state of a cell at any time is a function only of its previous state. Transitions between states are governed by a matrix of transition probabilities, which are estimated based on actual land use data. Where the assumptions of the Markov process hold, the transitions of cells between states through time can be modelled and predicted as Markov chains. Markov chain models have a relatively simple and intuitive logic that makes them attractive alternatives to more complex formulations of stochastic land use models, at least for sketch planning purposes. Of interest is their ability to fore- cast over medium to long-term time horizons. In this study we use land use data for the Minneapolis-St. Paul (Twin Cities) region covering various years between 1958 and 2005 to calibrate a Markov chain model of land use change. The data represent a fine scale of spatial resolution, with the dimensions of each cell measuring 75 meters by 75 meters. This data set is applied to both "backcast" changes from the past to the present and to predict the distribution of land use decades into the future. The paper is organized as follows. The next section describes the properties of Markov chains and cites several of their applications to questions of urban land use. The third section formally introduces the structure of the model and the assumptions required for its application. The fourth section describes the cell- level data set constructed for this study, and uses it to develop an estimate of the amount of land use in the region devoted to transportation. The fifth section describes the results of the application of the Markov chain model to the regional land use data, generating historical predictions based on earlier periods of data and using more recent data to forecast several periods into the future. The sixth, and concluding, section comments on the strengths and limitations of the model while also suggesting some directions in which it might be generalized in order to increase its usefulness as a planning tool.

2 MARKOV CHAINS AND LAND USE MODELING

2.1 PROPERTIES OF MARKOV CHAINS

Markov chain models are essentially projection models that describe the probabilistic movements an individual in a system comprised of discrete states. When applied to land use and many other applications, Markov chains often specify both time and a finite set of states as discrete values. Transitions between the states of the system are recorded in the form of a transition matrix that records the probability of moving from one state to another. The definition of a system as a finite Markov Chain requires a certain set of properties to hold (Stokey and Zeckhauser, 1978). These include:

- a finite number of well-defined states that mutually exclusive and collectively exhaustive (meaning that the rows of the probability matrix must sum to one);
- the probabilities of the transition matrix must be the same for any two periods;
- probabilities have no memory, that is, the state tomorrow depends only on the state today (the Markov condition);

- time periods must be uniform in length or duration.

In practice, one or more of these conditions may not be met. This is especially true in the case of land use applications, where the uneven temporal availability of data often requires relaxation of the last assumption. Moreover, the assumption regarding constant transition probabilities (or stationarity of the system) is often rejected when tested as a statistical hypothesis, yet is still included in forecasting applications. Turner (Turner, 1987) argues that, in fact, land use change is not a strictly Markovian process, though it does have some such elements. For example, the transition of a land use cell between states may be influenced by state of neighbouring cells as well, sometimes referred to as the "spatial neighbourhood effect". Additionally, transition rates are often not constant through time, especially over longer periods. Thus, an important question may concern the optimal length of transition periods in Markov chains. Unfortunately, the transition probabilities estimated in most empirical applications are a function of data availability and take the length of transition periods as given.

2.2 PREVIOUS APPLICATIONS

Markov chains as a modeling tool evolved out of social and economic science research dating to the late 1950s. Empirical applications of Markov chains in urban and regional analysis began appearing in the 1960s. One such early application was Clark's use of Markov chains to model the movement of rental housing in U.S. cities (Clark, 1965). Using census tract data on mean contract rents, Clark described the movement of census tracts between 10 different rent classes in four different cities (Detroit, Pittsburg, Indianapolis and St. Louis) over the period from 1940 to 1960. Another application by Lever sought to describe the decentralization of manufacturing in the Clydeside region of Glasgow, Scotland, UK (Lever, 1972). Using postal directory data on 419 manufacturing firms for the years 1959, 1964 and 1969, Lever modeled the movement of manufacturing firms between four zones of the city as both a closed and an open system, with the latter formulation allowing for firm birth, death and inter-regional migration. Applications of Markov chains to urban land use dynamics began to appear in the 1970s as an alternative to the use of large-scale urban simulations models for land use forecasting. Bourne cited the ability to incorporate elements of inertia in land use succession processes as a key advantage of Markov chain models (Bourne et al., 2000). In particular, the matrix of transition probabilities could be seen as embodying important aspects of urban land use such as the durability of housing and other building stock. This was critical, since stock adjustment processes were largely absent from previous models of land use change. Bourne illustrated these principles by estimating transition matrices with data on central city land use from the municipality of Toronto over the period from 1952 to 1962. Key findings of this study indicated that land use in developed parts of urban areas tends to stay in the same state (land use class) despite the occurrence of rebuilding or structural modification. Changes in land use that did occur tended toward more intensive uses (e.g. residential to commercial), with scattered, vacant parcels among the most likely candidates for conversion. While Bourne's study relied on parcel-level data with recorded changes to the building stock, Bell exemplified the use of remotely-sensed data and the cell-based representation of land use that is common in most contemporary studies of land use change (Bell, 1974). Bell studied land use change on San Juan Island, WA from 1949 to 1971 by breaking the study area into 100 meter-by-100 meter (1 hectare) grid cells, using the remotely-sensed land use imagery. This data was used to test for independence of current and preceding land uses for the given years. Results indicated that land uses for the later year were not independent of the preceding land use, lending support for the Markov chain formulation. Additional empirical findings on tests of stationarity of the transition matrix and a continuous time formulation of the Markov chain model, where transition probabilities are replaced by rates of change, are reported in Bell and Hinojosa (Bell and Hinojosa, 1977). More recent studies using Markov chains for land use prediction have sought to broaden the scope of application of these models and probe new kinds of questions. Turner compared the results of a Markov chain model with two other types of spatial simulation models to forecast long-term changes in landscape cover in the Piedmont region of northern Georgia (Turner, 1987). Muller and Middleton provide an application to the Niagara region of Ontario, Canada, where land use data from five different points in time between 1935 and 1981 are used to estimate a three-state Markov chain to predict the consequences of urban growth (Muller and Middleton, 1994). McMillen and McDonald demonstrated the coupling of Markov chains with regression models (McMillen and McDonald, 1991). In order to estimate the influences of land values on zoning changes they estimated a price function to predict land values, which then serve as explanatory variables for the transition probabilities of a three-by-three matrix of land use zoning change. Weng integrated the use of geographic information systems capabilities and remote sensing with a Markov chain model to predict the possible land use consequences of rapid urbanization and industrialization in the Zhujiang Delta of China (Weng, 2002). Finally, Levinson and Chen provide a Markov chain model of land use change in the Twin Cities region using historical data (Levinson and Chen, 2005). The states of the model include both a land use class and an indicator of the presence and type of highway within each cell. The model is used to demonstrate the mutually interconnected evolution of transportation networks and land use patterns.

3 THE MODEL

The basic premise of the Markov chain model is that land use at some point in the future $(t+1)$ can be determined as a function of current land use (t), or mathematically,

$$X_{t+1} = f(X_t) \tag{1}$$

where $X_{(t)}+1$ represents the land use at time $t+1$ and X_t represents land use at time t. The structure of the Markov chain model as applied to land use change involves a vector n_t with dimension $m \text{ x } 1$ (where m represents the number of states, in this case land use classes) describing the distribution of land use among current states and an $m \text{ x } m$ matrix of transition probabilities (P) that governs the probability of transition between each pair of land uses, i and j. The model can then be written as a difference equation in matrix form Baker (Baker, 1989)

$$n_{t+1} = Pn_t \tag{2}$$

where n_{t+1} is another $m \text{ x } 1$ column vector describing the distribution of land use at time $t+1$. Since the transitions are probabilities, it follows that:

$$\textstyle\sum_{j=1}^{m} p_{ij} = 1 \quad i = 1,2, \ldots m \tag{3}$$

meaning simply that the rows of the transition matrix must sum to 1. Maximum likelihood estimates of the transition probabilities can be obtained as (Anderson and Goodman, 1957):

$$\hat{p}_{ij} = n_{ij} / \textstyle\sum_{j=1}^{n} n_{ij} \tag{4}$$

where p_{ij} is the probability of transition between i and j and n_{ij} denotes the number of transitions from i to j. These values can all be obtained empirically. To test the validity of the Markov chain model, a useful first step is to test the null hypothesis that land use at one point in time, $t+1$, is statistically independent of land use at the preceding time period, t. This test can be conducted using standard contingency table techniques for cross-classified categorical data. The expected values for each cell indicating the number of transitions between i and j can be compared with the actual number of transitions to compute the test statistic, Pearson's chi-square, which is distributed χ^2 with $(M-1)^2$ degrees of freedom, where M indicates the number of land use classes (in this case 10). Under the hypothesis of independence, the expected number of transitions in each cell of the transition matrix $\hat{m}_{ij}$ can be calculated by:

$$\hat{m}_{ij} = n_{i+}n_{+j} \tag{5}$$

where n_{i+} denotes the marginal total of transitions for the ith row of the transition matrix and n_{+j} denotes the marginal total for the jth column of the transition matrix. Using these expected values, the test statistic (K^2) then takes the form:

$$K^2 = \sum_{i=1}^{I} \sum_{j}^{J} \frac{(n_{ij}+\hat{m}_{ij})^2}{\hat{m}_{ij}} \tag{6}$$

The test statistic is typically given the notation K^2 instead of X^2 to differentiate it from its distribution, which is chi-square. The null hypothesis of independence is almost universally rejected, indicating some level of dependency between successive land use states. Another important property of Markov chains, as identified in an earlier section, is the property of stationarity, particularly as it applies to the transition probability matrix. This property is critical for applications in which a Markov chain model is to be used for forecasting. The transition probability matrix (P) is assumed to remain constant in successive periods, meaning that at any future period $t+k$, the matrix of cell transitions can be obtained by multiplying the vector of current land uses, n_t nt by the transition probability matrix P, raised to the kth power (P^k). In most forecasting applications, the transition probability matrix is assumed to remain constant through successive time periods, and is seldom tested empirically. This study follows the work of Bourne (1971), who compared transition matrices for successive periods using simple correlations between cells of the matrix. By expressing the elements of one matrix $(P_{t+1,t+2})$ as a function of another $(P_{t,t+1})$, one can provide a rough check for stationarity by determining whether the correlation between matrix elements is significantly different from a value of one. In order to use the Markov chain model for prediction, an additional stochastic element is added. Since the transition probabilities represent estimates of the likelihood of conversion from one land use state at time t to one of 10 other states at time $t+1$, a mechanism is added to introduce randomness to the model and its predictions of future states. Since each row of the transition probability matrix sums to one, predictions of future land use states are obtained by drawing a pseudorandom number between zero and one, rounded to four digits. If the number falls within the probability space allocated to a particular land use state according to the transition matrix, then that state is chosen for conversion. This process is repeated for each land use cell in the data set. Predicted land uses can then be compared to actual observed land uses to summarize the accuracy of the model's predictions..

3 DATA

The land use data employed in this study build from a previous set of land use data used by Levinson and Chen (Levinson and Chen, 2005) in an earlier study of the Twin Cities. The expanded data set comprises a time series with observations for the years 1958, 1968, 1978, 1984, 1990, 1997, 2000 and 2005. Land use data for years prior to 1984 were manually digitized from paper copies of land use maps stored at the John R. Borchert Map Library at the University of Minnesota. Data for selected years from 1984 to 2005 were obtained from the Metropolitan Council, the Twin Cities' regional planning agency and designated metropolitan planning organization (MPO), which maintains a parcel-level land use inventory for the region that is updated every few years. The parcel-level land use data was converted to a raster format and rectified to reduce geometric distortion. Some error remains due to the manual digitization process and the lower level of accuracy associated with earlier mapmaking processes. Differences in classification schemes for land use across years were addressed by adopting a common set of 10 generalized land use classes. These land use classes, along with their adopted abbreviations, include: Airports (AIRPOR); Commercial (COMM); Highway (HWY); Industrial (INDUST); Parks (PARKS); Public (PUBLIC); Railroads (RAILWA); Residential (RES); Vacant (VAC); Water (WATER).

The data set covers a large portion of the core seven counties of the Twin Cities region. Some portions of the region could not be covered due to a need to limit the analysis to the part of the region for which common land use data sets could be acquired for each year. The portions left out of the study area are comprised mostly of low-density residential and non-urban uses, which would likely be classified as vacant under the present scheme. The resulting study area covers approximately 3,426 square kilometers (1,322 square miles). The study area is partitioned into a grid of 75-meter by 75-meter cells, a spatial resolution much finer than the 188-meter square cells used in Levinson and Chen's study, leading to a roughly tenfold increase in the number of land use cells in the study area. This produces a data set containing over 610,000 cells. Each cell is assigned a land use class according to its predominant land use. Figure 1 shows the land use patterns in the region in 1958 and 2005, respectively, while Figure 2 presents a summary of trends among the land use classes from 1958 to 2005.

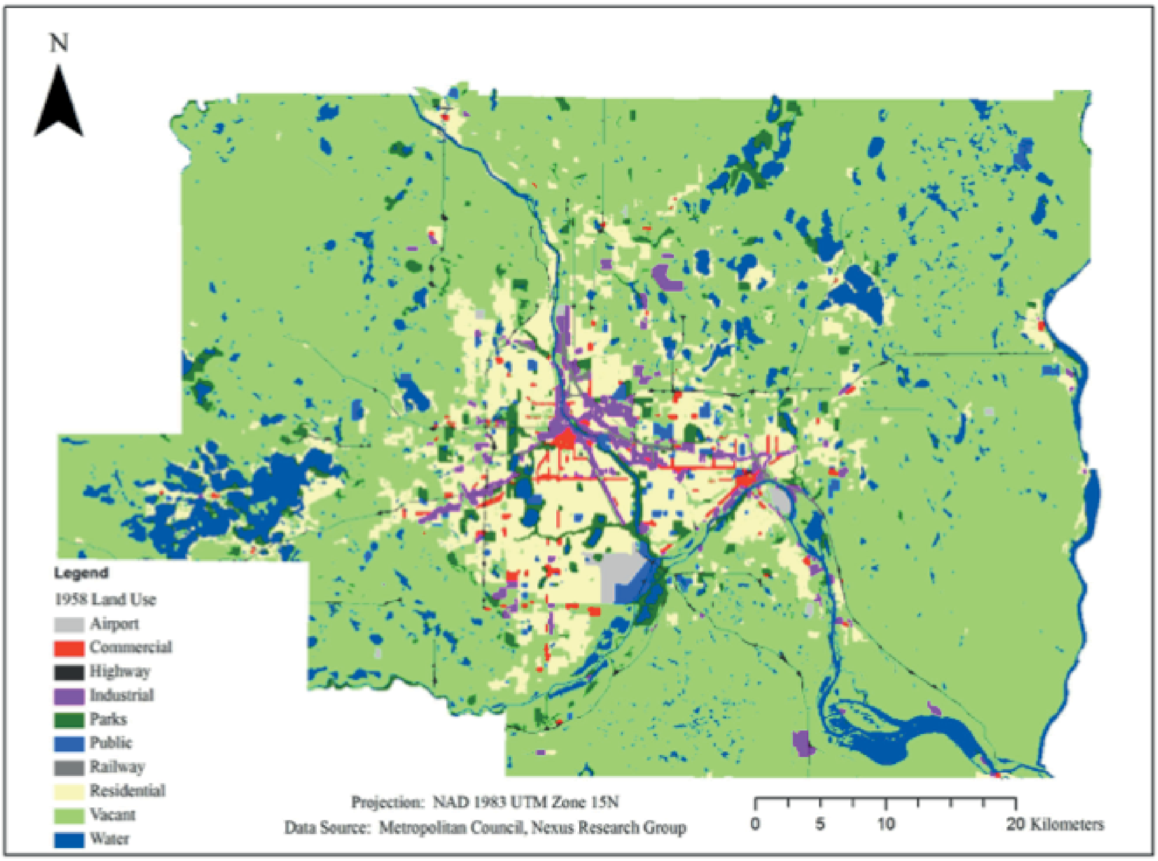

Fig. 1a Land use patterns in the Twin Cities region 1958

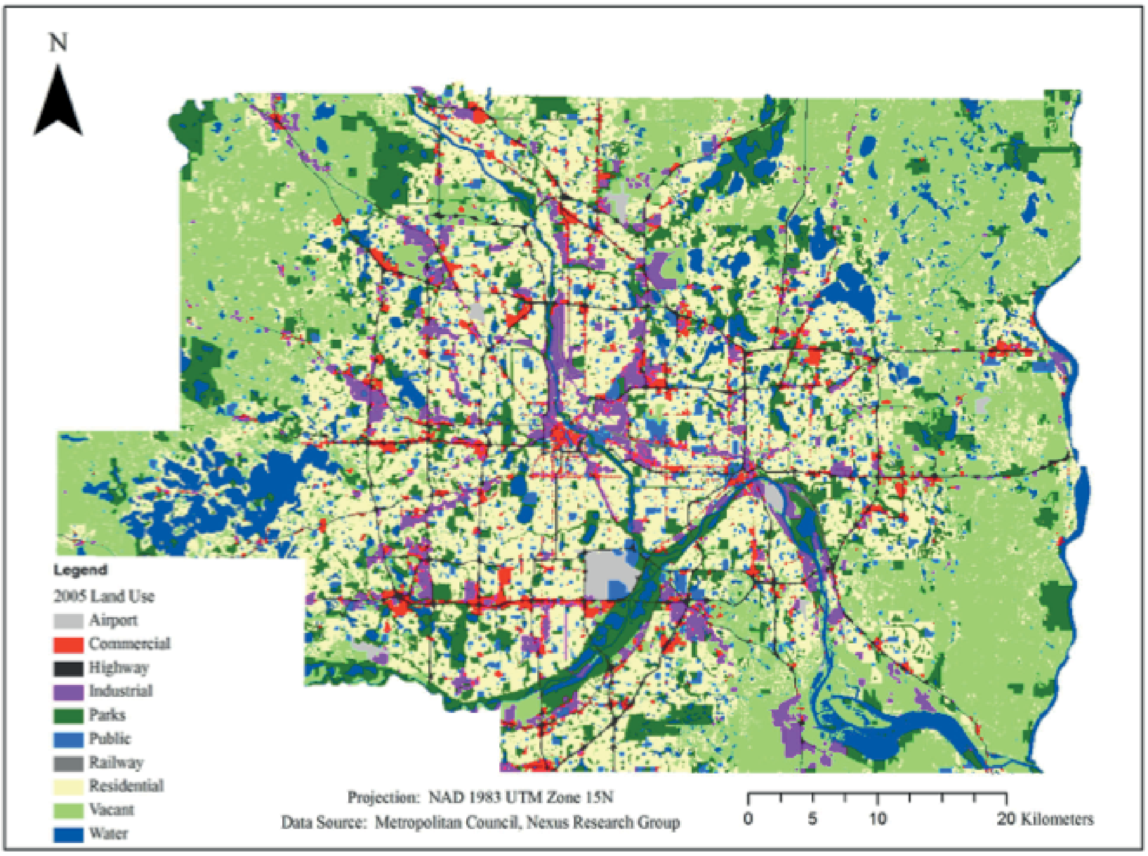

Fig. 1b Land use patterns in the Twin Cities region 2005

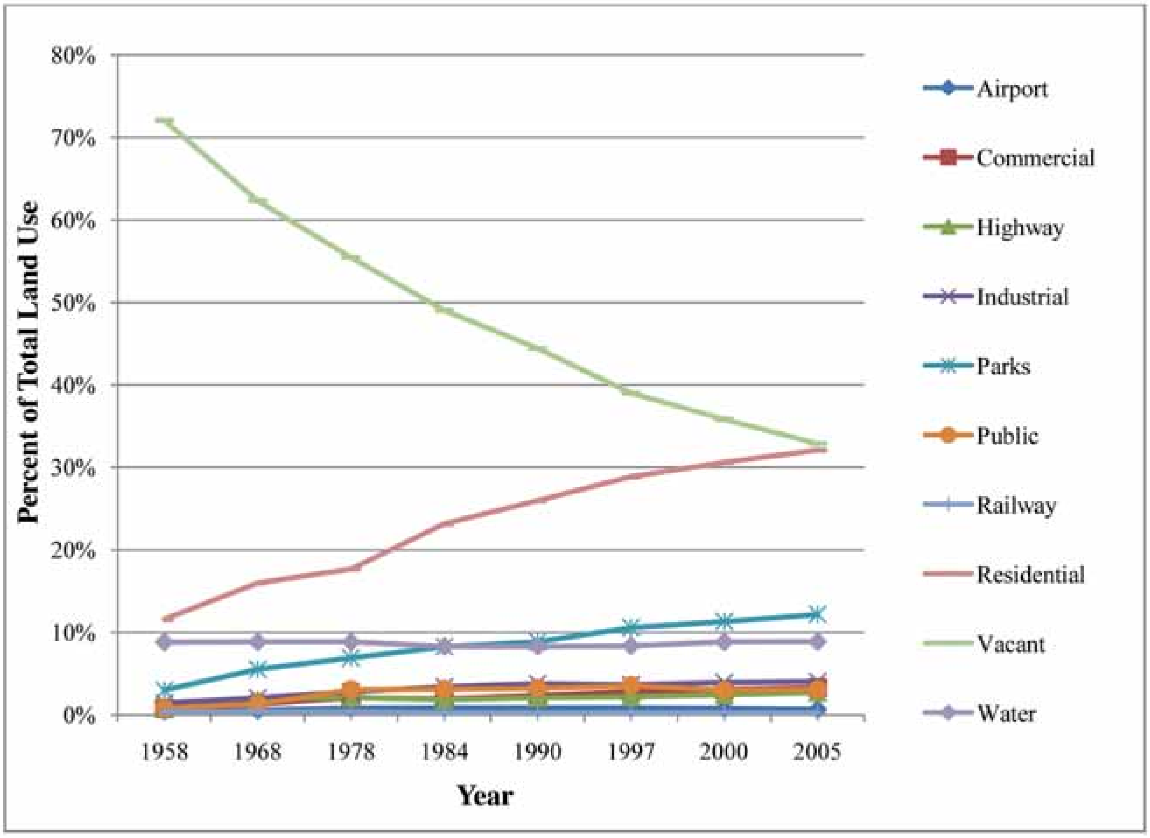

Fig. 2 Land use patterns in the Twin Cities region 2005

Virtually all land use classes have increased over this period, with the greatest increase in land use registered by the residential category. This growth has largely come at the expense of vacant land, as the region has been able to accommodate growth over the years via outward expansion. The data set contains three classes of land use related to transportation infrastructure: airports, railroads, and major highways. We can use the intermittent observations of land use to develop rough estimates of the amount of land that is consumed by transportation facilities and how it has changed over time as the region has developed. In the earliest year for which data are available (1958), transportation land uses covered 9,907 of the cells in the data set, the equivalent of about 1.6 percent of the total area in our sample or 55.7 km2 (21.5 mi2). Highways accounted for about one-half of all transportation-related land use. By 2005, these same three land uses covered a total of 22,187 cells, or 3.6 percent of the total area. Much of this growth came in the form of new highways, with highway land use increasing more than threefold. By comparison, the population of the 7-county core of the region, from which the land use data were drawn, increased by about 87 percent, from 1.5 million to 2.8 million. We interpret this estimate of transportation-related land use as a lower-bound estimate and, most likely, an underestimate. The land use data have no category for local roads which tend to be a denser network than regional highways, and treat parking as part of the respective land uses they serve. Other recent published estimates of parking coverage suggest that in urban settings, parking may account for 4 to 6 percent of total land use, while suburban settings tend to have lower amounts of coverage (mostly below 2 percent) (Davis et al., 2010a, Davis et al., 2010b). Were these two components to be added in to the total of transportation-related land use, the total coverage for the region would probably be somewhere in the range of 5 to 10 percent of all urban land use.

	AIRPOR	COMM	HWY	INDUST	PARKS	PUBLIC	RAILW	RES	VAC	WATER	TOTALS
AIRPOR	2874	12	2	148	9	90		59	160		3354
COMM	9	3709	59	588	238	508	1	2257	635	2	8006
HWY		15	10989	14	3	13		27	57		11118
INDUST	4	825	138	7641	343	496	21	1114	1886	4	12472
PARKS	383	364	137	378	18440	1191	4	3096	9622	76	33691
PUBLIC	62	226	5	95	354	4984	1	1688	644	3	8062
RAILW		3		9	3	4	2162	10	18		2209
RES	138	4597	261	1865	5579	5646	14	72155	7089	74	97418
VAC	1375	2976	1304	6198	17038	5676	35	27410	318548	174	380734
WATER		1	2	10	103	3		65	104	53636	53924
TOTALS	4845	12728	12897	16946	42110	18611	2238	107881	338763	53969	610988

Tab.1 Observed cell frequencies, 1968-1978

The K^2 statistic can be compared to a χ^2 distribution with $(10-2)^2 = 81$ degrees of freedom. With a critical region of $\alpha = 0.05$, values of the test statistic less than approximately 100 would indicate that land uses in 1978 were independent of those in 1968.

	AIRPOR	COMM	HWY	INDUST	PARKS	PUBLIC	RAILW	RES	VAC	WATER	TOTALS
AIRPOR	27	70	71	93	231	102	12	592	1860	296	3354
COMM	63	167	169	222	552	244	29	1414	4439	707	8006
HWY	88	232	235	308	766	339	41	1963	6164	982	11118
INDUST	99	260	263	346	860	380	46	2202	6915	1102	12472
PARKS	267	702	711	934	2322	1026	123	5949	18680	2976	33691
PUBLIC	64	168	170	224	556	246	30	1423	4470	712	8062

RAILW	18	46	47	61	152	67	8	390	1225	195	2209
RES	773	2029	2056	2702	6714	2967	357	17201	54014	8605	97418
VAC	3019	7931	8037	10560	26241	11597	1395	67225	211098	33631	380734
WATER	428	1123	1138	1496	3717	1643	198	9521	29898	4763	53924
TOTALS	4845	12728	12897	16946	42110	18611	2238	107881	338763	53969	610988

Tab.2 Expected cell frequencies, 1968-1978

With a computed K^2 of roughly $2.75x\,10^6$, this is clearly not the case. Again, it should be noted that in the case of Markov chain models of land use, the hypothesis of independence is nearly always rejected. Historical dependence in land use is a strong force, as is indicated by the primacy of the diagonal elements of the observed transition matrix. Another way to examine the validity of the Markov chain framework is to test the stability or stationarity of the transition matrix. As described in an earlier section, one way to do so is to observe the correlation between the elements of matrices describing the transition probabilities. By regressing the matrix elements of a subsequent time period on a base period, it is possible to determine whether (and how far) the correlations between the two matrices deviate. The matrix of transition probabilities for the period from 1958 to 1968 will serve as a base period, since this is the earliest transition period for which data is available. Table 3 shows the results of three successive transition probability matrices being regressed on the original 1958 to 1968 matrix. The X and Y variables denote the response and predictor variables in the regression. The fit of the equation is summarized with the adjusted R^2 value.

				95% C.I.	
Y	X	ADJ. R^2	β	LOWER	UPPER
1968-78	1958-68	0.977	0.98	0.95	1.01
1978-90	1958-68	0.943	0.948	0.902	0.995
1990-2000	1958-68	0.962	1.029	0.988	1.07
1968-78	1958-68	0.977	0.98	0.95	1.01
1978-90	1958-68	0.943	0.948	0.902	0.995

Tab.3 Summary of transition probability regressions

The value of the slope coefficient (β) is indicated, along with the lower and upper bounds of a 95% confidence interval for the mean value. In two of the three cases the 95% confidence interval includes the value of one, and in the third case the upper bound falls just short of one. While these results do not provide entirely conclusive evidence on whether the transition matrix is stationary, they offer some confidence that dramatic changes in transition probabilities are not occurring over time. Moreover, even a lack of stationarity does not need to preclude the use of Markov models. As Baker (Baker, 1989) has noted, stationarity can be assumed as a heuristic device for scenario generation using Markov chains. It is possible to evaluate how well the Markov chain model predicts land use change by using the historical time series to produce "backcasts" of land use for previous points in time. For example, the 1958 to 1968 transition probability matrix can be used as a base to predict forward in roughly 10-year increments to the years 1978, 1990 and 2000. Due to the different sources of data and data-generating processes noted for the years before and after 1984, we can provide "control" forecasts for the newer data using the 1984 to 1990 transition probability matrix as a base year matrix. These forecasts are provided for the years 1997 and 2005. Again, the land use conversion process in the model is governed by a random number generation procedure that draws values that correspond to the transition probabilities in the matrix for each initial land use state. Forecasts covering more than 10 years use the predicted land use distribution from 10 years prior as inputs to the forecast (e.g. forecast land use for 1990 is used as an input, along with the 1958-1968 probability matrix, for a forecast to the year 2000). This links the forecasts forward through successive time steps and preserves the Markovian principle that future states are only influenced by the present state. Summaries of the accuracy of the forecasts are provided in Table 4.

BASE YEAR MATRIX	FORECAST YEAR	% CORRECT
1958-1968	1978	70
1958-1968	1990	55.2
1958-1968	2000	47.8
1984-1990	1997	84.4
1984-1990	2005	78.5

Tab.4 Forecast accuracy using historical time series data

As the results indicate, the accuracy of forecasts made using the 1958 to 1968 matrix of transition probabilities declines sharply over time. While all long-term forecasts can be expected to decline in accuracy the further they are asked to predict, there is a notable decline between the forecast years 1978 and 1990. This period coincides with the use of different sources of land use data which may not be entirely consistent and which may introduce additional inaccuracy to the forecast. The monotonic decline in accuracy also indicates that errors in forecasts from previous periods are fed forward into subsequent predictions. On the other hand, the forecasts made using a more recent transition matrix (1984 to 1990) as an input show a higher degree of accuracy and a more moderate decline over the second time step. This may be a result of more consistent data as well as a shorter transition period (6 to 8 years). Lastly, we are interested in using the Markov chain model to predict land use patterns several periods into the future. The most recent land use data are available for the years 1997, 2000 and 2005, indicating that the 1997 to 2005 period most closely matches the 10-year transition periods used throughout this study. Thus, a 1997 to 2005 transition probability matrix can be constructed and used for forecasting in 8-year increments. This matrix is reproduced below.

	AIRPOR	COMM	HWY	INDUST	PARKS	PUBLIC	RAILW	RES	VAC	WATER	TOTALS
AIRPOR	0.7388	0.001	0.0068	0.001	0.0325	0.0131	0	0.0055	0.1984	0.0029	1
COMM	0.0001	0.8187	0.0201	0.056	0.0045	0.0227	0.0002	0.0413	0.035	0.0015	1
HWY	0.0004	0.0107	0.9542	0.0054	0.0058	0.0031	0.0002	0.0094	0.0105	0.0001	1
INDUST	0.0004	0.071	0.0099	0.8371	0.0082	0.0086	0.001	0.0106	0.0517	0.0014	1
PARKS	0.0022	0.0036	0.0031	0.0025	0.9128	0.0062	0.0001	0.0116	0.0364	0.0214	1
PUBLIC	0.0001	0.0193	0.01	0.0384	0.0569	0.7364	0.0004	0.0223	0.1091	0.0071	1
RAILW	0	0.0065	0.0142	0.0201	0.011	0.0032	0.9139	0.0168	0.013	0.0013	1
RES	0	0.0024	0.0024	0.0009	0.0041	0.0023	0.0001	0.9634	0.023	0.0013	1
VAC	0.0004	0.0141	0.0099	0.0156	0.0513	0.0057	0.0002	0.0988	0.792	0.012	1
WATER	0.0001	0.001	0.0003	0.0014	0.0136	0.0002	0	0.0055	0.0096	0.9684	1

Tab.5 Transition probability matrix for 1997 to 2005

The 1997 to 2005 matrix is used to forecast forward through three time steps, yielding land use forecasts for the years 2013, 2021 and 2029. These forecasts are shown below in Table 6, along with the land use distribution in 2005, the base year.

	2005	2013	2021	2029	CHANGE (2005-29)	CHANGE (%)
AIRPOR	4047	3273	2674	2266	-1781	-44.0%
COMM	20296	22565	24114	25152	4856	23.9%
HWY	16635	19546	22041	24272	7637	45.9%
INDUST	24503	25961	27040	27620	3117	12.7%
PARKS	74251	81395	86454	89758	15507	20.9%
PUBLIC	18820	16793	15257	14013	-4807	-25.5%
RAILW	1505	1476	1454	1427	-78	-5.2%
RES	195934	211257	223401	233143	37209	19.0%
VAC	200837	171864	149304	131764	-69073	-34.4%
WATER	54160	56912	59249	61573	7413	13.7%

Tab.6 Land use forecasts for 2005 through 2029

Table 6 shows the land use distribution in each forecast year, along with the absolute and percentage changes through each time step. The land use forecasts for each period appear to be sensitive to abrupt, discontinuous changes that occur during the 1997 to 2005 period and are reflected in the transition matrix. The most notable effect is the prediction of a major decline in airport land. While there appears to have been a small decline from 1997 to 2005, this trend is projected out in each of the forecast periods, leading to a predicted decline of 44 percent from 2005 to 2029. This is probably not likely in a growing metropolitan area that anticipates continued growth in air travel in the coming decades. The same can be said of the trend in land used for highways, which is projected by the model to grow by roughly 46 percent. It would be useful to attempt to decompose this predicted growth by class of highway. Interstate and state trunk highway networks are already in place and are not likely to experience sharp increases in the near future, yet county highway networks, which tend to be more robust, may see substantial growth in newly-developing parts of the region. The model also predicts a major increase in residential land use, mostly at the expense of vacant land. This largely reflects the effects of the real estate boom of the late 1990s and early 2000s in the Twin Cities. Due to this reliance on past trends, the model will probably overpredict the demand for residential land use in the 2005 to 2013 period. Once new data become available, this observation can be tested.

3 CONCLUSION

This paper has demonstrated the application of a Markov chain model for fore-casting land use change in the Minneapolis-St. Paul metropolitan region. The Markov chain model has been shown to adequately describe the process of land use change, at least for short to medium-term time horizons. The extremely fine resolution of the land use data produced for this analysis allows for more detailed descriptions of land use transitions over time. The greater availability of data in recent years also allows for models that incorporate shorter transition periods, potentially leading to more accurate forecasts. Still, there are some aspects of the Markov chain model that deserve critical attention, and some directions of extension that could improve the model's output. These will be discussed in turn. One the most desirable qualities of the Markov chain model is its simplicity. It is able to describe the complex and long-term process of land use conversion in terms of simple transition probabilities, making it a potentially useful sketch planning tool. However, this simplicity is also one of its greatest weaknesses. Since Markov chains are essentially projection models, they are not policy-sensitive and cannot easily incorporate the range of policy variables that might be of interest in predicting the impacts of various land use policies. The characterization of Markov chains as projection models also means that there is very little theory to guide their development. Except in cases where they are coupled with other types of models (e.g. McMillen and McDonald's zoning model), they may not encompass some of the important economic and regulatory forces shaping land use patterns in urban areas. These forces are often masked by the application of the transition probabilities. However, it is possible to introduce some of these factors directly into the model. Some applications have specified the transition probabilities themselves as functions of other variables (Brown et al., 2000; McMillen et al., 1991), thus making it possible to empirically estimate their determinants. One can imagine this being a possible path for introducing the influence of transportation networks on land use change within the MC framework. The use of transition matrices from a single period can also lead to forecasts that project short-term and perhaps discontinuous trends. An example of this was the projection of a major decline in airport land in the Twin Cities through 2029, despite countervailing trends in the underlying forces that drive the demand for airline services. A related matter is the application of transition matrices to residential land. Since housing markets are cyclical and are prone to boom-and-bust cycles, predictions based on a period of strong growth (or decline) may tend to overshoot (or undershoot) actual land use trends. Lastly, the Markov chain model, as applied in this study, does not account for neighbor effects. That is, land use in a particular location may be influenced not only by its previous land use, but also by the land uses of its neighbors. This principle has been incorporated into other types of cellular models of land use, such as cellular automata, which model land use as a function of the states of cells in a defined neighborhood. Modifying Markov chain models to incorporate this influence represents a potentially important improvement in model design. Indeed, there have been a handful of recent experimental efforts to design models with characteristics of both of these types of frameworks (de Almeida et al., 2003; Liu and Andersson, 2004; Pontius and Malanson, 2005). The basic Markov chain framework can also be extended in several directions to introduce greater detail and accuracy to processes of land use change. In addition to introducing neighbor effects, land use cells can be merged with data on the presence of transportation network links (Levinson and Chen, 2005) to describe the interaction between transportation networks and the demand for location among competing land uses. A further division of land use into classes based on intensity of use would also improve the model's detail. Residential uses in particular could be classified according to density or building height, along the lines of current zoning classifications. A similar classification scheme could be applied to commercial uses. Finally, more robust measures are needed to account for these additional influences in determining modeled outcomes. The evaluation measures employed in this study were fairly simple, and more elaborate frameworks are needed to model and forecast the interaction of land use with other dynamic processes at work within urban areas.

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A TOOL FOR APPRAISING MOBILITY ENVIRONMENT WITH A PERCEPT BASED INDEX MEASURE

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ABSTRACT

Diverse methods, approaches and models have been employed in explaining mobility in both the urban and human context. However, there has been the ever-present drawback premised on data unavailability, "dyrtiness" or scantiness. More so, the techniques and parameters used, does not provide clues about mobility complexities engendered by attributes of "mobility environments", as a result, determinants of mobility complexities are hardly fully described. To narrow the gap, it is conjectured that systematic evaluation of traveler perception of "mobility environments", may provide hints about the degree to which specified spatial units enhance or hinder mobility, by rating such environment with a perception based index construct we hope will help improve assessments of "mobility environments". This need is underscored by the necessity to explore alternative decision support tools, for mobility evaluations, especially where it may be implausible to apply advanced, high end, data hungry models of mobility evaluation. The method involved a two-pronged survey of transport professionals and randomly selected travelers. The professionals helped with "mobility environment" attributes identification and selection of contextually relevant ones from a list of potential attributes of influence, extracted from relevant literature using the Delphi method. Randomly selected travelers were in turn presented with the short listed attributes for rating on a five point Likert scale. Ratings were then used to determine attribute rankings and their commensurate index equivalents, as a basis for classification. Travelers indicated that a high activity mix, high road and pedestrian network density are good mobility enhancing qualities a city should possess. However, aggregate indexing indicated that enhancing development characteristics, mode characteristics, travel and economic attributes, are the most important for the study area. The measures are targeted at facilitating development of cost effective and parsimonious means of identifying urban mobility challenges by local authorities, to provide a strategic pathway for a city's "mobility environments" qualities to be identified and objectively appraised, in order to satisfactorily target interventions at improving both the "mobility environment" and the quality of life of city inhabitants.

KEYWORDS:
mobility appraisal, mobility environment, index measure, mobility influencers, mobility complexities, traveler perception

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用基于认知的衡量指标来评估移动环境的一种工具

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ABSTRACT

在解释城市和人类移动环境的过程中，人们已经采用了各种不同的方法、途径和模型。但经常存在因数据无效、"被污染"或缺乏而造成的不足。而且，所用的技术和参数并未提供关于由"移动环境"属性造成的移动复杂性的线索，因而很难全面描述移动复杂性的决定因素。为了填补这个空白，我们推测，旅行者对"移动环境"认知的系统评价或许可以提供关于指定空间单位增强或阻碍移动性的程度。通过用一个基于指标结构的认知对这种环境进行评级，我们希望能有助于增强对"移动环境"的评估。对移动评估来说，探索决策支持替代工具的必要性突出了这种需要，尤其是当不可能采用需要大量数据的先进高端移动评估模型。这种方法涉及同时对交通专业人士和随机选择的旅行者进行调查。专业人士可以有助于识别"移动环境"的特性，并从用Delphi 方法从相关文献中提出的潜在影响特性的列表中，选择与环境相关的特性。对于随机选择的旅行者，则会给他们一个李克特5分量表，然他们对所列的特性进行评分。然后用评分来确定特性的排名以及与它们对应的指标等价物，以此作为分类的基础。旅行者表明，一个城市应当拥有的增强移动性的好品质包括：较高的活动混合、较高的道路和人行道密度。但合计指标表明，对这个研究领域来说，不断增强的发展特征、模式特征、旅行和经济特性才是最重要的。这些衡量指标的目的是推动开发出具有成本效益和节俭的方法，来识别出地方当局面临的城市移动性挑战，为要被识别和客观评估的城市"移动环境"品质提供一个战略路径，从而进行令人满意的干预，改善"移动环境"和城市居民的生活质量。

KEYWORDS:
移动性评估，移动环境，衡量指标，移动影响，移动复杂性，旅行者认知

1 INTRODUCTION

Mobility as a phenomenon have been widely studied, its connotations in transportation, accessibility and general human wellbeing have been explored to varying degrees, as exemplified in the works of Patla and Shumway – Cook, (1999), WBCSD, (2004), Oluseyi, (2006), Asiyanbola, (2007), Lotfi and Kooshari, (2009), and Hjorthol et al., (2010). To this end, diverse methods, approaches and models have been employed in explaining mobility in both the urban and human context. However, there has been the ever present drawback premised on data unavailability, "dirtyness" or scantiness. More so, the techniques and parameters used, according to Hong, (2010) and Isaacman et al., (2011), does not provide clues about mobility complexities facing the individual as a result of the nature of "mobility environments", which according to Soria – Lara et al. (2014), should be understood as a comprehensive planning concept based on the interaction between land use and transport factors, which Hong, (2010) and Isaacman et al., (2011) stated are critical determinant of mobility capabilities of individuals.

Therefore, to harness opportunities that may accrue from evaluating the link between "mobility environments" and how they affect travelers', it will be pertinent to develop other ways of gaining this insight. Hence, it is suggested that tapping into perception of travel by the traveler, as a consequence of the attributes of "mobility environments" from which engendered inhibitors and enhancers of mobility embedded in such spaces can be deciphered, may be one way of achieving this. The growing interest in examining the relationship between the physical environment and active transportation through audits and perception studies, as attested to by Vanwolleghem, et al., (2014), underscores this thinking. Florindo et al., (2009), also stated that, developing operational concepts of mobility are desirable towards measuring or identifying benefits associated with individual movement. To buttress this point Bertolini and Dijst (2003) mentioned that the quality of "mobility environments" depend on the features of each location, but also on individual characteristics, showing that there is a relationship between environmental and individual attributes which shapes mobility perception. Based on the foregoing, it is believed that opportunities and threats to mobility should be inferable from examining how attributes of "mobility environments" affect perception of such space. This line of thought is desirable because it will further deepen the understanding of how percept based determinants of an individual or city's mobility requirement can be identified, especially in terms of broadening the perspective from which mobility dilemma can be evaluated, as a bases for achieving a more effective and traveler centered mobility planning.

Furthermore, studies linking environmental factors to mobility perception or active transportation, such as Hume, et al., (2005) which looked at association between physical environmental factors (perceived and objectively measured), and levels of physical activity in children found a strong association between them. Similarly, a cross-sectional study of more than 1200 primary school children in Australia found associations between children's walking levels and their perceptions of the local neighbourhood's environment (Alton, et al., 2007; Timperio, et al., 2004; Humpel, et al., 2004). Also, importance of environment to mobility disability has been acknowledged, even though the potentially disabling features of the environment are difficult to identify, it is apparent that there are potentially many environmental features that influence the complexity and difficulty of mobility, embedded in "mobility environments" (Patla and Shumway – Cook, 1999). This proves that there are salient perception influencing attributes of mobility, associated with the mobility operating space of individuals. Therefore, perception based studies can be used to gain insight into the array of pervasive factors that might be influencing particular cohorts. Given that, individuals with different travel modes show differences in their perception of important factors influencing mobility Howard et al., (2001).

Thus, understanding the relationships between user perception and experiences can bolster mobility planning and related interventions. For this reason, it is conjectured that a systematic evaluation of traveler perception of mobility influencing attributes of "mobility environments" could provide hints about how certain groups of people perceive them. This paper proposes a technique of appraising perception of "mobility environments” with an index construct, as a measure of the aggregate type of influence the “mobility environment” is having on travelers. The work seeks to use indicators deducible from the percept of interaction between the moving subject and the containment within which mobility takes place, to rate the extent to which such spaces hinder or foster mobility. It further seeks to evaluate whether it will be practicable to determine “mobility environment” induced dilemma from travelers’ perception, and also attempt establishing an index based measure of extent of positivity or negativity of a “mobility environment’s” effect on travelers. The technique is proposed as an alternative approach to assessing or describing how “mobility environments” determine mobility perception of urban areas, in order to provide a decision support platform for managing cities, thereby setting the stage for use of traveler perception determined attributes in city planning. Since, ultimately the target of mobility planning is to remove constraints, ease movement and foster adequate accessibility to component areas of a spatial entity, in a manner that will accommodate motorized and non – motorized travelers, as pointed out in Asiyanbola (2007). The paper is structured into five parts, the first part introduces the research and presents issues from related literature, part two sets out the conceptual bases of the argument. Three contains the description of the study area and why it was selected as the study case. The fourth section explains how data was gathered and the method of analysis. Lastly, the fifth part presents discussion on important points, ultimately ending with conclusions.

2 CONCEPTUAL ISSUES AND JUSTIFICATIONS

Due to the exploratory nature of this work, it is necessary to explain some key terms and underpinnings. Despite the development of different practical applications based on “mobility environment”, as can be seen in Bertolini (2006), Soria – Lara (2012) or Talavera et al. (2014). There are no strict guidelines on how “mobility environment” can be defined, identified or mapped (Soria – Lara et al. 2014). However, Bertolini and Dijst (2003), asserted that “mobility environment” is defined by the whole of the external conditions, that may have influence on the presence of people in a given location, as defined by features of both the transportation services available there and the activity place itself, underscored by institutional arrangements, such as regulations. Based on this, the concept is described for the purpose of this study as “the totality of three dimensional spaces, within which elements - upon, through, around, and with which mobility take place - are contained, as defined by the guidelines governing the use of such spaces”, which collectively influence how such a space is perceived”. The idea that perception of a phenomenon is shaped by internal and external factors that could further be classified into tangible and intangible aspects, as described by (Sokolowska, 2014) buttresses this notion. Hence, the attributes of a “mobility environment” are thought to determine how a traveler perceives mobility in such places, so it becomes pertinent to seek out how such an environment can be structured to elicit positive perceptions.

In another sense, “the degree to which an identified “mobility environment” hinder or foster mobility of a group of randomly selected individuals, operating within it, is expected to be related to the attributes of such “mobility environment”. So, it is our thought that, the degree to which a “mobility environment” foster or hinder mobility, should be inferable from its rating in relation to an established scale, ranking or interpretation system. This posture is justified by assertions that intangible phenomenon are measurable through scaling, rating or indexing as exemplified by works such as Mingshun (2002), Zaly (2010), Shittu et al. (2015). Against this backdrop, an attempt is made to use traveler’s perception of the environment within which travel takes place as a measure of the kind of influence such an environment is having on travelers. The fact that a collection of ideas are needed to achieve the task necessitated a multidisciplinary approach. Most importantly, a number of principles or consensus opinions were identified from diverse literature, upon which the foundation of this work was built, these include:

- the fact that intangible phenomenon are measurable through scaling, rating or indexing;

- an established commitment to importance of the "person" as a fundamental unit of analysis and data derivation (the holistic modeling posture), as a necessary requirement for bottom up solutions that targets human behaviour related conditions;
- as an extension of (ii) above, the established need to incorporate human perception in measurements as a crucial element in understanding human preferences and requirements, because measurements lacking human perceptions are usually faulty.
- the prioritization of self reported factors in the analysis of mobility can more appropriately capture an individual's mobility complexities, thereby providing information that will be helpful in identifying appropriate interventions;
- the inability of abstract models to capture information on nuances underlying perception, which are important indicators of how changes to status quo are reacted to; and
- the need to promote inclusive and functional explore-ability of cities as a fundamental requirement of social participation and inclusion.

At the operational level, "mobility environments" have been used to describe geographical units with homogeneous mobility characteristics, based directly on the idea that mobility planning should play a central role in urban planning (Bertolini and Dijst, 2003). It was also put forward that the concept has been used to facilitate the adoption of particular methodologies to identify and use "mobility environments" from different countries and planning contexts. The direction now in "mobility environment's" study, is aimed at helping planners root policies in the very source of mobility, and also to help identify needs and constraints of individuals as members of different types of social organizations. The thrust is towards fully integrating mobility and accessibility considerations into urban planning and design. In the long run, it is expected that different kinds of "mobility environments" will emerge (Soria – Lara et al. 2014), as a bases for fashioning out better strategies and policies for specific "mobility environments".

3 THE STUDY AREA

Ilorin, a metropolitan area in Kwara state, north central Nigeria was selected for the study. The selection was made because the city exhibits characteristic dualism similar to many developing country cities, as mentioned in (Ahmed, 1996). Thus, Ilorin can be taken as a fair representation of cities in developing countries, more so Nigeria. The city has both organic and inorganic sectors, reflecting both modern and traditional characteristics. The city of Ilorin comprises of 20 political subdivisions known as wards. The city's population was estimated to be 510,444 persons for 2014. Ilorin metropolis sits on an estimated land mass of 111.46 km2.The city has no formal public transportation system, transport services are provided by private informal operators. Expectedly, the city also suffers from inadequate planning data base, as attested to by (Aderamo, 2000). Ilorin, to a large extent exhibits homogeneity in terms of development density, environmental quality, and in transport enterprises (Aderamo, 2003). Efforts to provide adequate transport infrastructure for the city of Ilorin have been adjudged ad–hoc, uncoordinated and poor in (Aderamo, 2008). Figure 1(a), depict Ilorin metropolis in the context of country and state within which it is located, while Figure 1(b), illustrates its political subdivisions known as wards. The socio–economic profiles and infrastructural status of the constituent wards of Ilorin metropolis, are largely similar. Mobility issues are not dealt with in relation to city needs and requirements, as attested to by (Aderamo, 2000), akin to most metropolitan areas of its kind and status in Nigeria.

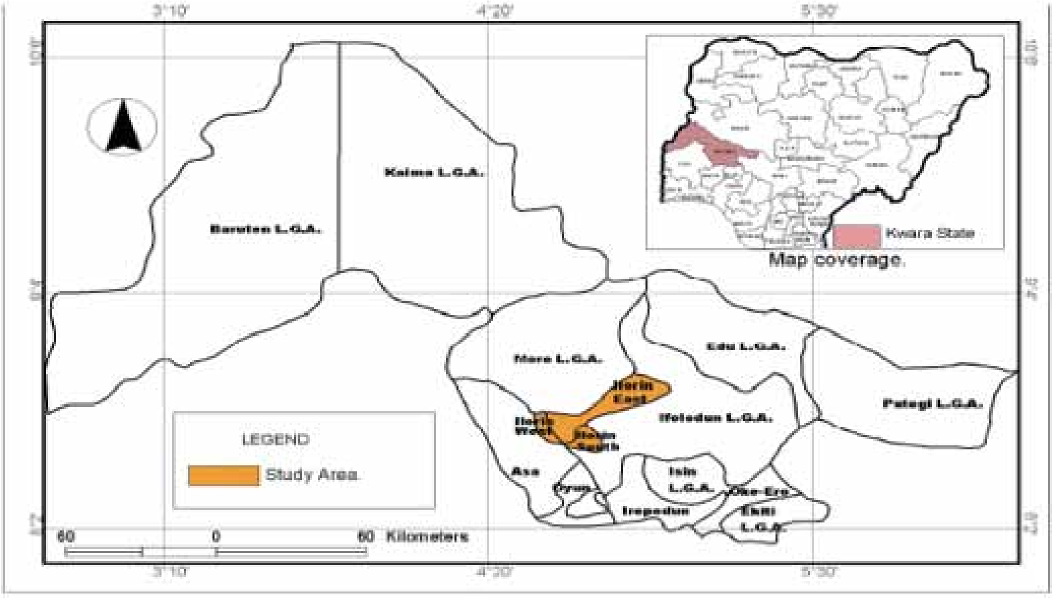

Fig. 1(a) Ilorin Metropolis in the context of Kwara state

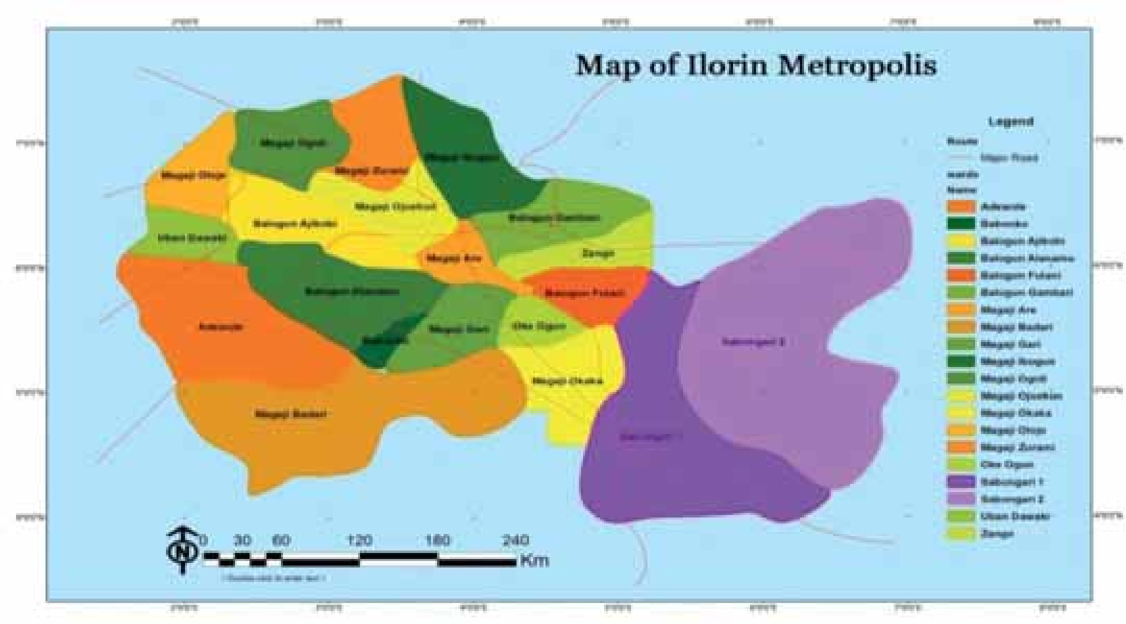

Fig. 1(b) The twenty wards of Ilorin Metropolis

4 DATA ACQUISITION AND ANALYSIS

4.1 DATA ACQUISITION METHOD

Two types of surveys were carried out. The first one targeted the experts, while the second type was directed at general respondents. The experts helped with attribute reduction exercise via the Delphi method. Ten (10) urban planning and transportation professionals were purposively selected from agencies and associated institutions in Ilorin metropolis. Six (6) of whom are field professionals and four (4) from local tertiary institutions, all belonging to the senior cadre. Professionals from planning institutions were selected because they are statutorily responsible for urban planning activities in Ilorin. Representatives from tertiary institutions were targeted because Ilorin metropolis is their main study zone, and for the advisory role they play in policy development. The general survey on the other hand, was carried out by trained research assistants with knowledge of the local language and terrain. The interviews were carried out in respondents' houses and in the streets of the constituent wards of Ilorin, for which information is sought. Respondents were interviewed and asked to rate attributes such as modal variety, pedestrian network density, activity and land use mix, based on the checklist that emerged from professional contextual evaluation of 57 potential attributes of "mobility environments" harvested from literature. 500 questionnaires were administered, based on Krejcie and Morgan, (1970), Veal, (2006) and Morenikeji (2006), suggestions and in view of the population of the city. This translates into 25 each per ward. In addition, 5 extra questionnaires were added as a precaution to make 30 per ward, in order to make room for substitution in case some are returned unusable at the end of the city wide survey, which usually is the case with survey based data collection exercises. Equal numbers of interviews were conducted in all wards, mainly, because the population figures at the ward level are not officially available. So, there was no base for differing figures. Hence, 25 questionnaires were in turn randomly selected without replacement from the total number of valid questionnaires returned from each ward. The main issues of consideration in sampling for this research were geographic distribution, age, gender, employment status, income, location of activities of daily living and available human and financial resources to the researchers. The targeted age bracket was 18 – 65, normally considered active age range. Interviews were conducted along randomly selected streets by trained research assistants covering specific wards of the city. Approach to respondents' selection was systematic random sampling.

4.2 DATA ANALYSIS

4.2.1 EXTRACTION OF CONTEXTUALLY RELEVANT ATTRIBUTES FROM RATINGS

The professional raters reduced the 57 potential attributes of "mobility environment" harvested from relevant literature to 30 contextually relevant ones to mobility assessment in Ilorin metropolis. The rating of harvested attributes were done on a 5 point Likert scale ranging from 4 – 0, with extremely significant having the highest and not significant the lowest. For instance, there is no formal bus system in Ilorin metropolis, hence a score of (0) is awarded and the attribute end up taken off the list. Only 7 of the 10 participating professionals were available for each of 3 contacts. Therefore, only ratings from these 7 were utilized for further analysis.

		4	3	2	1	0	WEIGHTED	DECISION
S/NO	ITEMS	ES	HS	S	LS	NS	MEAN-WM	R/NR
1	Road Network Characteristics	3	4	0	0	0	3.43	R
2	Public transport cost	5	1	1	0	0	3.57	R
3	Public transport Fare/Distance relationship	3	4	0	0	0	3.43	R
4	Quality of public transport facilities	1	3	3	0	0	2.71	R
5	Land Use Mix	5	2	0	0	0	3.71	R
6	Activity Mix	4	3	0	0	0	4.00	R
7	Modal Variety	3	2	2	0	0	3.14	R
8	Private Modes	5	2	0	0	0	3.71	R
9	Congestion effect on mobility	3	3	1	0	0	3.28	R
10	Effect of time spent waiting at transport stops	3	2	1	1	0	3.00	R
11	Diversity of Movement Channels	5	2	0	0	0	3.71	R
12	Road Network Density	6	1	0	0	0	3.85	R
13	Pedestrian Network Density	6	1	0	0	0	3.85	R
14	Quality of public transport services	2	2	2	1	0	2.71	R
15	Public Transport Service Reliability	4	2	1	0	0	3.43	R
16	Delay factor	3	1	2	1	0	2.86	R
17	Safety attributes of Pedestrian Paths	3	4	0	0	0	3.43	R
18	Perceived Safety of bus stops	2	3	2	0	0	3.00	R

19	Traffic accidents	2	3	2	0	0	3.00	R
20	Road markings and signage	2	4	0	1	0	3.00	R
21	Development Density	4	3	0	0	0	3.57	R
22	Development Pattern	3	3	1	0	0	3.28	R
23	Public transport fare effect on monthly income	4	2	1	0	0	3.43	R
24	Public Modes	3	2	2	0	0	3.14	R
25	Number of transfers on routine trips to work/school/shopping	2	3	2	0	0	3.00	R
26	Public Transport Service Comfort	2	3	1	1	0	2.86	R
27	Distance from transport stops to your destination(s)	4	2	1	0	0	3.43	R
28	Distance to Public Transport stop at your origin	4	2	1	0	0	3.43	R
29	Average travel time to work/school/shopping	3	2	2	0	0	3.14	R
30	Pedestrian Network Characteristics	3	2	2	0	0	2.20	R

Tab. 1 List of Extracted Contextually Relevant attributes of "Mobility Environment in Ilorin Metropolis

Following professional contextual relevance rating, the weighted mean of entries for each factor were derived to pave way for comparison with the calculated cut-off point. The cut-off point of acceptance or rejection of items rated in Likert scale is the arithmetic mean of individual weights, Morenikeji, (2006), which in this case are 4, 3, 2, 1 and 0. Hence, the cut-off point was calculated to be 2.00, see eqn (1). Therefore, any item with a weighted mean (WM) of 1.99 and below is considered not significant in the context of the study area, while those with WM equal to or above 2.00 are considered significant, WM is derived as shown in eqn (2). The extraction of contextually relevant mobility influencing factors was then done. Table 1 shows the WM values of extracted contextually significant attributes for Ilorin metropolis.

$$\text{Cut-off point} = \frac{\sum_{i=1}^{n} W_i}{n}, \quad i = 1, 2, 3 \ldots . n \tag{1}$$

$$WM = \frac{\sum_{i=1}^{n} W_i F_i}{n}, \quad i = 1, 2, 3 \ldots . n \tag{2}$$

4.2.2 THEMATIC CATEGORIZATION OF CONTEXTUALLY RELEVANT ATTRIBUTES FOR ILORIN METROPOLIS

Here, the contextually relevant attributes are grouped into thematic areas, according to trait similarities. Attributes that collectively describe a certain phenomenon, say city development density, were all classified under such a sub – heading. This is necessary because several factors tend to cluster together in defining specific domains and also in shaping perception of individuals (Sokolowska, 2014). It also enables group by group, as well as item by item comparison. The 9 groups of factors identified and classified descriptively are as presented in Table 3. The categorization then forms the basis for preparing the questionnaires for the general "mobility environment" perception survey targeted at respondents from the 20 wards of Ilorin metropolitan area.

4.2.3 DEVELOPMENT OF ATTRIBUTE RANKING, RANK ORDER OF IMPORTANCE POINTS (ROIP) AND INDEX EQUIVALENTS (IE) TEMPLATE FOR ILORIN METROPOLIS

After ascertaining the number of contextually relevant attributes with the help of local professional urban and transport planners, a factor ranking and Index Equivalent (IE) template was developed. The premise was that since 30 contextually relevant factors were identified, it means ranking can only range from 1st to 30th. Ranking signifies order of importance of a particular attribute, according to respondents' perception in a particular city sub-unit. However, to show true effect, Accentuated Rank Order of Importance Points (ROIP) were assigned to rank positions. The ROIP considered the total number of contextually relevant attributes, as bases for accentuating rankings, using true values of figures to show relative magnitude. Consequently, the highest ranking attribute is assigned 30 points as ROIP, to reflect its magnitude of importance, while the lowest ranking attribute, receives 1 point as ROIP, signifying its low level of influence on traveler perception in the specific city unit within which the attribute has been rated. Subsequently, the general IE for each contextually relevant factors were established by dividing a specific ROIP with the sum of all ROIPs, see eqn (3), this ensures normalization of IE values between 0 and 1, thereby removing the need to attribute separate characteristic units to each factor. Table 2 then becomes the template for iterative index equivalent assignment to attribute rankings for all the wards, according to city wide survey. Note that WM values were also derived from respondents' ratings for ranking purposes, as shown in column 5 of Table 3.

$$IE_i = \frac{ROIP_i}{\sum ROIP} \qquad i = 1, 2, 3 \ldots 30 \tag{3}$$

RANK ORDER (RO)	ACCENTUATED RANK ORDER OF IMPORTANCE POINTS (ROIP)	INDEX EQUIVALENT (IE)
1st	30	0.065
2nd	29	0.062
3rd	28	0.060
4th	27	0.058
5th	26	0.056
6th	25	0.054
7th	24	0.052
8th	23	0.049
9th	22	0.047
10th	21	0.045
11th	20	0.043
12th	19	0.041
13th	18	0.039
14th	17	0.037
15th	16	0.034
16th	15	0.032
17th	14	0.030
18th	13	0.028
19th	12	0.026
20th	11	0.024
21st	10	0.022
22nd	9	0.019
23rd	8	0.017
24th	7	0.015
25th	6	0.013
26th	5	0.011

27th	4	0.009
28th	3	0.006
29th	2	0.004
30th	1	0.002
Total	465	1.000

Tab. 2 Attribute Ranking, Rank Order of Importance Points *(ROIP)* and *(IE)* Template

4.2.4 TRAVELER RATING OF MOBILITY ENVIRONMENT ATTRIBUTES FOR WARDS IN ILORIN METROPOLIS

For this exercise, rating was done on a five point Likert scale ranging from 5 – 1, reflective of type of influence and degree to which contextually relevant mobility influencing attributes affect respondents' mobility, with strongly positive having the highest, that is 5 points and strongly negative the lowest, that is 1 point. After respondents' rankings for all 20 wards in Ilorin metropolis were received. Results obtainable for one of the 20 wards in Ilorin metropolis that is Adewole ward is presented in Table 3, as an example. Then, Average Category Index (ACI), which is the mean IE value for a specific thematic category of a "mobility environment" Index (xMEI), that is the sum of ACI's of all categories for a ward were derived as depicted in eqns (4) and (5) respectively. The x connotation against xMEI identifies a specific ward appropriately.

$$ACI_m = \frac{\sum_{i=1}^{n} IE_{mi}}{n}, \quad i = 1, 2, 3 \ldots n \tag{4}$$

$$xMEI = \sum_{i=1}^{n} ACI_{mi} \quad i = \text{A, B, C….. I} \tag{5}$$

S/No	Attribute Description	W_iF_i	n	$\frac{\sum W_iF_i}{n}$	Rank Order	IE	ACI
A	**Network Characteristics**						
1	Diversity of movement channels	77	25	3.08	10th	0.045	
2	Road network density	77	25	3.08	10th	0.045	
3	Pedestrian network density	68	25	2.72	25th	0.013	0.034
B	**Development Characteristics**						
4	Development density	78	25	3.12	5th	0.056	
5	Development pattern	76	25	3.04	14th	0.037	
6	Road characteristics	78	25	3.12	5th	0.056	
7	Pedestrian network characteristics	78	25	3.12	5th	0.056	
8	Quality of public transport facilities	85	25	3.40	1st	0.065	0.054
C	**Density of opportunity**						
9	Land use mix	71	25	2.84	19th	0.026	
10	Activity mix	75	25	3.00	15th	0.034	0.030
D	Mode characteristics						
11	Modal variety	78	25	3.12	5th	0.056	
12	Private modes	81	25	3.24	2nd	0.062	
13	Public modes	77	25	3.08	10th	0.045	0.054
E	**Travel characteristics**						
14	Number of transfers on routine trips to work/school/shopping	64	25	2.56	27th	0.009	
15	Average travel time to work/school/shopping	81	25	3.24	2nd	0.062	0.036
F	**Transport accessibility factors**						
16	Distance to public transport stop at your origin	69	25	2.76	23rd	0.017	0.022

17	Distance from transport stops to your destination(s)	71	25	2.84	19th	0.026	
G	**Economic factors**						
18	Public transport cost	69	25	2.76	23rd	0.017	
19	Public transport fare/distance relationship	78	25	3.12	5th	0.056	
20	Public transport fare effect on monthly income	73	25	2.92	17th	0.030	0.034
H	**Operational Characteristics**						
21	Congestion effect on mobility	71	25	2.84	19th	0.026	
22	Effect of time spent waiting at transport stops	72	25	2.88	18th	0.028	
23	Public transport service reliability	67	25	2.68	26th	0.011	
24	Public transport service comfort	64	25	2.56	27th	0.009	
25	Delay factor	70	25	2.80	22nd	0.019	
26	Quality of public transport services	79	25	3.16	4th	0.058	0.025
I	**Safety factors**						
27	Safety attributes of pedestrian paths	47	25	1.88	30th	0.002	
28	Perceived safety of bus stops	53	25	2.12	29th	0.004	
29	Traffic accidents	74	25	2.96	16th	0.032	
30	Road Markings and signage	77	25	3.08	10th	0.045	0.021
WMEI							0.310

Tab. 3 Rank Order of Perception Ratings of Mobility Influencing Attributes for Adewole ward

Table 3, illustrates results for Adewole ward, where a wMEI of 0.310 was derived. The least contributor to wMEI index for Adewale ward in terms of thematic categories was the "safety factor" group. Specifically, "safety attributes of pedestrian paths" ranked the lowest, which is 30th position, with a weighted mean value of 1.88 and IE of 0.002, meaning that the largest proportion of raters, consider safety characteristics of pedestrian paths as unfavourable to them. The highest ranking attributes for this ward was "quality of public transport facilities", a pointer to a relatively good perception of public transport facilities, which for this case, refers almost entirely to bus stops, mainly utilized by informal public transport providers. The "development characteristics" and "modal varieties" categories tied on ACI contribution of 0.054 to xMEI as perceived for Adewole ward, which means that, respondents' perceived development density of the area quite positively, just as they believe the choices of modes available to them are favourable, even though most of the respondents prefer to use private modes. This is possibly because of the unfavourable distance to public transport stops at respondents' origin, which turned in a low IE of 0.017, along with public transport cost. The "network characteristics" and "economic factors" categories also turned up with equal ACI of 0.034 for the ward, the public transport "fare/distance" relationship under the "economic factor" group was particularly rated high, coming 5th in terms of positive influence on respondents' mobility, meaning that respondents consider public transport fare versus distance generally acceptable, even though overall cost are perceived not to be so. The "public transport accessibility" thematic category on the other hand, turned up with a low ACI of 0.022 for the ward, signifying a need for priority intervention in both "public transport accessibility" and "safety" areas. If the general perception of "mobility environment" of Adewole ward is to improve from a grade level 8 good "mobility environment" rating to a better status on the mobility environment ratings interpretation table, as shown in Table 4.

MEI VALUE RANGE	DESCRIPTIVE RATING CHANGE INDICATOR	MEI INCREMENT INDICATOR	INTERPRETATION
= 0.5850		32.5	Exceptional Mobility Environment
0.576 – 0.584	1	32	Excellent Mobility Environment

0.558 – 0.575	2	31	
0.540 – 0.557	3	30	
0.522 – 0.539	4	29	
0.504 -0.521	5	28	
0.486 – 0.503	6	27	
0.468 – 0.485	7	26	
0.450 – 0.467	8	25	
0.432 – 0.449	1	24	
0.414 – 0.431	2	23	
0.396 – 0.413	3	22	
0.378 – 0.395	4	21	
0.360 – 0.377	5	20	
0.342 – 0.359	6	19	
0.324 – 0.341	7	18	
0.306 – 0.323	8	17	Good Mobility Environment
0.2925 – 0.305		16.25	Satisfactory Mobility Environment
0.288 – 0.291	1	16	
0.270 – 0.287	2	15	
0.252 – 0.269	3	14	
0.234 – 0.251	4	13	
0.216 – 0.233	5	12	
0.198 – 0.215	6	11	
0.180 – 0.197	7	10	
0.162 – 0.179	8	9	Fair Mobility Environment
0.144 – 0.161	1	8	
0.126 – 0.143	2	7	
0.108 – 0.125	3	6	
0.090 – 0.107	4	5	
0.072 – 0.089	5	4	
0.054 – 0.071	6	3	
0.036 – 0.053	7	2	
0.018 – 0.035	8	1	Poor Mobility Environment

Table 4 Mobility Environment Rating Interpretation Table

The premise here is that, the perception of a "mobility environment" improves positively as "mobility environment index" (MEI) tend towards the max, in this case 0.5850 achievable index points, while" mobility environment" perception deteriorates negatively as "mobility environment index (MEI) tends towards the minimum achievable points, which is 0.018. The figures literarily denote the degree to which a spatial unit enhances or inhibits mobility. Therefore, it is expected that the higher the MEI value, the higher the perceived positivity of influence of "mobility environment" by that spatial unit and vice versa.

$$CMEI = \frac{\sum_{i=1}^{n} xMEI_i}{n}, \quad i = 1, 2, 3, \ldots, n \qquad (6)$$

S/NO	WARD NAME	WARD MOBILITY LEVEL INDEX (WMSLI)	WARD RANKING BY MSLI VALUE	PERCENT CONTRIBUTION OF WARD
1	Adewole	0.310	12th	4.90
2	Babooko	0.316	8th	5.00

3	Balogun Ajikobi	0.316	8th	5.00
4	Balogun Alanamu	0.302	17th	4.77
5	Balogun Fulani	0.308	16th	4.87
6	Balogun Gambari	0.329	5th	5.20
7	Magaji Are	0.310	12th	4.90
8	Magaji Badari	0.300	18th	4.74
9	Magaji Gari	0.324	7th	5.12
10	Magaji Ibogun	0.315	10th	4.98
11	Magaji Ogidi	0.300	18th	4.74
12	Magaji Ojuekun	0.313	11th	4.95
13	Magaji Okaka	0.325	6th	5.14
14	Magaji Oloje	0.334	2nd	5.3
15	Magaji Zarumi	0.330	4th	5.21
16	Oke Ogun	0.334	2nd	5.3
17	Sabongari 1	0.309	15th	4.88
18	Sabongari 2	0.310	12th	4.90
19	Uban Dawaki	0.298	20th	4.71
20	Zango	0.339	1st	5.4
Cumulative MSLI		6.322		100
$\mathrm{CMEI} = \frac{\sum_{i=1}^{n} xMEI_i}{n}$, i = 1,2,3,…n		0.316		

Tab. 5 Derivation of CMSLI Value for Ilorin Metropolis

5 DISCUSSION AND CONCLUSIONS

From the general overview of the 20 wards, the difference between the highest and lowest XMEI contribution is 0.041 index points, which signifies only a two (2) stage drop or climb for the highest contributor or the lowest contributor to be at par, respectively. It can then be deduced that the status of the wards "mobility environment" in terms of effect on perception of mobility are similar and not significantly different from one another. Even though, the major contributing attributes to the shades of perception reported for each ward differ. The lesson here is that aggregate description attributes of "mobility environment" may produce a generalized outlook that might not be reflective distinct geographical units. This reiterates the belief of Bertolini and Dijst, (2003), that "mobility environments" are geographical units with homogeneous mobility characteristics. The general outlook of "mobility environments" in Ilorin metropolis further proves this point because it presents a quite homogeneous picture of different wards, irrespective of the fact that some wards developed entirely organically, while others had some planning history or interventions in the course of their development. It may then be concluded that the disjointed and piecemeal approach to planning in the metropolis underscored by lack of continuity has resulted into a scenario where advantages accruable from occasional planning are eroded by the disadvantages of the lack of concerted planning.

More so, the highest ranking positively influencing attributes of mobility were private modes, rated 1st, in 16 of the 20 wards, with an IE of 0.065 in all cases. This agrees with assertions in the literature that private means of movement are usually preferred by travelers, unless conscious efforts are instituted to reduce its use from several fronts, so as to reduce the side effects of over motorization, which is usually compounded by inadequate planning, as is the case in Ilorin metropolis. This also shows that perception based indices are adequate in eliciting probable determinants of mobility preferences and dilemma. On the contrary, attributes of public modes were generally perceived negatively; thereby ranking lowest that is 30th, with IEs of 0.002 in 45% of cases. This without doubt reflects the highly decentralized nature of the sector, due mainly to its total informal private ownership, and the lack of service quality enforcement of public transport modes in the metropolis. This attribute of public modes also explains the possibility of having such diverse characteristics in public transportation within one city. This is underscored by the fact that some wards are serviced by only rickshaws, or motorcycles, or taxis or minibuses, while others are served by a combination of taxis, minibuses, and motorcycles, leading to a different array of public transport mode choices available for each ward. Furthermore, route choice is basically governed by "cream skimming", where the lucrative routes are over supplied and the less profitable ones neglected.

In terms of utility, the index based "mobility environment" appraisal technique is developed basically to provide an alternate assessments procedure aimed at simplifying mobility planning decision making, especially where the normal gamut of required data and information to run sophisticated mobility evaluations are lacking. It also enables dimensioning and classification that allows a "mobility environment" to be assessed with respect to its peculiarities, be it covert or overt, in order that the complexities of mobility suffered by individual traveler become clearly understood. Besides, the measures generated from the application of the MEI technique provide justifiable reasons for project and programme design and selection for specific districts of identified cities. The tool is also useful in that it offers urban mobility planning and improvement decision support criteria for resource allocation, project prioritization and programme assessment. In addition, the tool also provide the bases for comparative analysis of needs and budgets in a manner that targets the overall mobility objectives of a city, besides enabling the assessment of goal(s) achievement. Budgeting tasks can be dealt with by using rankings of factors to determine priority projects and programmes, on the basis of how they fare on the ranking table. Future expenditure requirements can also be gleaned from simulating preferred positions of factors against city goals or targets, or by expert re-ordering of ranks by allocating weight of importance. In practical terms, the bases for mobility need projections and trend analysis in hitherto "mobility environment" attribute indeterminate areas have been presented, as a precursor to achieving goals of urban sustainability and livability.

In conclusion, the deeper understanding of underlining explanations of "mobility environment" induced mobility complexities by authorities responsible for urban mobility planning and management will improve responsiveness on the part of decision makers, leading to an improved and positively perceived "mobility environment" and quality of life. This research is expected to stimulate further enquiries into ways of quantitatively capturing perception based indicators from "mobility environments", as inputs in urban mobility assessments. First, the work presents an alternative mobility appraisal technique to complex data hungry models. This tool uses easily gathered data to facilitate realistic situational mobility evaluations, thus, permitting some measure of conscious management to begin in settings where inadequate mobility data and skilled manpower bedevil the sector. The study also strives to bridge the need gap for a parsimonious technique of assessing mobility, from the angle of environmental qualities. This serves to reduce the negative implications of indeterminate and indescribable mobility environment situations, thus enabling reasonable evaluations as a basis for local solutions and interventions. The tool's usage of individual percept of mobility influencing attributes enables a decent capture of some measure of mobility complexity determinants from the "mobility environment", by this means prioritizing the real essence of mobility planning, which is meeting Instrumental Activities of Daily Living (IADLs), an important determinant of quality of life. An attempt has been made in this study to develop a tool for deriving a percept-to-index construct, which can be used to describe "mobility environments", it will still be necessary to evaluate the extent to which the MEI technique can be relied upon to depict future changes, from evaluation of ex-post-facto ratings by new groups of respondents, after the implementation of MEI based programmes and project. In other for the tool to be a reliable instrument of measuring the achievement of short and long term goals of mobility planning. The belief is that, if factors that shape human perception of a phenomenon can be identified, they will go a long way in helping decision makers arrive at more acceptable decisions.

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IMAGE SOURCES

Fig. 1(a): Source: Kwara State Town Planning Authority

Fig. 1(b): Source: Kwara State Town Planning Authority

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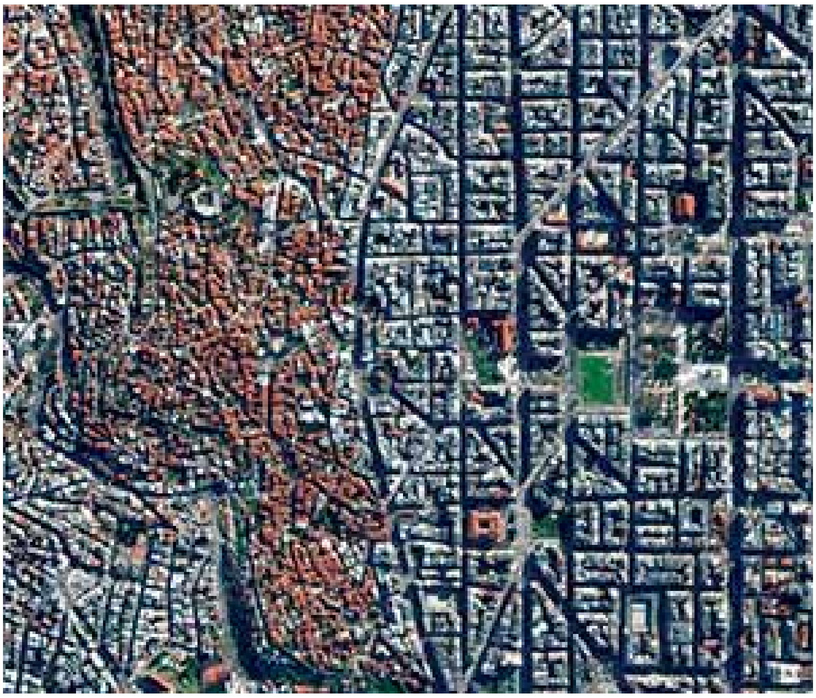

A LAND-USE APPROACH FOR CAPTURING FUTURE TRIP GENERATING POLES

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ABSTRACT

Changes in the usage of a particular urban or regional area have immediate effects on transportation, such as the development of a new multimodal terminal within a city, or the creation of a business park in its outskirts. Thus far, this correlation has been under-researched at a national level in Greece. As a result, its effects on trip generation and passenger flows has been underestimated at the planning level, leading to the implementation of projects that are neither viable nor sustainable. This paper proposes that land use changes ought to be considered in tandem with transport-related changes at the planning stage. To this effect, we present a three-step methodology for an integrated approach to capturing future trip generation: the identification of future trip-generating poles within the study area; the development of scenarios related to the probability of these changes occurring and their potential magnitude; an estimation of future trends in passenger flows. The methodology is applied to the Metropolitan area of Thessaloniki, Greece. Using data obtained from development plans, national statistical services and research projects' and studies' findings, we estimate future trip-generation subsequent to land use change. Data is processed and evaluated by a local experts' group, representing various key-disciplines of the area's planning stakeholders.

KEYWORDS:
trip generating poles, land use and transport interaction, data driven approach, expert assessment, Thessaloniki

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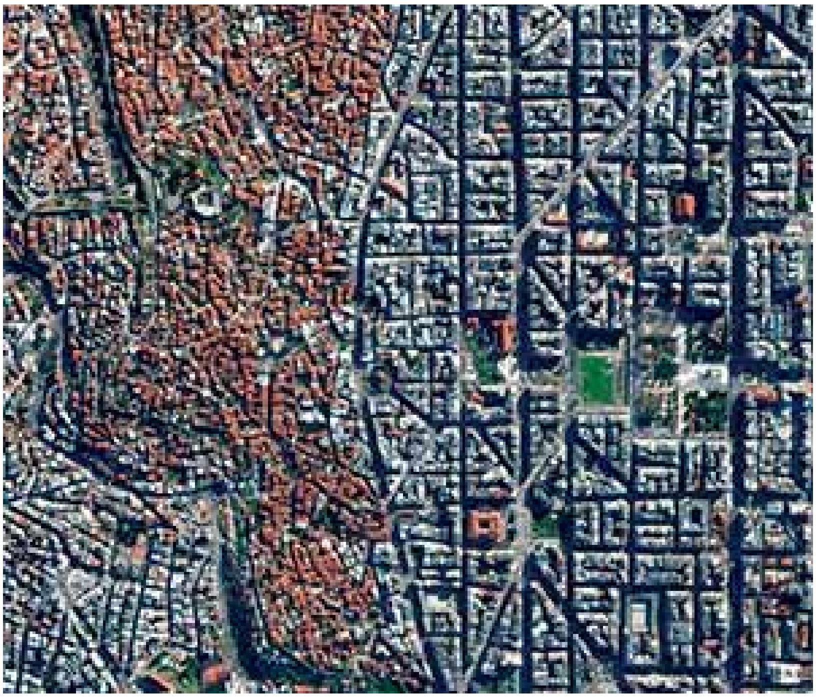

用土地利用的方法找到未来出行生成极

I. STAMOS[a], G. AIFADOPOULOU[b], E. MITSAKIS[c], M. MORFOULAKI[d], I. TAMIAKIS[e], P. IORDANOPOULOS[f]

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ABSTRACT

特定城市或地区性区域用途的改变（如在城市中建设新的多模式终端或在市郊创建商务园区）会立即对交通产生影响。但在希腊全国层面，人们对它们之间的关联到目前为止并未进行充分研究。因此，在规划层面低估了土地利用改变对出行生成和乘客流量产生的影响，导致实施了既不可行又不可持续的项目。本文认为，在规划阶段，考虑土地利用的变化时，应与交通相关的变化一起进行考虑。为此，我们提出用一个包含三步的综合方法来捕捉未来的出行生成：在研究区域内识别未来的出行生成极；创建与出现变化的概率及其潜在量级有关的情景；估计乘客流量的未来趋势。这个方法应用于希腊塞萨洛尼基的大城市区域。通过利用从开发计划、国家统计机构以及研究项目结果和学习结果中获得的数据，我们在土地利用变化之后对未来的出行生成进行估计。数据的处理和评估由代表该地区规划利益相关者各主要学科的一个本地专家组进行。

KEYWORDS:
出行生成极,土地利用与交通互动,数据驱动的方法,专家评估,塞萨洛尼基

1 INTRODUCTION

Land use and transportation are two core factors whose interaction is directly linked to sustainability of modern cities (Wegener, 2004). According to the European Environment Agency (EEA, 2010) one of the goals to make urban environment more sustainable is to ensure equal access to resources and services and thus enhance accessibility that is the general measurement of spatial separation of human activities (Morris et al., 1979). Concerning passenger transport, accessibility is the degree to which land use and transport systems enable people to reach specific activities or destinations (Litman, 2003; Geurs and van Wee 2004a). Apart from transport and land use components, Geurs and van Wee (2004a) identify temporal constraints (availability of opportunities at different times of the day etc.) and individuals' characteristics as the four components that affect accessibility.

Enhanced accessibility is a key element that affects trip generation and distribution. However, travel behavior is equally affected by other socio-economic (price of travel, income level of household) and socio-demographic (gender, age, education level) factors as well as land use and urban design characteristics (Boarnet and Crane, 2001). Cervero (1998) estimate trip frequency based on socio-demographic, land use and street connectivity variables. Socioeconomic changes directly affect the number of trips conducted within an area according to Preston (2001). To an extent, this number is determined by factors such as area population and population density (Boarnet and Crane, 2001; Levinson, 1976). Other socioeconomic changes include income, vehicle ownership and employment status (Koppelman and Pas, 1984).

These changes account for increased/decreased mobility within an area and therefore influence the total number (and purpose) of trips conducted. Van Wee (2002) indicates that density, land use mix, neighborhood design and distance to public transport connections are the main land use characteristics that affect travel behavior. Cervero (1996) concludes that neighborhood design and land use mix influence at various degrees motorized and non-motorized commuting mode choice.

The same author studied the influence of neighborhood on mode choice for non-motorized trips and identified that land use mix can improve urban mobility through reducing motorized traffic, encourage car sharing and promote shared-use parking schemes (Cervero and Radisch, 1996). Based on each land use (either existing or future), different trip generation rates are produced, and therefore an analysis of such changes is necessary. It becomes obvious that trip generation is directly affected by land use in a complicated way.

The interest in the interaction of land use and transport has risen since the mid-60s, when it was established that land use inventories, future land use demand and land use plans along with socio-economic indicators (employment, population forecasts, etc.) are an integral part of the transportation planning process (Schlager, 1965). During the same period, Schlager identified the forecasting of population and employment as the first function of any planning sequence (including that of transportation), succeeded by the determination of future land use changes.

By then it was already evident that the advent of mechanized transport means, had and would continue to significantly shape the way space is structured. Had it not been for the revolutionary change transport mechanization brought to travel speed, the effects on land use and land cover would not have been correspondingly large (Webster's and Paulley, 1990). Understanding the nature of this bidirectional link, where changes in any transportation-related aspect (extending from transport mode based technological advances to car-ownership rates) are responded by land use, and vice-versa, is thus central if policies of either discipline are to be reliably predicted.

The impacts of land use and transport planning on transport demand can be estimated through three distinct methods (Wegener, 2004): by asking people regarding their travel behavior in relation to alternation in certain factors; by observing the transport decisions of travelers under different conditions and by simulating human decision making through models. A number of mathematical models exists that try to identify the effects of land use on transport at both aggregate and disaggregate levels using well-established methodologies. However, there is no established representation of the converse relationship (Mackett, 1993).

Geurs and van Wee (2004b) identified the framework for Sustainability Impact Assessment by reviewing various operational land-use/transport interaction models based on land use, transport, accessibility, economic, environmental and social impacts definition (Geurs and van Wee, 2004b). Advances in mathematics support progress in modelling land use and transport interaction. However, a widely applied general model for addressing properly the issue does not exist (Wilson, 1998).

Badoe and Miller (2000) purport that the main reason for this methodological weakness is the existence of gaps in our understanding of the interaction. The main drawbacks of the current models include according to Hunt et al. (2005): excessive spatial aggregation, excessive reliance on static equilibrium assumptions (with associated assumptions of large time steps and lack of path dependencies), overly aggregate representations of households and firms, as well as a lack of representation of individuals as decision-making units separable from their households, lack of endogenous demographic processes, lack of endogenous car ownership processes and reliance on four-stage travel demand modelling methods.

Taking into account that trip generation is a decisive parameter for all planning activities related to future investments and policy interventions on a national, regional and urban level, as the literature suggests, it is a field where authorities often use forecast and estimates (Gordon, 1994; Giuliano and Hanson, 2004). Trip generation is therefore an issue whose thorough and detailed investigation can justify efforts towards a certain direction or predict the future sustainability of a project (Ortuzar and Willumsen, 2001). Moreover, it is a crucial element of land-use development, as the identification of future demand for travel can help determine whether a planning measure ought to be implemented in a certain location. It can also serve to prioritize measures in order of significance, so as to provide planners and stakeholders with guidance through selected measures when planning, but also while implementing those measures.

In the current study, an effort has been made towards the capturing of trip generation through methodological framework of land-use approach. More specifically, future trends in passenger flows are estimated through the identification of existing and potential trip generating poles and the development of various future scenarios. The proposed methodology manages to relate land use changes in tandem with transport-related changes at the planning stage. In the next parts, the proposed methodological approach is being elaborated. Then, the methodology is being applied in the Metropolitan area of Thessaloniki, Greece resulting in useful outcomes.

2 METHODOLOGICAL APPROACH

The basic rationale for the development of the methodology, depicted in Figure 1, is the combination of various parameters and sectors related with trip generation (either directly or indirectly), such as land use, transport planning and economy. These sectors act as sources of information that thoroughly map the existing situation and any change in the latter will provide a detailed insight on future trends in passenger flows. The methodology consists of three steps, which are discussed in detail in the following sections.

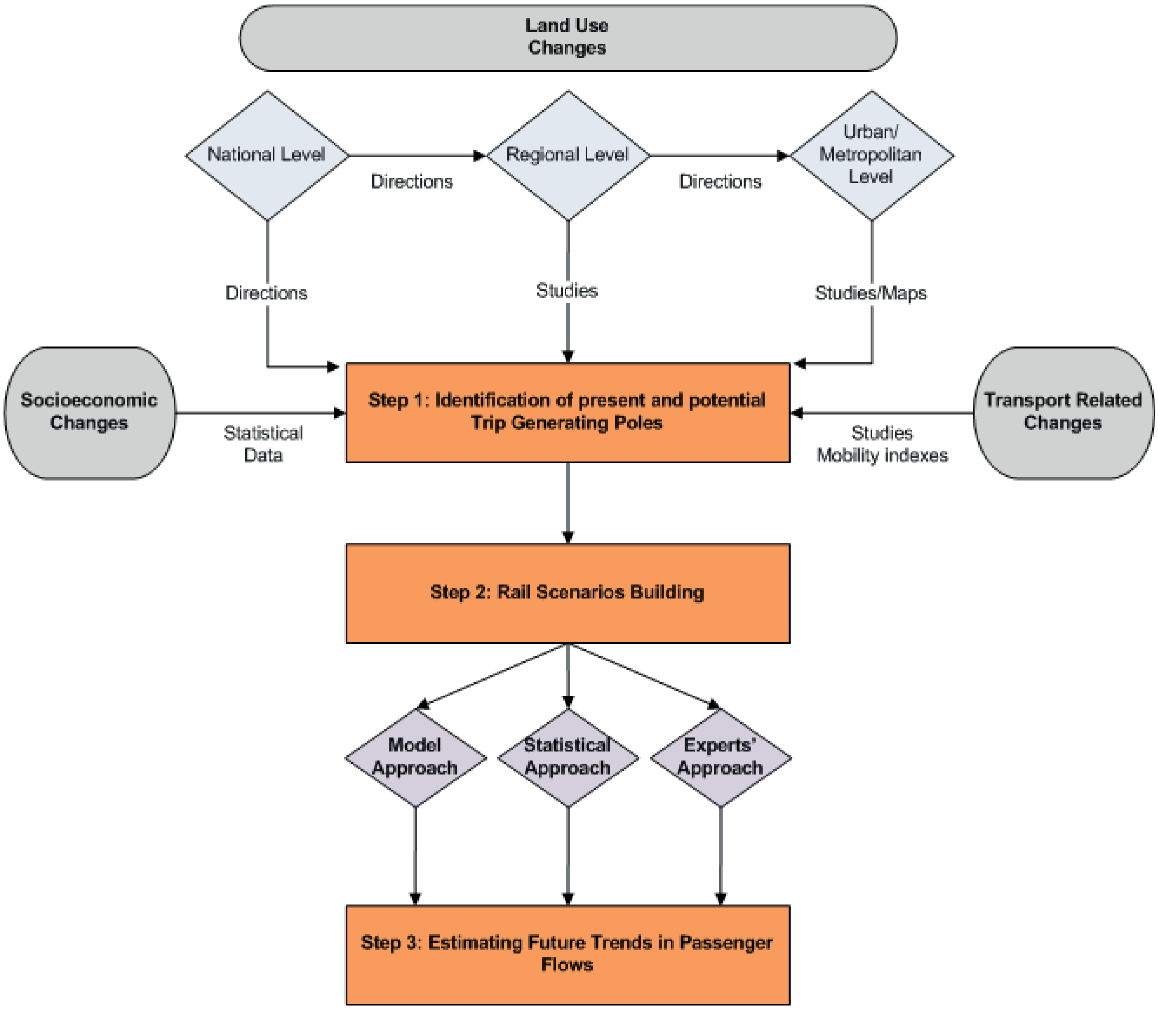

Fig. 1 Proposed methodology for identifying trip-generating poles and estimating future trends in passenger flows

2.1 STEP1 - IDENTIFYING EXISTING AND POTENTIAL TRIP GENERATING POLES

The first step of the methodology deals with the identification of present and potential trip-generating poles. As depicted in Figure 1, the following areas are directly associated with trip generation:

- Land-use changes;
- Socioeconomic changes;
- Transport related changes.

2.1.1 LAND-USE CHANGES

In order to accurately estimate future trends in passenger flows, it is important to map land uses, whose change directly influences the number of trips conducted within an area.

According to the Institution of Transport Engineers (ITE, 1976), land uses related to business, industry, education, health and leisure account for the highest trip generation rates in urban environments. Moreover, it is important to define the magnitude of each land use change in spatial terms (international, national, regional, and urban/metropolitan).

Land use changes are often included in national, regional and urban development plans of each country, depending on the population and extent of the area they refer to (Figure 2). Such plans include national development plans (e.g. General Plans for Spatial planning and Sustainable development (GPSPSD), Special Plans for Spatial planning and Sustainable Development (SPSPSD), which provide guidelines and determine strategic directions of planning on a national level. General plans concern a wide variety of sectors and refer to a target year, in which the desired change/measure is planned to be implemented (approximately a period of 15-20 years since the development of the plan). Special Plans are dedicated to specific sectors and the respective changes therein (business, tourism, aqua/agriculture, renewable energy sources). On a national level, regarding sectorial planning and development, National Operational Plans are also conducted, including sectors such as transport, environment, energy, telematics and tourism.

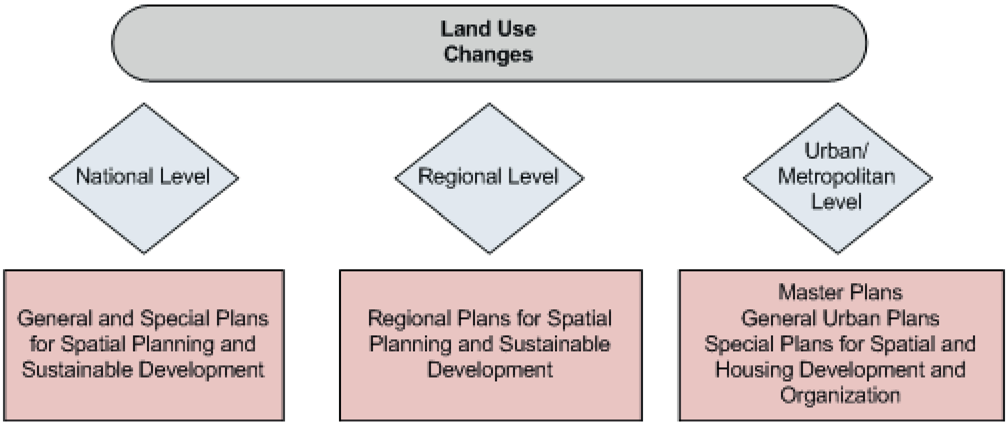

Fig.2 Identification of Land use changes at various levels

Such plans also include regional development plans (Regional Plan for Spatial Planning and Sustainable Development (RPSPSD)), which contain specifications of the General plans at regional level and provide analyses of the current situation and proposals concerning urban organization, land use definition and transport infrastructure. Also at regional level, Operational Plans are conducted, concerning geographic regions not always in compliance with administrative region boundaries.

Finally, urban/metropolitan development plans also contain information on land use changes (Master Plans (MP), General Urban Plan (GUP) and Operational Plans of each municipality). In detail, Master Plans provide general guidelines concerning metropolitan areas while General Urban Plans provide analyses of the current situation and direct suggestions concerning house organization, transport infrastructure and land uses. Regarding the lowest planning level, municipalities lay out the strategy, developmental vision and specific actions and measures, as well as funding sources, through operational plans.

2.1.2 SOCIOECONOMIC CHANGES

Figure 3 summarizes various socioeconomic characteristics whose change would significantly influence future flows of passengers.

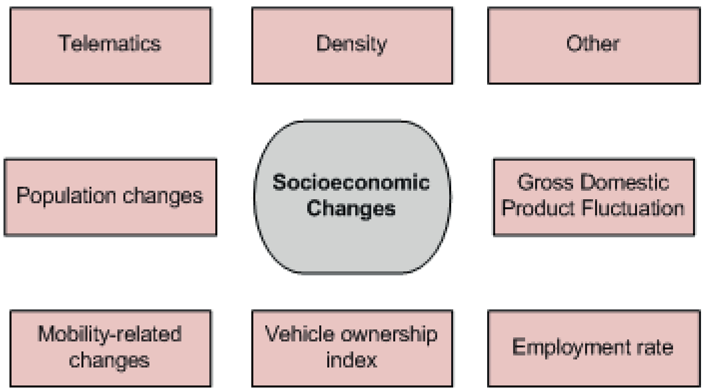

Fig. 3 Identification of socioeconomic changes

Data regarding socioeconomic characteristics of areas and regions are often found within national statistical services or in specific surveys, statistical institutes and intergovernmental organizations (ELSTAT, 2014). These services include detailed, yet often not analyzed, data on potential trip-generating parameters such as population, vehicle ownership, changing density in certain areas, and employment. Studies at regional and urban level, often financed through national funds, may also contain similar data. In addition, certain data concerning the demography of areas and regions are often contained (in numerical form) in the Development Plans identified above, as well as in Operational Plans conducted by each municipality. Operational plans contain analyzed demographic characteristics both at regional and urban/metropolitan level and provide further data concerning fields of employment, business and population changes.

3.1.3 TRANSPORT RELATED CHANGES

Transport-related changes concerning the implementation of new infrastructure or the modification of existing ones (e.g. turning a railway station in a multimodal hub), the introduction of new transport services or lines and connections (both for public and private transport), are directly associated with generation of trips and are depicted in Figure 4.

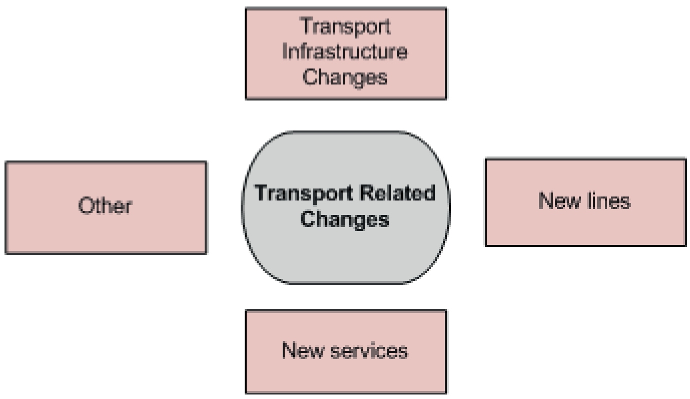

Fig. 4 Identification of transport related changes

Development plans described in previous sections are not limited to reporting on land use changes, future planning directions or residential developments, but also contain information related to transport issues. As all of the above poles are correlated rather than being isolated from one another, similar sources may be drawn upon to identify trip-generating poles.

3.2 STEP 2 - SCENARIOS DEVELOPMENT

As it is rather unrealistic to assume that all actions and measures described in development plans or studies will be implemented in the future, scenarios can be developed based on the probability that certain changes might be realized or not. This probability can be assessed by relevant experts (Hsu, 2007) who can evaluate the changes identified in Step 1 and decide on the probability of a change being implemented based on various factors, such as:

- Support in the planned change by the private sector;
- Accomplished legal procedure for the implementation of the change;
- Size of change;
- Political and societal support in favor of the change.

In addition, the significance of these changes should also be taken into consideration, as some changes are more important than others are, and should thus be examined separately. In that sense, it is proposed that developed scenarios describing the changes identified in Step 1 are classified based on a probability-significance index into 3 classes as depicted in Figure 5. The development of the probability-significance index can be an output of experts' opinions or can be stated within Development Plans as priorities for each change.

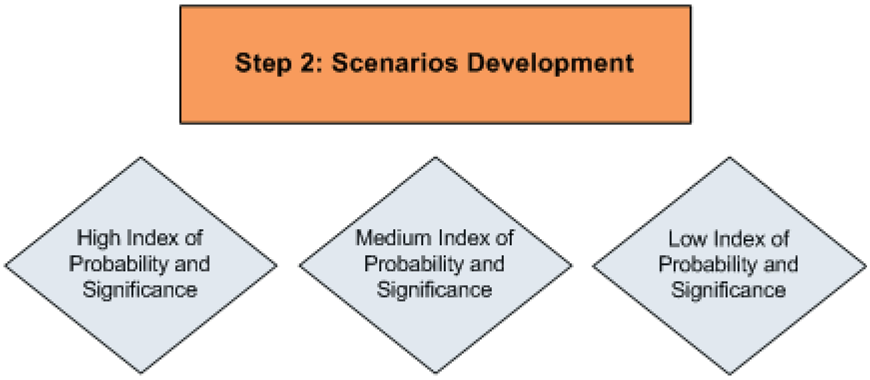

Fig. 5 Scenarios classification based on Probability-Significance Index

Another important aspect that has to be taken into consideration is the target year these scenarios refer to, in order to assure a common approach for the final evaluation.

3.3 STEP 3 - ESTIMATING FUTURE TRENDS IN PASSENGER FLOWS

The issue of quantifying future trends in passenger flows, based on trip generating poles identified at the previous step, is rather challenging and demanding. Data are not often available, or when available, not in a format easily quantifiable. Figure 6 summarizes several approaches for estimating future trends in passenger flows.

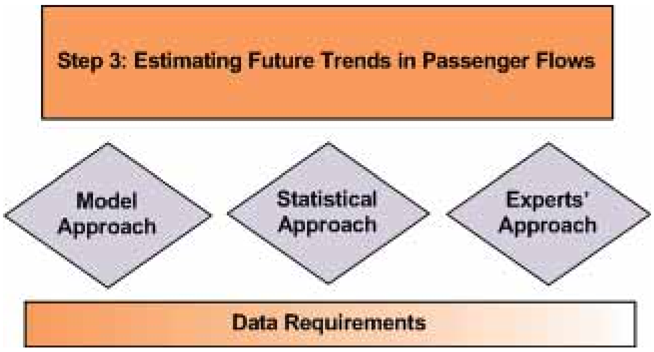

Fig. 6 Approaches for estimating future trends in passenger flows

Models able to integrate land use data (e.g. extent of area, number of places of employment), transport-related data (e.g. trips per citizen according to age) and socioeconomic data (e.g. income per citizen) can be used in this step to quantify future passenger flows. Models have the advantage of being able to accurately predict future trends in passenger flows, by taking into account several parameters. However, data requirements are significantly high, rendering the process difficult and labor-intensive. Alternatively, a statistical approach can be followed. Such an approach involves exploiting data (to the extent that they are available) and estimating future passenger flows based on general assumptions that reveal overarching trends. For instance, based on income change, population change and vehicle ownership, a future trend can be deduced, revealing the tendencies of a particular region in these areas. Therefore, future trends can be calculated by taking into account the particular identity of the region. Finally, experts from various related sectors, such as business, academia, research, public authorities, can be recruited in order to assess available information (for instance a city's planning direction towards becoming an industrial area) and estimate passenger flows in a percentage format, indicating future changes (e.g. +5%).

4 AN APPLICATION

In order to assess the applicability of the proposed methodology, a case study is presented under this section.

4.1 THE CASE OF THESSALONIKI, GREECE

Thessaloniki is the second largest city in Greece, currently accommodating 1.006.730 citizens in its metropolitan area. Situated in Northern Greece, Thessaloniki covers a total of 1.455,68 km2 with an average density of 16.703 inhabitants per km2 (Stamos et al., 2012). Due to its geographical location, Thessaloniki plays an important social, financial, and commercial role in the national and greater Balkan region, in part because of the development of a transportation hub within the city's limits. According to the General Statistical Secretariat, the total number of vehicles in the city exceeds 777.544, including private cars, heavy vehicles and motorcycles, while approx. 1,8M trips are conducted in the city on a daily basis (Politis et al., 2012; Stamos et al., 2013; Mitsakis at al., 2013). Figure 7 depicts the municipalities of the Metropolitan area of Thessaloniki that are examined herein.

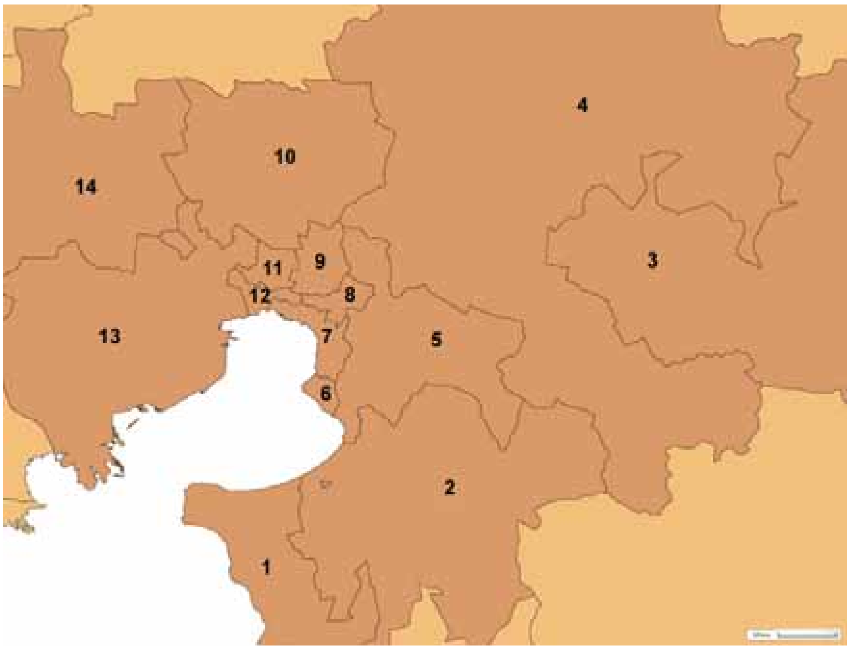

Fig. 7 Municipalities within Thessaloniki prefecture (scale refers to 10km)

4.2 MAPPING OF TRIP GENERATING POLES

4.2.1 LAND-USE CHANGES FOR MUNICIPALITIES

With regard to the metropolitan area of the city, the Master Plan (MP) suggests the conservation of the industrial area and the reinforcement of competiveness among the industries and smaller craft businesses. Furthermore, a sound allocation of scattered industries throughout Thessaloniki's metropolitan area is advocated in order to minimize negative impacts to the urban environment. The MP also suggests the promotion of research and innovation and the utilization of natural resources, historical environments and business activities in order to create and promote new forms of tourism within the area (City of Thessaloniki, 2009). Besides the MP, which is generally considered as a guideline for strategic development, specialized General Urban Plans (GUP) have been developed for each municipality included in Thessaloniki's Greater Area. The GUPs conducted for the municipalities suggest the development of business centers, such as malls, in the western part of the city and the organization of an industrial area, again in western Thessaloniki.

In addition, a concentrated allocation of business hosts in the western part of the metropolitan area is suggested, e.g. of universities and technological institutes. Furthermore, the development of health-related units in the western part of Thessaloniki is recommended in order to provide all citizens with equitable access to health services, which are currently concentrated in the Eastern part of the metropolitan area of Thessaloniki. In order to provide citizens with proper athletic facilities, the GUP suggests the development of athletic cores in specific urban centers within the region. Finally, regarding the touristic development of the metropolitan area, the promotion of special forms of tourism such as agro-tourism and spa-tourism are proposed and allocated circumferentially in the greater region. Table 1 summarizes the most characteristic land use changes for municipalities within the hub of Thessaloniki.

NAME	CHANGE	SECTOR	TARGET YEAR	SOURCE	PROBABILITY	MAGNITUDE
Greater Thessaloniki area	Conservation and organization of industrial area and reinforcement of competiveness of industries and smaller craft businesses	Industry	2022	MP	H	Regional
Greater Thessaloniki area	Consolidation of scattered industries	Industry	2022	MP	L	Local
Greater Thessaloniki area	Research infrastructure development	Business	2022	MP	L	Regional
Delta	Displacement of Thessaloniki's international fair to the western part of the agglomeration	Business	2022	MP	H	Local
Lagkada	Promotion of spa-tourism infrastructure	Tourism	2022	MP	H	Regional
Pylaia	Creation of hospitals exclusively related to oncology	Health	2022	GUP	L	International
Thermaikos	Creation and organization of an area concerning fish products	Business	2022	MP	L	Regional
Lagkada	Creation of new veterinary university in the eastern part of the agglomeration	Educatio n	2022	GUP	L	International

Pylaia	Creation of new Polytechnic university in the northern part of the agglomeration	Education	2022	GUP	L	International
Thermi	Creation of new geologic university in the eastern part of the agglomeration	Education	2022	GUP	L	International
Ampelokipoi-Menemeni	Creation of a business park in Laxanokipoi area	Business	2022	GUP	H	Regional
Eastern Thessaloniki area	Development of commercial center	Business	2022	MP	M	Regional
Thermi	Organization of an innovation business zone	Business	2022	MP	L	Regional
Delta	Promotion of sports tourism and agro-tourism	Tourism	2022	MP	H	Regional
Western Thessaloniki area	Development of commercial center	Business	2022	MP	M	Regional

Tab. 1 Land use changes for municipalities within the hub of Thessaloniki

4.2.2 SOCIOECONOMIC CHANGES FOR MUNICIPALITIES WITHIN THE HUB OF THESSALONIKI

Information and data described herein are obtained from a research project recently conducted for Thessaloniki's agglomeration (Morfoulaki et al., 2011). The project aimed to provide a suite of services for travelers, in order to assist them in everyday mobility-related decisions by providing real-time mobility-related and environmental conditions information, optimal route planning based on traveler-defined criteria (fastest, shortest, cost efficient and environmentally friendly routing), public transport information and routing services, ride sharing and user awareness tools.

In the framework of this project, 5.000 household phone surveys and Road Side Surveys (RSS) at 40 locations with 33.000 participants were executed between October and November 2010. Based on the surveys, the average number of persons in a household is estimated at 3,03 and the respective average of driving license holders per household at 1,75. Additionally, 58% of all citizens hold a driving license and 71% of the population owns at least one private car (Mitsakis et al., 2013).

The average number of trips per person is 2,08. About 89% of the survey participants stated that they usually execute up to two trips per day: one trip for various purposes (work, education, leisure, etc.) and one trip for returning home. Among various trip purposes, 47,6% of the trips are conducted for work and 26,8% for leisure. The percentages for shopping, education and other purposes are 12,9%, 5,8% and 6,8% respectively (Mitsakis et al., 2013).

The modal split analysis reveals that the majority of trips is conducted with private vehicles (67% private cars, 4% motorcycles and 4% taxis), while 23% is conducted with public transport (PT) and 2% with non-motorized modes of transport (NMT). Based on the RSS results, the average vehicle occupancy is 1,44. 65% are single occupancy vehicles, while 28% and 6% of the vehicles travel with 2 and 3 passengers respectively. Concerning the vehicle type distribution, this is estimated as follows: 77% private vehicles, 5%

motorcycles, 2% taxis, 11% vans and 5% trucks. The total travel demand for a typical weekday is estimated in the range of 1.300.000 vehicle trips. On a daily average, the city center attracts a total of 11,5% of all trips (Mitsakis et al., 2013).

4.2.3 TRANSPORT RELATED CHANGES FOR MUNICIPALITIES WITHIN THE HUB OF THESSALONIKI

As mentioned above, transport-related changes concern the implementation or modification of transport infrastructure and the introduction of transport lines and services. Regarding transport infrastructure-related changes, the MP for the city of Thessaloniki proposes the overall reinforcement of the role of public transport in high-density areas so as to provide equitable access to all citizens.

The promotion of multimodality is a crucial part of future transport planning in Thessaloniki, in order to increase the effectiveness of public transport and address passenger safety issues. Additionally, the MP provides directions concerning the organization of municipal mobility centers in order to control traffic and minimize congestion at a local level. The upgrade of Thessaloniki’s airport and harbor is also included, as well as the upgrade of the rail and bus station into regional transport stations. Table 2 summarizes the most characteristic transport-related changes planned for municipalities within the hub of Thessaloniki.

4.3 SCENARIOS DEVELOPMENT

At this step, changes that are both highly probable and of regional to international magnitude are isolated, so that they can be handed over to experts for assessment (Table 3).

NAME	CHANGE	TARGET YEAR	SOURCE	PROBA BILITY	MAGNITUDE
Thessaloniki	Reinforcement of the role of public transports	2022	MP	H	Local
Thessaloniki	Equitable access for all citizens, throughout networks and public infrastructure, and formation of a fair pricing system	2022	MP	H	Local
Thessaloniki	Promotion of multimodality in transports in order to increase effectiveness and safety	2022	MP	M	Local
Thessaloniki	Reinforcement of Thessaloniki's role as an international node of freight transport	2022	MP	M	International
Thessaloniki	Development of public transport consistency in order to provide service in high density areas	2022	MP	H	Local
Thessaloniki	Organization of Municipal mobility centers	2022	MP	M	Metropolitan
Thermi	Upgrade of International Airport of Thessaloniki "Macedonia" into an international node of passenger transport	2022	MP	H	International
Thessaloniki	Upgrade of International harbor of Thessaloniki and functional	2022	MP	M	International

	unification with the urban environment of Thessaloniki				
Thessaloniki	Upgrade of passenger rail station into regional centers	2022	MP	M	Regional
Ampelokipoi-Menemeni	Upgrade of passenger bus station into regional centers	2022	MP	M	Regional
Thessaloniki	Creation of a united system for bike transport in order to help decongest the transport network and promote sustainable mobility	2022	MP	H	Metropolitan
Thessaloniki	Railway connection throughout the region	2022	GUP	M	Metropolitan
Thermaikos	Improvement of Michaniona's harbor and connection with Pieria	2022	GUP	M	Regional
Ampelokipoi-Menemeni	Creation of terminal subway stations in western Thessaloniki	2022	GUP	L	Metropolitan
Kalamaria	Creation of terminal subway station	2022	GUP	L	Metropolitan
Thermaikos	Creation of terminal subway stations in the airport area	2022	GUP	L	Metropolitan

Tab. 2 Transport infrastructure changes for municipalities within the hub of Thessaloniki

NAME	CHANGE	SECTOR	TARGET YEAR	PROBABILITY	MAGNITUDE
Metropolitan area of Thessaloniki	Conservation and organization of industrial area and reinforcement of competiveness of industries and smaller craft businesses	Industry	2022	H	Regional
Delta	Displacement of Thessaloniki's international fair to the western part of the agglomeration	Business	2022	H	International
Lagkada	Promotion of spa-tourism infrastructure	Tourism	2022	H	Regional/International
Pylaia	Creation of hospitals exclusively related to oncology	Health	2022	H	International
Ampelokipoi-Menemeni	Creation of a business park in Laxanokipoi area	Business	2022	H	Regional
Eastern Thessaloniki area	Development of commercial center	Business	2022	M	Regional/International
Delta	Promotion of sports tourism and agro-tourism	Tourism	2022	H	Regional/International

Western Thessaloniki area	Development of commercial center	Business	2022	M	Regional/International
Thessaloniki	Reinforcement of Thessaloniki's role as an international node of freight transport	TI/Freight	2022	M	International
Thessaloniki	Organization of Municipal mobility centers	TI	2022	M	Metropolitan
Thermi	Upgrade of International Airport of Thessaloniki "Macedonia" into an international node of passenger transport	TI/Air	2022	H	International
Thessaloniki	Upgrade of International harbor of Thessaloniki and functional unification with the urban environment of Thessaloniki	TI/Marine	2022	M	International
Thessaloniki	Upgrade of passenger rail station into regional center	TI/Rail	2022	M	Regional
Ampelokipoi-Menemeni	Upgrade of passenger bus station into regional center	TI/Bus	2022	M	Regional
Thessaloniki	Creation of a united system for bike transport in order to help decongest the transport network and promote sustainable mobility	TI/Bike	2022	H	Metropolitan
Thessaloniki	Railway connection throughout the region	Ti/Rail	2022	M	Metropolitan
Thermaikos	Improvement of Michaniona's harbor and connection with Pieria	TI/Marine	2022	M	Regional

Tab. 3 Medium and highly probable changes in the hub of Thessaloniki

4.4 ANALYSIS OF TRIP GENERATING POLES – TREND ESTIMATIONS

In order to estimate future trends in passenger flows, the experts' approach described above has been used for the hub of Thessaloniki and a DELPHI approach has been adopted (Hsu, 2007). Experts were asked to assess present and future trip generating poles scenarios, based on the current status of the metropolitan area of Thessaloniki and the proposed/planned future developments.

The experts' group consisted of 4 transport engineers (freelancers), 2 researchers (employed at Hellenic Institute of Transport), 4 research associates (employed at the Hellenic Institute of Transport), 3 university professors (Aristotle University of Thessaloniki) and 2 municipal employees (civil servants) dealing with transport planning at urban level.

The experts had the following input at their disposal, in order to estimate a future passenger flow percentage change:

- Scenarios of future changes based on the probability and magnitude of each identified change;
- Numeric changes in land use, socioeconomic and transport-related changes for the hub of Thessaloniki;
- Number of trips currently conducted within the hub of Thessaloniki;
- Number of trips currently originating from outer zones and destined to the hub of Thessaloniki;
- Purpose of trips (home-based trips, work, leisure, education, other);
- Trip generation rates from previously existing traffic studies for the hub of Thessaloniki.

At the first stage of their assessment, experts estimated the percentage change from current to future number of passenger flow individually. At the second stage, results were gathered and disseminated to the group. Experts then reexamined their results, taking into consideration the ongoing economic crisis as well as other related socioeconomic conditions.

The provided scenarios of future changes in land use and transportation can be grouped in two general categories, the one being the development of new infrastructure and therefore the creation of new land uses and the other being the reinforcement or upgrade of existing land uses.

The lowest percentage change in future passenger flows according to experts will be +6% and the highest percentage change will be +9%. Moreover, the analysis revealed that in case of new infrastructure the trip generation will focus on motorized traffic. The percentage of private transport or use of public transport is highly correlated to the level of service the new land uses are expected to have as regards public transport coverage.

On the other hand, according to the respondents, upgrade of existing infrastructure can lead to generating more non-motorized traffic (cycling, walking) than motorized taking into account that the existing land uses are part of a mix land use subsystem that enhances non-motorized trips. This fact is in line with results from various other studies that elaborate on the advantages of mix land use (Cervero, 1996) and on the results from regression models (Boarnet and Crane, 2001).

5 CONCLUSIONS

This paper addresses the need to consider land use change and transportation in tandem in relation to trip generation. Land use and transportation are two intimately interdependent sectors that affect accessibility and ultimately travel behavior. Apart from accessibility, travel behavior is also affected by various other factors most of which are related to socioeconomic and socio-demographic criteria.

These criteria play an important role when it comes to identifying the impacts of land use and transport planning on transport demand. Various studies have tried to determine these impacts by developing methodologies in order to identify travelers' behavior either through questionnaire surveys or by simulating human decision making through models. However, current studies have so far been incomplete and underdeveloped especially for Greece where transport planning and land use development are two separate non-correlated processes.

Our suggestion here includes a three-step methodology that integrates the two sectors and allows planners to develop more efficient land use and transportation policies.

Through this methodology various scenarios are developed based on estimates for future changes in social, economic and demographic sectors as well as on proposals and strategic planning of areas and regions regarding future development of transportation and land use.

The results of the methodology's implementation in the case of Thessaloniki Prefecture reveals that the creation of new trip generating poles and the increase of trips' generation and distribution go hand in hand with the type of land use development and modifications as well as changes in provided transport services of an area. The estimated impacts can be determinant factors for decision making on urban or regional future development. Therefore, the methodology laid out in this paper can be used as an evaluation tool that can help the strategic planning of future actions, measures and projects.

Our contribution undoubtedly constitutes a first step in the direction of integrated decision making at the planning process regarding land use and transportation. Nonetheless, additional research is needed in order to succeed in developing an accurate assessment of the complex interactions between land use change and transportation.

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TOURISM AND MOBILITY

BEST PRACTICES AND CONDITIONS TO IMPROVE URBAN LIVABILITY

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ABSTRACT

This paper considers the relation between tourism and mobility and tries to highlight how tourism can act as a driving urban function in order to promote more sustainable lifestyles. Tourism and mobility are strictly connected: the moving from the usual residential place for leisure or entertainment represents the essential condition of tourism. There is no tourism without physical displacements, as the WTO definition affirms, highlighting that the movement of people is connected to two different mobility forms. On one hand, the tourist displacement is generated by the need to reach the destination (transit/access mobility). On the other hand, flows are generated by tourist activities at destination (visit, stay, entertainment, etc.) and it could be defined as an internal mobility. In both case, tourism represents a factor of human and environmental pressure. The WTO (2012) estimates that tourism mobility is responsible for 5% of CO_2 emissions (referred to air travel) and points out that a change in the styles of tourism consumption is necessary also to meet the challenges of climate change that present cities must face. Traditionally, tourism and transport have been considered separately and mobility has been seen as a prerequisite rather than an integral part of the tourist activity; rarely this connection has been investigated in tourist planning and in mobility planning. The movements of visitors had a marginal role before the acknowledgment of the sustainable mobility paradigm, which introduced the concept of efficiency in transport system connected to the reduction of the environmental and social impacts encouraging modal shift in order to contrast the car-dependence. In the context of these considerations, this article tries to underline how tourism could play a strategic role in promoting sustainable way of moving inside the city if it will be mainstreamed within the government process of urban transformation. As a "pervasive" urban activity, tourism involves different sectors (public and private) and different social levels and it can act as an "accelerator of changing" to improve a new mobility culture and to change users behaviors. Which are the conditions needed to activate this change? This is the main question this paper tries to answer also considering some significant examples oriented to integrate tourism promotion with mobility planning.

KEYWORDS:
tourism-mobility integration, urban livability, urban transformation

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旅游业与移动性：改善城市宜居性的最佳实践和计划

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ABSTRACT

本文研究的是旅游业与与移动性之间的关系，并尝试突出旅游业能成为一种可以推动更可持续生活方式的强劲的城市智能。旅游业是当今城市经济中的一个重要组成部分，同时也是人类和环境压力的一个因素。世界旅游组织（UNWTO2012）预测，旅游业占到了5%的二氧化碳排放（涉及航空旅行）。该组织还警告，为了应对现代城市必须面对的气候变化挑战，需要改变旅游业的消费方式。考虑到旅游业的增长趋势（预计到2030年会有18亿国际游客，UNWTO 2014），需要制定有效的缓解措施。在这些缓解努力中，技术进步是一个重要的工具，但它单靠自己无法解决气候变化问题。因此，为了有效地化解运输部门面临的压力，需要采取混合措施，包括技术改进、监管和基于市场的措施以及行为改变。技术创新（产品和流程）的贡献是非常重要的，但为了真正起作用，它必须整合到城市转型的治理过程中。旅游业需求中出现的变化（可理解为城市用户特殊需求类型的一种表达）的确表明，人们正日益关注旅游业消费。而且与这些变化相对应，那些旨在增加城市对游客吸引力的城市政策也日益以创新服务的定义为导向，以此支持和促进城市旅游业。这其中就包括推动将旅行方式转变为使用汽车（可持续移动性），并成为城市竞争力的一个战略要素。基于这些考虑，本文将提议分析一些旨在将旅游业与移动性整合作为城市系统新成就的最佳实践。

KEYWORDS:
旅游业与移动性整合, 可持续旅游业, 可持续移动性, 智能移动, 城市政策

1 TOURISM AND MOBILITY INTERACTION

"Tourism is a social, cultural and economic phenomenon, which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes. These people are called visitors (which may be either tourists or excursionists; residents or non-residents) and tourism has to do with their activities, some of which imply tourism expenditure". The definition is by the World Tourism Organization (UNWTO/OMT), the main international institution of the United Nations system aimed at spreading sustainable tourism development particularly in developing countries.

In the context of the scientific literature, tourism represents the set of movements generated by the search for places and activities that are different from usual and have no economic motivation (Miossec 1976, Page 2003, Cohen 2004). In this definition, tourism depends on the coexistence of at least three conditions: 1) a displacement from the residence place to a different one; 2) an overnight stay (twenty-four hour minimum to be considered as a tourist); 3) a motivation that is different from work that activates the displacement. Origin, duration and motivation of the move are the variables for which tourism is defined and classified. Such a definition underlines that mobility is essential to tourism.

Whatever the definition, or the distinction among typologies of tourism, it is undeniable that there is a close connection between tourism and transport. The growth and evolution of tourism has been intrinsically connected to the development of the transport system: it is known that railways and then the airplane decisively contributed to its growth and diffusion as a "mass" phenomenon, in a relatively short time. The importance of transport is then decisive in the planning phase of tourist activities, accessibility having a strong influence on the choice of a destination and, in this sense, it can constitute a competitive factor. This is only one aspect of tourist mobility (external component). The second aspect concerns the displacements to visit the chosen destination. Both types of displacement are characterized by a high concentration of space-time affecting the operation and organization of the urban system concerned.

Page (2005) refers to a "tourist transport system" which is a complex system combining the physical movement of visitors using one or more forms of transport (the logistical component) and the travel experience (the experiential component). Both components of the tourist transport system demonstrate the system's unavoidable environmental, economic and social impacts.

Tourism, in fact, despite having a role in the economy is also a catalyst for negative impacts on the environment (emissions of pollutants due to the increasing volume of traffic; increased waste; noise; consumption of primary resources; etc.) and more generally on urban livability (quality of services, social integration, well-being and safety of the resident population).

The balance between economic development and environmental protection is the main challenge that the cities that decided to invest in tourist activity, maybe more than any other, are called upon to face.

The European commitment to achieving sustainability objectives, including the development of tourism, has led to the production of documents and codes of conduct aimed at supporting both the realization of integrated public policies (convergence of goals between different stakeholders) and raising awareness of tourists (compared to the needs of local communities; reduce consumption; navigation optimization , etc.). One of the priorities consists in reducing the CO2 emissions generated by tourist mobility in Europe (Tourism Sustainability Group final report "action for more sustainable European tourism").

In the report Climate Change and Tourism: Responding to Global Challenges[1], international and domestic tourism, from transport and accommodation are estimated to represent between 4.0% and 6.0% of global emissions (fig. 1).

[1] The report was presented in the context of the Second International Conference on Climate Change and Tourism, in Davos, on October 2007. It highlighted the vulnerability of the sector to climate change and the impacts of tourism on climate itself. It underscored the need to develop the tourism sector in a sustainable manner in order to mitigate greenhouse gas emissions firstly deriving from transports and accommodations.

	CO_2 (Mt)
Air transport	517
Other transport	468
Accommodation	274
Activities	45
TOTAL	1,307
Total world [1]	26,400
Share (%)	4.95

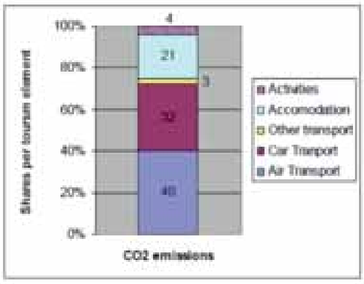


Fig. 1 Emissions from tourism and contribution of various tourism sectors to CO2 emissions. In the left table, the color of each grid cell represents the degree of certainty with respect to the data and underlying assumptions. Green represents a degree of uncertainty of +/10%, blue +/25% and red +100%/50% (Source: Report on Climate Change and Tourism: Responding to Global Challenges, 2007)

In Italy, tourist mobility is largely characterized by the dominance of car use and by a trend of cities as a preferred destination. At present, indeed, cities have become one of the preferred tourist destinations (Page and Hall, 2003) generating a new form of tourism that can be defined as urban tourism2. The presence of cities in the "tourist experience" shows the change that has been increasingly affecting tourist demand. Indeed cities have become the "object of tourist desire" as they are the place where more experiences can be lived contemporarily and they represent a perfect destination for a short holiday.

The need, therefore, to provide infrastructure and services aimed at encouraging forms and modalities of tourist transport more compatible with the demands of sustainability (environmental, social, economic) becomes a priority to make cities livable. Complicated and a long term issues, if we consider that the realization of these objectives (as well as an indispensable collaboration between different stakeholders, public and private, involved in the planning, promotion and management of tourism) requires also a substantial behavioral change by the user.

As regards Italy, the relationship between public entities responsible for managing tourist flows and private operators is often confrontational. Coordination between the different skills, instead, it would be necessary for the creation of an integrated tourism system. The supply and quality of services for tourist activity plays a significant role and affects mainly the degree of attraction of a city making it more competitive.

City planning actions (intended as the search for an order according to a plan) should mostly focus on this last component (the supply of urban services and facilities) to minimize the negative impacts generated by tourism on the city, envisaging an improvement of the conditions of use of the city itself.

At present, tourist activity still seems to be intended as "other" and it is seldom integrated within the urban planning process. Policies for urban promotion, however, seem to concentrate mostly on city branding, rather than on the definition of strategies aimed at making cities able to support an additional urban load expressed by tourist demand. Referring to these premises, this article is aimed to underline how tourism could represent an urban drive function able to promote more sustainable lifestyles especially referring to mobility issues. In the first part, tourism characteristics are explored with particular reference to mobility. The second part considers some European examples where the integration tourism-mobility represents an occasion to improve the diffusion of a sustainable way of moving. In the conclusion, the paper tries to individuate conditions that could improve integration between tourism and transport.

[2] Urban tourism has been investigated in literature, for more in-depth analysis see Ashworth G. and Page S.J. (2010) Urban tourism research: Recent progress and current paradoxes, Tourism Management 32 (2011) 1-15, Elsevier; Edwards D., Griffin T., Hayllar B. (2008) Urban Tourism Research Developing an Agenda, Annals of Tourism Research, Vol. 35, No. 4, pp. 1032–1052, 2008; Bramwell B. (1998) User satisfaction and product development in urban tourism, Tourism Management, Volume 19, Issue 1, February 1998, Pages 35-47, Elsevier.

2 TOURIST FRUITION AND URBAN MOBILITY

The spatial-temporal movement represents the essential component of the tourist activity in the absence of which there is no tourism. The motivation of tourist displacements is also a key element in defining the characteristics of tourism demand. Tourists are "temporary citizens" who, although for a concentrated period, express a demand for services and facilities to which the city must answer, in terms of performance, amenities and space (urban supply) (fig. 2). Tourism, therefore, represents an additional urban load that, if not properly planned and managed, can affect the balance and the organization of the city. In this sense, the relationship between tourism and urban activities is often confrontational and it affects the mobility system. Within tourist cities, in fact, an overlap occurs between at least two different types of mobility. On the one hand, the daily displacement flows, generated by residents and daily users (users and city commuters). On the other hand, occasional users (tourists and one-day visitors) generate displacements.

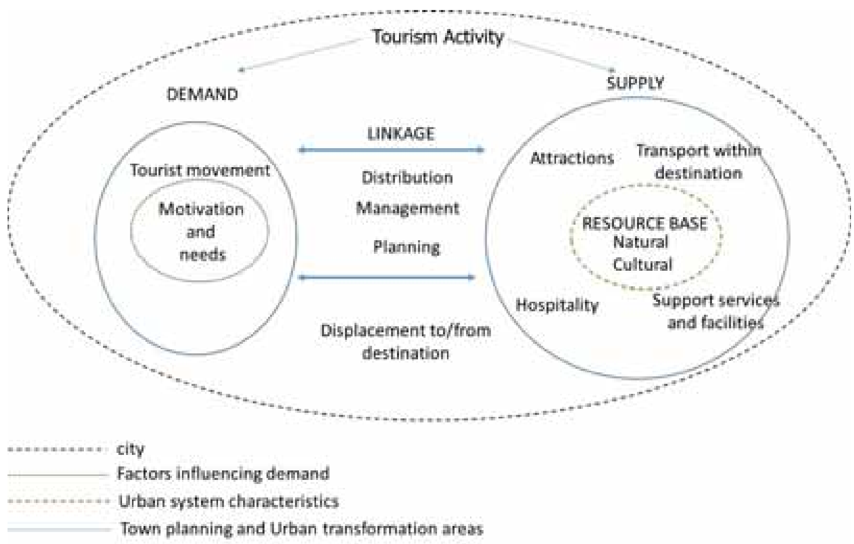
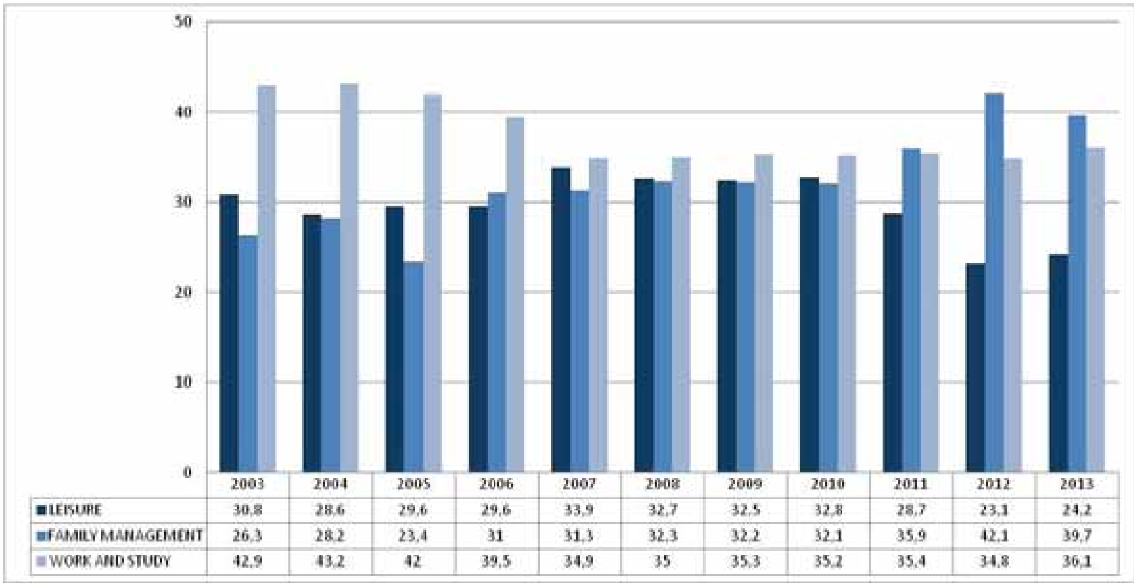


Fig. 2 Conceptual scheme of the tourism system referred to the component of demand and the component of urban supply. Urban Planning can act on the supply component in order to address tourist demand towards more compatible ways of fruition of urban resources (rielaboration from Lubbe, 2003)

This overlap creates congestion (traffic, air and noise pollution) affecting particularly the central urban areas. These flows tend to be concentrated in urban areas, mainly characterized by the presence of attractors, artistic and architectural historians, at specific times of the year. These considerations should be the object of an integrated mobility planning, considering tourist mobility as part of the urban motility system (meant as the set of displacement generated to carry out urban activities).

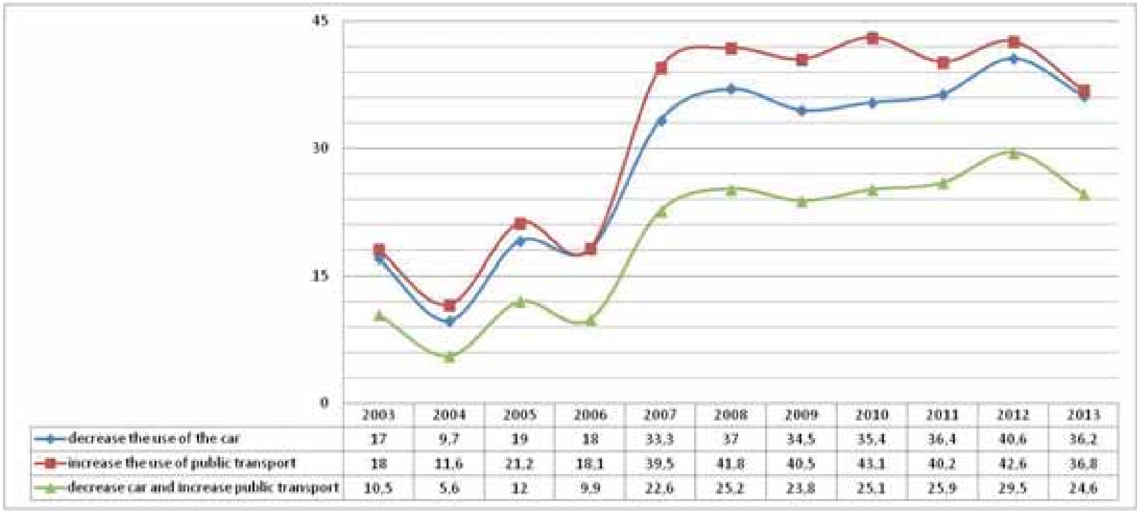
Leisure mobility (including tourist component), in fact, represents an important section of urban displacements (work, study, family management, commissions, etc.) and represents the 24% of total displacements (ISFORT, 2013). Data show the predominance of the use of the car for these displacements even though there is a low propensity to reduce car use in favor of public transport (Figg. 3, 4, 5).

The situation in Italy, in fact, is characterized by a prominence of car users whose habits are hard to change (fig. 6).



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
LEISURE	30,8	28,6	29,6	29,6	33,9	32,7	32,5	32,8	28,7	23,1	24,2
FAMILY MANAGEMENT	26,3	28,2	23,4	31	31,3	32,3	32,2	32,1	35,9	42,1	39,7
WORK AND STUDY	42,9	43,2	42	39,5	34,9	35	35,3	35,2	35,4	34,8	36,1

Fig. 3 Urban mobility by motivation in Italy (elaboration on ISFORT data 2013)



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
decrease the use of the car	17	9,7	19	18	33,3	37	34,5	35,4	36,4	40,6	36,2
increase the use of public transport	18	11,6	21,2	18,1	39,5	41,8	40,5	43,1	40,2	42,6	36,8
decrease car and increase public transport	10,5	5,6	12	9,9	22,6	25,2	23,8	25,1	25,9	29,5	24,6

Fig. 4 Customers' propensity to reduce the use of car, in Italy: decrease car and increase public (green); decrease the use of the car (blue); increase the use of public transport (red).

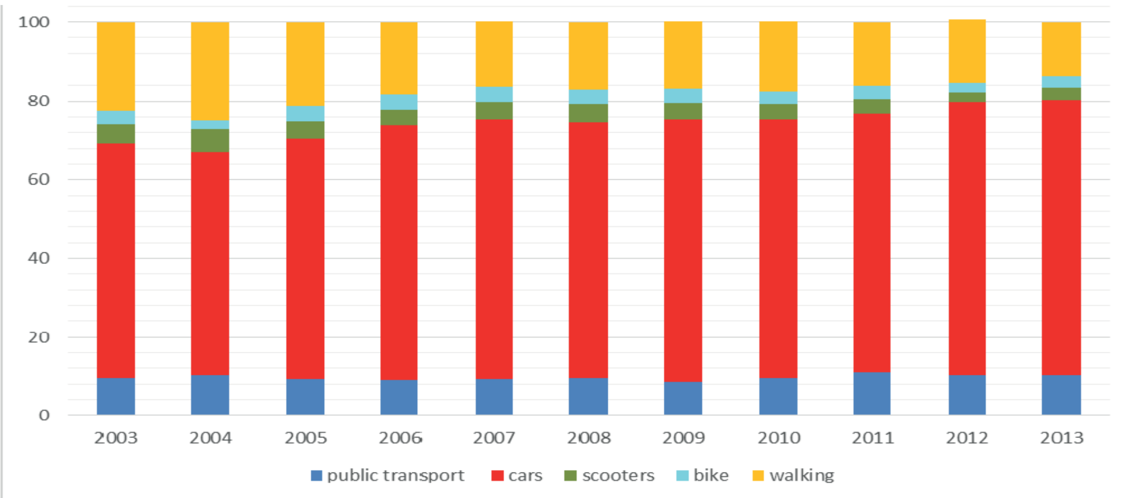


Fig. 5 Percentage of displacement by means in Italy: public transport (blue), cars (red), bikes (green), scooters (turquoise), walking (orange)

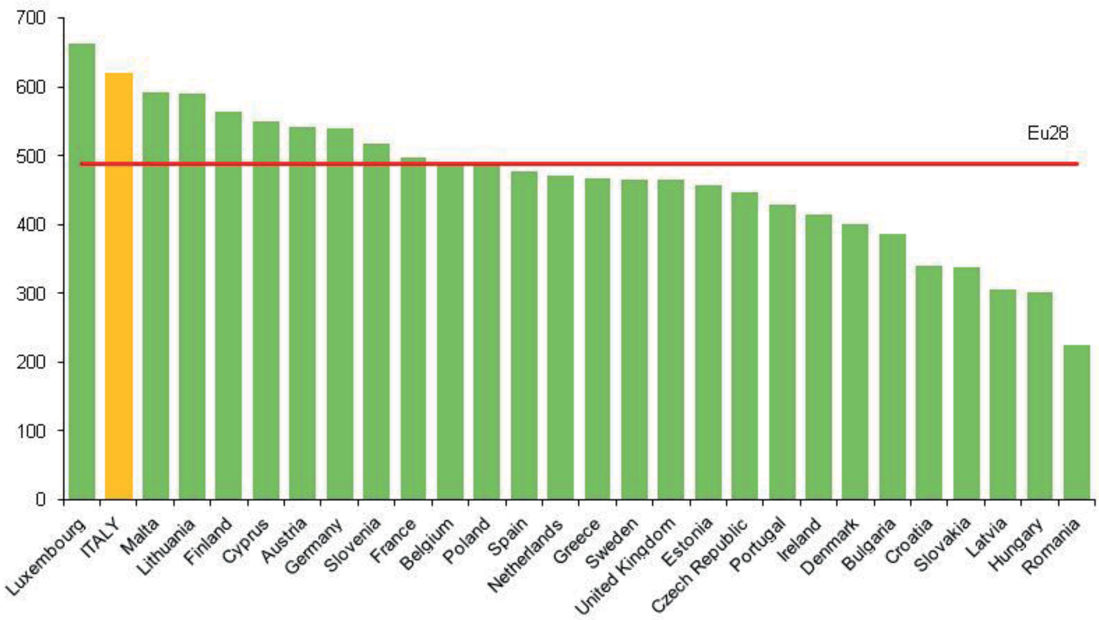
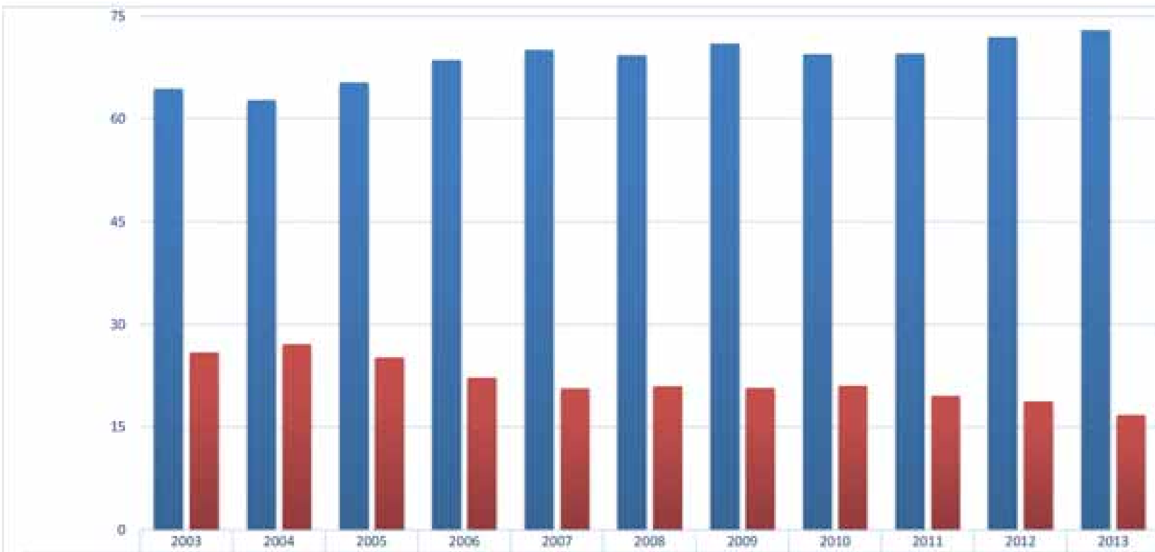


Fig. 6 The number of cars per thousand inhabitants (motorization rate) allows one to measure the negative impact of congestion on the road system mainly due to the density of vehicles in use. In Italy, the motorization rate increased from about 501 cars per thousand inhabitants in 1991 to about 621 in 2012, one of the highest rates in the world and the second in Ue28. (Elaboration on data from ISTAT 2012)

At present and especially as it concerns the Italian situation, mobility is overbalanced towards road transport and private cars. Italy is among the EU countries that have the highest motorization rate (Eurostat 2014), even though data show that there is a general propensity to reduce the use of the private car. Really, the Italian situation is characterized by a large difficulty to affirm a new mobility culture based on more sustainable forms of urban mobility, despite a prolific production of laws and roles referred to emergency of adopting alternative ways of moving to minimize negatives impacts of urban mobility on the human health and on climate change.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
car dipendence	64,4	62,7	65,3	68,6	70,1	69,3	71	69,4	69,5	72	72,9
soft mobility	25,9	27,1	25,2	22,2	20,6	21	20,7	21,1	19,6	18,7	16,8

Fig. 7 Despite the general European trend, in Italy the "soft mobility" is not yet affirmed. In this case, soft mobility considers pedestrian and cycle displacements (Elaboration on ISFORT data)

A recent study referred to European cities[3] (Pieralice and Trepiedi, 2015) shows the correlation between the urban mobility policies and modal choices and proposes an experimental mode to define an Index of Sustainability[4] to evaluate the effect of these policies. Authors define four dimensions of urban sustainable mobility, particularly referred to:

- social sustainability as it concerns the accessibility aspect;
- social sustainability as it concerns the livability conditions;
- environmental sustainability;
- economical sustainability.

These dimensions have to be contemporarily considered in order to define policies and intervention that could have some efficacy according a holistic vision of the problem.
Authors elaborate a ranking on the base of the value that the Index assumes, referred to a sample of 22 European countries. Analysis underline how sustainable mobility depends on different variables and it is not strictly connected to the motorization rate nor to the GDP. It depends on a mix of factors that refer to culture, at both social and administrative level, and to the governance ability in promoting and acting policies aimed at the diffusion of forms of mobility alternative to the use of the private cars. Authors define this attitude as an "innate sustainability" that characterize some countries rather than others. The top of the ranking, in fact, with some exceptions probably due to a lesser economic availability, is occupied by those European countries that have a deep-seated tradition in policies and practices of sustainable mobility.
What seems to be relevant is the proposal to test the index within the General Transport Plan of Rome (Italy) in order to improve the performances expected by the plan in a five-year period. This proposal seems to be particularly significance especially referred to Italian situation as it concerns the present organization of the mobility planning. In Italy, in fact, the urban mobility system is regulated by different plans, acting at different territorial level (tab. 1). Within these plans, tourism rarely is considered as a part of mobility system and interventions and/or measures vary according the importance that it assumes within the objectives of urban development policies.

TERRITORIAL LEVEL	PLAN	OBJECTIVES	TOURISM INTERATION
NATIONAL	General Transport Plan	To define a common approach to transport policies To coordinate skills among different administrative levels	WEAK
REGIONAL	Regional Transport Plan	To assure integration among transport services To provide new infrastructure	MEDIUM
LOCAL	Urban Mobility Plan	To define long-term strategies for the mobility system also between multiple municipalities	STRONG
LOCAL	Urban Traffic Plan	To define a set of coordinated interventions to improve public and private urban mobility (vehicular pedestrian, cycling).	VERY STRONG

[3] The study investigates the impacts of the modal split in the European context and considers a large number of data by different sources Eurostat, Eltis, Epomm-Tems, Isfort-Audimob, Ispra.
[4] The Sustainable Index results from four components: weighted index of motorization; index of accidents; mobility index, pollution index by PM10.

LOCAL (sectorial)	Urban Parking Plan	Rationalization of the urban supply for parking; Considers different typologies of parking demand.	STRONG
LOCAL	Sustainable Urban Mobility Plan	Proposes a different approach to the urban planning according to a strategic approach referred to participation, evaluation and integration principles.	VERY STRONG

Tab. 1 Organization of mobility system by plans in Italy. The last column refers to the level of interaction among mobility policies and tourism planning

Local level represent the place where interaction between tourism and mobility could occur and SUMP5 seems to be the technic tool to improve this objective. The sustainable urban mobility plan (SUMP) introduce a new approach to the mobility planning according the indication given at European level via the Action Plan on Urban Mobility (2009) and the Transport White Paper (2011). It refers to a planning concept able to address transport-related challenges and problems of urban areas in a more sustainable and integrative way. This plan proposes a different approach to the mobility planning, posing more attention to the involvement of the social component (citizens and stakeholders) and promotes a new mobility culture based on a long-term vision of benefits deriving by shared solution to the issues of urban mobility6. The innovative approach that SUMPs want to affirm represents a first point of convergence expressed by the idea of a collaborative planning among both different administrative levels and sectors involved in urban mobility management. Assuming that tourism can be consider as a component of the urban mobility, these plans should indicate possible sustainable strategies and measures to reduce the impacts of tourist flows on the urban mobility system. Strategies could be balanced between pull measures (incentives) and push measures (restraints) promoting sustainable ways of moving and visiting the city.
"Pull measures" refer to mobility polices aimed at promoting a "car-free tourism" and they should focus on:

- *functional actions* (mainly concerning the administrative level):
  - tariff integration among different operators of public transport both at local and regional level;
  - strengthening of the public transport supply;
  - modernization of the means (use of zero-emission vehicles for the public transport such as: electric bus,
  - extension of the operation time of the public transport;
  - institution of public transport lines connecting the attractive poles[7] inside the city;
  - integration between urban planning mobility and land use;
  - prevision of sectorial plan to integrate the urban traffic plan (urban parking plan, mobility cycling plan[8]; pedestrian mobility plan; etc);
  - improve urban road safety;

[5] The mobility policies undertaken at European level in the last decade (Action Plan on urban mobility, in 2009 and Transport White Paper, in 2011) indicate the Sustainable Urban Mobility Plan (SUMP) as a new mobility planning tool able to face the energy and environmental problems and the inefficiencies of urban transportation, introducing an integrated approach to the traditional mobility planning approach.

[6] The guidelines elaborate for the European Commission and for the Executive Agency for Competitiveness and Innovation show principles and objectives of SUMP. Benefits of SUMP are substantially referred to ten points: 1) improving quality of life; 2) create economic benefits; 3) contribute to a better health and environment; 4) make mobility seamless and improve accessibility; 5) make more effective use of limited resources; 6) public support; 7) prepare better plans; 8) using synergies, increasing relevance; 9) fulfilling legal obligation; 10) moving towards a new mobility culture.

[7] "Attractive poles" refer to elements (building, museum, exhibition centers, etc.) that exert a pull on tourist flows acting as "urban magnets".

[8] In Italy, the law 366/1998 set the rules for the funding of the cycling mobility.

  - widespread dissemination of information;
  - involvement of stakeholders for economical support;
  - planning of campaign of information to involve citizens;
  - adopting and promoting the sharing mobility (car sharing, bike sharing);
  - incentives for residents who do not own a private vehicle and/or do not exceed a defined threshold of km per year;
  - free loan of eco-vehicles (bikes and electric cars) for some categories of users (associations, schools, administrations) to improve the use of sustainable means of transport;
  - data sharing;
  - adoption of a systemic approach to the urban issues.
- *physical actions* (mainly concerning the quality of urban spaces):
  - design of an integrated network of public transport;
  - improving dedicated lanes for public transport;
  - realization of soft mobility paths (cycling and pedestrian);
  - building of pedestrian paths both in central and in peripheral areas;
  - planning of connected parking areas for bus tourists;
  - design of bus stop as "active poles" of urban services supply (information; safety; integration with urban function, etc) located in strategic points of urban area;
  - individuation of strategic points to manage mobility flows inside the city;
  - requalification of significant places for citizens;
  - improving green areas and paths inside the city;
  - defining and promoting urban image.

"Push measures" refer to mobility polices aimed at dissuade the car use by imposing restrictive actions that should focus on:

- *functional actions* (mainly concerning the administrative level):
  - taxation to access in urban central areas (congestion charging, pass for tourist bus, road pricing);
  - imposition of a tourist tax;
  - improving the number of traffic restricted areas within the city;
  - increasing the limited speed zones (zone 30);
  - design a web portal for the exchange of information related to tourist mobility;
  - establishing a call-center dedicated to diffuse information about tourist access by coach and cars
  - access restraints and taxation for no eco-vehicles;
  - institution of park and ride areas
- *physical actions* (mainly concerning the quality of urban spaces):
  - planning the localization of smart sensor to control accesses to the historical centers or in other sensible urban areas;
  - creation of a network of parking areas outside the central zone of the city;
  - design of a network of "city gate" acting as check-point for the measurement and the management of the incoming tourist flows;
  - planning of the short-term parking areas;
  - design of park and ride areas as equipped zone to manage incoming urban tourist flows;
  - design of an efficient system of signage;
  - use of GPS system to allow visitors to choose the permitted driveways itineraries inside the city.

2.1 RESTRICTIVE MEASURES: THE CASE OF THE LOW EMISSION ZONES (LEZ)

Among the restrictive mobility polices adopted in the last decade and aimed at improving the quality of air in the cities, the institution of the Low Emission Zone (LEZ) could be particularly significant also referred to the tourist use of the city. The aim of the LEZ is to preserve sensible urban areas (mainly corresponding with historical center) from pollution caused by traffic (production of PM_{10} in particular).
In the case of London, the institution of LEZ (2008) covers most of Greater London (about 1579 square km, 7.7 million of inhabitants) disposing limited of accessibility to vehicles that do not respond to the fixed standard. The measures, then, refer to the state of the mean on the base of "the polluter pays" principle and they aim at a drastic reduction of polluting emission produced by large vans, light commercial vehicles and other special vehicles, public or private. By 2016, measures will be more restrictive also for public transport means that will be comprises in the EURO 6 category or will be composed by hybrid vehicles. The restraints will interest also ambulances and campers. Strict measures will interest also tourist buses whose accesses will be forbidden if they will not respect the standards. The institution of LEZ is adjunctive to the Congestion Charge Zone that is applied to the central part of London and it is substantially different from this. LEZ operates 24 hours a day, for every day while the CC operate from 7.00 to 18.00 p.m. five days a week. In Norway, the National Transport Plan (2014-2023) instituted some LEZ combined with other system of prizing (road prizing) to access the central core of the main cities (Oslo, Bergen e Trondheim).The revenues will be used to improve the supply of public transport and to create new infrastructures dedicated to the soft mobility (pedestrian and cycling). The French *Versament Transport* date back to the Seventies and represents the main revenue allowing the public transport authorities to invest in better quality of the public transport services. This measure can be applied to the tourist cities with a population of less than 10.000 inhabitants and it represents an economic contribution of the visitors to the improving of the public services supply. Restriction measures indubitably constitute a revenue for tourist cities representing a contribution of tourists for the use of services and infrastructures, they are also the object of dissenting views and they can change by country to country according to the specific objectives of their policies.

2.2 INCENTIVE MEASURES: THE BIKE SHARING SYSTEM AS SUCCESS PUBLIC SERVICE

The practice of bike sharing has widely spread in the recent year as one of the main alternative urban services to reduce traffic pollution in the cities. The revolutionary idea refers to free use of a bike that can be picked up and returned in specific locations and dates back to the Sixties, when in Amsterdam was proposed the White Bike program based on the free use of bike to move in the city[9]. From its origin, this public service has changed both for the necessity to improve the customer tracking and for the development of the bike technologies. The evolution of the bike sharing program and its diffusion as a component of the system of urban transport supply passed through three different generations and it rapidly has spread in European cities more than in other parts of the world (DeMaio, 2010). At present, bike sharing represents one of the "smarter model" of urban service using technology both to use and to manage the service. The current smart generation of bike sharing system bases on a variety of technological improvements, including electronically-locking racks or bike locks, telecommunication systems, smartcards and fobs, mobile phone access, and on-board computers. In the meantime, a new generation of bike sharing already is affirming a model aimed to improve efficiency, sustainability, and usability of the service to better diffuse the use of bike for urban displacements. This is being accomplished by improving deployement of bikes, installation, powering of stations, tracking, pedal assistance bikes and other business models.
Despite the large recourse to this system as virtuous urban practice, the use of bike sharing for tourists is not still diffused due to the difficulty to access the service for a temporary user typology as tourist is. The most diffuse systems, in fact, propose a yearly subscription or present high level of difficulties to rent the

[9] The program had not the expected success as the bikes were stolen or throw in the channels.

bikes. These difficulties mainly refers to the lack of information, to the only use of local language, to the duty of age limits, to the restrictions for categories of user different from residential. Nevertheless, the integration of cycling and enhancement of the urban cultural heritage is an increasingly success urban practice to promote more sustainable way of visiting the cities. In 2012, a recent comparative survey (EuroTest, 2012) referred to a sample of forty European cities highlighted the characteristics to define the efficiency of the bike sharing system, especially as it concerns tourist use. If we compared the ranking elaborated by Eurotest (2012) and the ranking of the Top Cities destinations Ranking elaborated by the Euromonitor International (2014) some discrepancy stand out between the quality of the bike sharing system and the level of tourist attractiveness. London, Barcelona and Amsterdam, for instance, do not match high level for the quality of the bike sharing system while occupy high positions in the destination ranking. Although the limits of these rankings and of their comparison, it is possible to make some considerations about how to improve the use of bike sharing to promote sustainable tourism mobility. In particular, present systems should be integrated by technical measures aimed at:

- optimize the urban deployment of the stations;
- definition of planning criteria for the stations localization (i.e. closeness to strategic urban function; network among attractiveness, and so on);
- integration with the local public transport to encourage the modal split;
- facilitate the procedure to access the service;
- improve the quality of information to use the service;
- increase the quality of the means;
- design stations as integrated poles of urban services.

These indications should be supported by the coordination among public administrative and private operators. The involvement of private investors could improve the quality of the service and, at the same time, could reduce the costs both for fabrication and the management of the whole system (installations, purchase of the equipment, etc.) for the administration. There is no ideal model of provision, as it depends by different factors (population, size of the city, number of daily users, etc.) but it could be reasonable to indicate the mix private-public model as one of the more actionable.

CITIES	SYSTEM	EUROTEST EVALUATION	POSITION IN THE EUROTEST RANKING	POSITION IN THE EUROMONITOR INTERNATIONAL RANKING	NUMBER OF TOURIST ARRIVALS (MILLIONS)
Paris	Vélib'	very good	2	5	15,2
Brussels	Villo!	very good	3	55	2,9
Berlin	Call a bike	very good	4	37	4,3
Milan	BikeMi	very good	9	24	5,8
Munich	Call a bike	very good	13	57	2,8
Prague	Homeport Prague	very good	19	21	6,2
Dublin	Dublinbikes	good	21	49	3,3
Vienna	Citybike Wien	good	22	28	5,1
London	Barclays Cycle Hire	acceptable	28	4	16,7
Barcelona	Bicing	acceptable	36	25	5,5
Amsterdam	OV-fiets	very poor	39	27	5,2

Tab 2 Comparison between Eurotest evaluation of the bike-sharing system in 40 European countries and the Euro-monitor International Ranking of the most visited destinations in the world. Table contains only cities that are present in the both rankings

3 TOURISM AS "ACCELERATOR" OF CHANGE

This paragraph is aimed to underline how tourism could play a strategic role in the promotion of new forms of fruition and visit the city that could be more sustainable for the urban and the environmental system. This assumption refers also to the change that occurred in tourist demand due to the innovation technology. This radically changed the way to communicate and amplified the experiential component of tourism. Referring to this component it is possible to state that tourists represent the ideal typology of urban users to test the effects of innovative policies aimed at shifting by the actual unsustainable behaviors to smarter use of the resources and better lifestyles.

Tourism can be considered as an urban activity as it is concentrated in cities expressing a specific demand of use services and facilities that, in origin, have not been designed for tourist use. As a pervasive activity[10] where social component has a fundamental role, tourism can influence behaviors and plays a driving role in promoting more sustainable use of cities (soft mobility, decrease of waste production, water use reduction and energy consumption, etc.). In this vision, town planning has to play a key role in driving the urban system towards compatible states of equilibrium characterized by appropriate and innovative use of resources and of energy in particular. The integration between tourism development goals and urban planning targets would maximize positive aspects of tourism and minimize the impacts that it generates the city's organization.

Considering the present challenges that cities have to face, and first of all the adaptation to climate change in order to implement urban resilience (Colucci, 2012), the emerging paradigm of a "smart city" could be an opportunity to promote an effective change in the use of cities both at a social and an administrative level. The smart city concept seems to highlight that, from a town planner's point of view, the actual challenge consists in making cities more efficient referring to the quality of services, the reduction of environmental impacts (polluting emissions) and the control of energy consumption, by means of innovating technologies (ICTs) capable of supporting the management, monitoring and functioning of cities. The active role of the human factor (citizens, residents, city users, tourists) is becoming increasingly important also because it can significantly affect the success or not of a city as a tourist destination and then on its level of competitiveness.

Tourism, being characterized by "transversality" and "pervasivity"[11], can play a strategic role of driving function able to shift the system towards urban smartness conditions that necessarily engages a physical, functional and social component of the urban system. In this sense, the "smartness" can identify a condition of possible equilibrium (between tourist demand and supply) where the city achieves widespread urban quality levels for all categories of users: residents, city users, tourists.

The change that is characterizing the current tourist demand (from tourism to "smart tourism")[12] denotes an improvement of tourist behaviors and consumptions, and promotes a new model of use for the city according to the sustainability paradigm. Although sustainability in tourism is still an object of debate, at present, it refers to a new approach in tourist supply chain (transport, hospitality, entertainment) rather than to a tourist typology. The present tourist demand, however, is more careful about environmental questions making the sustainability principle one of the factors that influences the choice of a destination.

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[10] In spite of the global crisis, tourism has had an uninterrupted growth over the past six decades. International tourist arrivals have increased from 25 million globally in 1950, to 278 million in 1980, 527 million in 1995, and 1133 million in 2014 (UNWTO 2015). At present, tourism involves all different social levels, being a cross activity, affecting several sectors (mobility, hospitality, leisure, etc.).

[11] Transversality refers to the multiplicity of sectors (public and private) involved in tourist development. Pervasivity refers both to the possibility that ICT offer to share experiences and emotion in real time. This deeply change in communication is emphasized during the tourism experience. Actually, tourists share their opinion and emotion on social networks that, at present, represent also the main source for the analysis of tourist phenomenon.

[12] Buhalis et al. (2014) defines the characteristics of a smart tourism destination referring also to tourists. A smart tourist profile is proposed in La Rocca R.A. (2014) The role of tourism in planning the Smart City, in TeMA Journal of Land Use, Mobility and Environment, Vol 7, n.3 e-ISSN 1970-9870.

In this sense, the promotion of a "sustainable destination" (i.e. zero emissions hotels, management and recycling of waste production; alternative energy applied to lighting of monumental areas and public buildings as well as to the private building sector, etc.), represents a factor of improving its attractiveness and competitiveness[13] of a city.

Tourism can be both a tool to activate new forms of sustainable facilities and services, at the level of supply (involving private and public sector) and as a means of affecting social behaviors, at the level of demand (social component). The spread of ICT has deeply changed the way of sharing emotions and experiences among tourists introducing a "real time" dimension in which distance is almost dissolved. This transformation inevitably affects the tourist supply system chain, oriented at capturing the customers' preferences, but at the same time, it is also a possibility in order to promote new forms of supply that can modify tourist behaviors.

4 SUSTAINIBLE TOURIST MOBILITY FOR THE FRUITION OF CITIES AND REGIONS: EUROPEAN EXAMPLES

This part wants to propose some reflections about the potentialities connected with the planning of new forms of supply in order to activate virtuous behaviors able to reduce impacts of tourism mobility both at local and regional scale. In this framework and referring to the above mentioned considerations, tourism can play a strategic role acting as an accelerator of change promoting more sustainable lifestyles. Tourist demand, indeed, is evolving towards behaviors and practices that are more responsible of the energy consumptions and, then, more selective and quality oriented. This propensity requires a substantial rearrangement in the planning processes of tourist supply that need to be oriented towards the definition of new services and facilities to satisfy the demand exigencies. The need of a change in the tourism consumptions has been expressed at European level both in policies and in declarations to promote sustainable and responsible tourism. This interests mobility as the main responsible of the production of negative effects on environment and on human health. Nevertheless, the integration between development objective and safeguard exigencies is still not effective, even though some significant best practices demonstrate that limiting negative impacts of tourism is possible without reducing its positive economic effects.

In the following, the selected example identify best practices oriented to the definition of innovative forms of tourist fruition aging as pull factors for the development of destination.

4.1 THE PROMOTION OF A CAR-FREE TOURISM DESTINATION IN THE ALPINE REGION

In the context of the above mentioned considerations and referring to the European context, in recent years, tourism has become one of the key elements to promote sustainable mobility on both a large and a local scale. In the first case, interventions and projects aimed at promoting car-free tourism through the use of low-pollution intermodal forms of travel (cycling, public transport, collective transports) connecting different tourist destinations inside a region. In this vision, tourist destinations are part of an equipped network that connects the different poles of attraction and its realization often activates the requalification of paths and itineraries closely connected to the territorial memory and history.

The success of this type of initiative is strongly based on two fundamental conditions.

The first one concerns the coordination among different administrative levels engaged both in the planning of transport and in regional planning, considering an integrated approach to mobility and land use to gain

[13] Criteria for destination pointed out by the Global Sustainable Tourism Council propose and establish standards for sustainability in tourist destination recognizing tourism as a potent tool for both preserving resources and reducing poverty (see http://www.gstcouncil.org).

the objective of a real change in tourist behaviors. The second one refers to the building of an efficient information network able to spread and share objectives and implementations of the projects.

Related to this second condition, the project Alp Infonet (2007-2013) aims to promote the Sustainable Mobility Information Network in the Alpine Space. Based on the idea that the diffusion of information could improve the use of public transport rather than private, the project proposes to integrate the already available information platform in the Alpine Space by providing travelers with comprehensive information about sustainable transport modes beyond regional and national borders. The main objective is to stimulate the use of public transport to visit and to reach the Alpine Space in order to reduce the impact of tourist mobility on the environment. In the name of the Alpine Convention[14] and acting in a collaborative perspective, the five partner (Austria, France, Germany, Italy, and Slovenia) undertake to disseminate the objectives of the project with no discrimination in dissemination of information. This will permit them, on the one hand, to share economic advantages coming from tourist flows, on the other hand, to mitigate the impacts deriving from tourism on the Alpine region.

4.2 THE “CITY MOBIL” PROJECT FOR A SMART MOBILITY

The interventions at a local scale mainly are connected with the issues of urban requalification of urban public spaces. Promoting sustainable mobility in the city deals with three main issues: 1) safety of users; 2) integration with local public transport; 3) information, reception and management of the tourist flows.

At this level, technologies seem to have a major role in supporting the success of the projects leading some scholars to talk about a “techno-centric approach” (Papa and Lauwers, 2015) focused on infrastructural innovation to promote a “smart mobility”.

Self-driving cars could represent the most significant example of this typology even though they are still considered with skepticism, especially because they will not reduce the use of cars in the city although, if the use of them will really spread, it will surely revolutionize the way we drive and use the car.

Cybercars belong to the same typology and are utilized also for a tourist target. They are electric driverless minibuses, connected to a sophisticated device that assures security and reliability of the displacement. They could be used for tourist displacements in urban context utilizing specific and reserved path.

At present, this kind of vehicle is the focus of the European project “City Mobil” aimed at testing this technology in some pilot cities. The city of Brussels is testing the possibilities of creating an automated shuttle system to connect the main tourist attractions. One limit of the project, apart from the high cost of the vehicles, is the lack of rules that can insure the use of cybercars also from a legal point of view. Until now, the Highway Code regulates the circulation of cars, pedestrians and cycles and does not consider automated vehicles. Some experts envisage their use as complementary to the supply of local public transport, especially for tourist use.

4.3 THE SEEMORE PROJECT: NEW PERSPECTIVES FOR TOURISM CONSUMPTIONS

Integration tourism-transport aimed at promoting more sustainable forms of displacement to visit destinations is the main objective of the SEEMORE (2013-2015) project (Sustainable and Energy Efficient Mobility Options in tourist Regions in Europe) based on the idea that it is possible to integrate tourism within the general planning of displacements. According to this main concept, the SEEMORE project aims at promoting sustainable mobility in tourist destinations. It refers in particular to eight coastal tourist European

[14] The Alpine Convention is an international treaty between the Alpine Countries (Austria, France, Germany, Italy, Liechtenstein, Monaco, Slovenia and Switzerland) as well as the EU, for the sustainable development and protection of the Alps. (http://www.alpconv.org).

regions[15] where interaction between visitors and mobility has been implemented by the definition of a set of local actions: mobility information packages for tourists; communication and awareness-raising campaigns; improved sustainable mobility options; integrated products for leisure and mobility; integrated planning processes taking the needs of tourists into account.

The centerpiece of the project is the cooperation among stakeholders, civil and transport administrations, as well as the integration between tourist and transport information by the use of efficient and clear planning to enable tourists to visit destinations by using public transport and cycling.

The development of the SEEMORE project allows us to underline some interesting conditions that could improve the definition of active urban policies aimed at integrating tourism and transport:

- public transport should be marketed as an integral part of the holiday experience;
- cooperation between transport and tourism sector;
- the mobility of visitors and leisure transport should be an integral part of the Sustainable Urban Mobility Plan.

The first condition refers to the opportunities that the use of public transport could offer for tourists in terms of lower costs for displacements and a more integrative way to visit the destination. An audio application for smart phones could turn a public transport trip into a guided visit. For the second condition, an active cooperation between the hospitality sector and the transport sector should be activated. For instance, by the training of staff about the offers of public transport or the sale of tickets at the hotel reception, or by integration with the use of bikes among the public supply of urban services. For the third condition, the occasion given by the introduction of SUMPs should be better fostered by the definition of methodologies to manage urban tourist mobility. At present, the main difficulties refer to the availability of data to measure the impacts of urban tourist flows, this difficulty could be overcome by the application of open data in defining strategies of tourist development and territorial management (Las Casas et al., 2014).

4.4 POLICIES TO INTEGRATE TOURISM AND MOBILITY IN FRANCE

The report "Transport urbains et tourisme" analyzes the supply of services for tourist mobility in France and highlights the lack of integration between tourism and mobility in an urban context especially as it concerns the application and the web sites. The only case of integration refers to Paris with the application "Visiter Paris en metro". The study concludes by stating that among the French agglomerations tourist mobility is not yet considered as an element of the global tourist supply system (fig. 8).

5 TOURISM AND MOBILITY: CONDITIONS FOR SUITABLE INTEGRATIONS

Tourism is still categorized as a form of mobility that is different from the others inside the city, representing in some cases, an inconvenient element for residents and regular city-users. Indeed, tourism is a factor of disequilibrium but what this article tries to state refers to the possibilities of reducing tourist impacts by the integration of this activity within the urban planning process. As mentioned above, tourism could represent a driving function to shift present cities towards more sustainable states and in this sense it represents a resource not only for its indubitable economic value as an industry. The promotion of sustainable mobility in cities adds a global value to city-life for both tourists (as a tourist product) and residents (as a better quality of urban public space). At the same time, tourist travel habits can act as a generator for global change in actual lifestyle even though a concrete integration has not yet been reached. Considering the analyzed examples some conditions emerge, acting as pull factor for the activation of possible integrations tourism-mobility.

[15] The eight region involved were: Provincia Forlì-Cesena (Italy), Choczewo, Pomerania (Poland), Dobrich District (Bulgaria); Mallorca, Balearic Islands (Spain); Limassol (Cyprus); Bohuslän (Sweden); Malta; Madeira (Portugal).

Fig. 8 The report Urban Transport and Tourism, elaborated by Cerema in 2014, shows the lack of integration between tourism and mobility services in the main French urban agglomeration. Paris (green) is the only case where integration occurs; Metz, Tours and La Rochelle (grey) are cases of only tourism applications; Lille, Rouen, Nantes, Bayonne, Toulon, Grenoble, Nancy, Strasbourg (orange) refer to only transport applications; Rennes, Bordeaux, Lyon, Mulhouse, Avignon, Montpellier, Toulouse, Marseille, Nice (blue) are cases of dissociated application transport-tourism.

– *Cooperation between public and private actors*

The first level regards administrative conditions to assure the co-operation between local authorities, transport and tourism companies, in order to obtain the integration objectives. Protocols to share data and information among public and private actors should be drafted. This could have a double benefit. On one hand, cooperation and data sharing would permit a real monitoring of tourist flows, on the other hand it would allow the definition of integrated policies aimed both at promoting and governing the urban system. Cooperation between the hospitality sector and the public administration, for instance, could activate positive interventions of requalification of urban public space, the allocation of costs and the sharing of benefits for both (public and private stakeholders).

– *Dissemination and information sharing*

Another positive effect of cooperation is the possibility to combine different products in an integrated supply (for instance a combined ticket for public transport and attractions; an audio guide for public transport or for cycling routes, a reduction in the entrance price for visitors using public transport to reach the place, etc.).

The information availability is another indispensable condition to steer tourists in making their choice of modal displacement and of routes. In this sense, it is possible to state that interventions should concentrate in disposing actions aimed at implementing the knowledge of tourists, acting on the availability of information rather than on the tourist way of moving. The design of on line platforms that are freely accessible and able to inform tourists about the possibilities of moving inside the destination using public transport seems to be one of the solutions that is more likely to be achieved. Moreover, through an appropriate authentication procedure, tourists should be able to access the wi-fi network and to connect to an urban platform.

– *Virtual and physical planning integration*

– The aforementioned "digital condition" has to be reflected in the physical state. In other words, if intelligent platforms can contribute to the diffusion and the rationalization of information, it is necessary to have an efficient network of mobility (infrastructures and services) in order to promote car-free tourism inside a destination. In this sense, the tourist component can be integrated in the urban demand and it should be considered in the design of the mobility plans at both urban and regional level. These plans should define strategic actions to improve sustainable forms of mobility, among these:

- increasing the supply of public transport;
- improving the quality of the service of the public transport (i.e. trained staff; equipped vehicles; etc.);
- caring of the design of the public transport stations;
- establishing car pooling for short and long distance journeys;
- strengthen the network of pedestrian paths within the city;
- promoting the use of bike-sharing through installations in strategic points of the city;
- institutionalizing of innovative sharing modes of displacement (i.e. taxi sharing);
- design of equipped and interconnected cycling network;
- predisposing a network of equipped parking;
- design of up-to-date and reliable signage in different languages.

These measure should be mainstreamed within tools of mobility planning at different scale, introducing a different vision to mobility planning aimed to integrate the issues of tourist mobility, in order to promote more sustainable way of moving inside the city.

6 CONCLUSION

This article has tried to underline how the planning of urban mobility (composed by the set of displacements to conduct urban activities) could assume a strategic role in improving urban livability. Mobility represents the sector able to increase a more sustainable way of life. In Europe, since the second half of the Nineties, the concept of sustainable mobility has tried to contrast the use of private vehicles in favor of less polluting modes of travel based on the need to safeguard public health. Nevertheless, car dependence continues to prevail, although there is an increase in the propensity to change behaviour of use (ISFORT 2013).

If this, on one hand, represents a positive trend, it is not yet sufficient to activate the change needed to face the challenges that our present cities have to face (climate change, energy and water saving, dependence by fossil energy, etc.) and also considering that vehicular mobility is the biggest culprit regarding urban pollution and thus global warming. The contribution that some forms of mobility, more compatible with environmental requirements, can provide was also shown by the increasing interest of the industry proposing "green engines" to "zero emissions", all, however, aimed at improving the efficiency of the vehicles rather than “car dependence”. What this article tries to state, also by taking some European examples into account, is the consideration that in order to achieve the objectives of sustainability the search for “green technologies” is no longer enough, but the need for actions that are able to spread awareness of both users and decision-makers. In the context of these considerations, tourism as a pervasive activity could improve the change towards more a sustainable lifestyle acting as a driving function to promote alternative ways to use the city. In this sense, it is no more an agent of disequilibrium but an accelerator to change mobility behaviors. The “smart city” concept, even though its difficulties need to be clearly defined, can contribute towards the changes needed, but a holistic vision is needed to be efficient. A smart city approach should aim at improving the quality of urban life through the integration between technology components and social exigencies. The considered examples showed that transformation is based on a collaborative approach in order to activate measures and interventions aimed at improving livability and a better quality of life. At the same time, the involvement of citizens and city-users within the process of urban transformation has to be achieved. The potentialities of tourism as a key function to activate new forms of sustainable facilities and services, at the level of supply (involving the private and public sector) and as a means of affecting social behavior, at the level of demand (social component) should be investigated and integrated more successfully within the global process of urban transformation planning. At the end of these reflections, further context conditions that could act as lever of changing could be indicated in order to define direction toward suitable change more attentive to the emerging exigencies of cities. These conditions refer to:

- integrated approach to the mobility issues by a general renewal of the government process of urban transformation;
- intermodality that means to adopt a "network logic" at both operative and planning level;
- implementation of investments programs aimed at improve the ecological networks and local services related to urban planning;
- improving the diffusion and application of urban policies aimed at supporting soft mobility;
- adopting more integrated approach oriented to the best use of technology for improving quality of urban life;
- innovation of the government process, in terms of territorial integration, transparency and participation.

Acting on these different "component of the change" and considering the factors occurring to adopt sustainable mobility seem to be the way to shift cities towards better state of urban livability.

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COUNCIL TAX POLICIES AND TERRITORIAL GOVERNANCE

ANALYSIS AND OUTLOOK OF A DIFFICULT RELATIONSHIP

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ABSTRACT

In recent years, the dependency of local public finance from various forms of taxation related to urban development and real estate has become increasingly evident in Italy. Nevertheless, to date no organic relationship seems to have been established between fiscal policies, on the one hand, and urban planning, on the other.
This article examines the ties linking the two areas, focusing on different types of taxes and discussing the aspects that have come to influence the area of planning, with special regard to territorial competition, urban equalization, building rights and land consumption mitigation measures.

KEYWORDS:
taxation, urban planning, fiscal federalism

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议会税政策与地方治理：一种艰难关系的分析与展望

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ABSTRACT

近些年在意大利，地方公共财政已经变得越来越依赖与城市开发和房地产相关的各形税收。但到目前为止，财政政策与城市规划之间似乎并没有建立有机联系。
本人将研究连接着两个领域的纽带，聚焦于不同类型的税收，讨论会影响规划的各个方面，并特别涉及区域竞争、城市均衡、建筑权利和土地消耗缓解措施。

KEYWORDS:
税收,城市规划,财政联邦主义

1 INTRODUCTION

In the last twenty years, the introduction of new local taxes, ICI and IMU in particular, has made clear the link between tax and urban policies. This link is anything but new: tax reform was an alternative to failed urban reforms already in the Sixties (Sullo, 1964), not to mention Constitutional Court decisions on pre-emptive expropriation of buildable land (Sandulli; Spasiano; Stella Richter, 2007).

In those year, taxes were seen as an instrument for the reuptake of urban income, or for the mitigation of big disparities as a consequence of land transformation. The link between the two policies is nowadays far more complex and integrated with planning instruments, because taxes on urban transformation are increasingly high and because urban planning legislation is getting more and more complex, what surely has an impact on the whole planning process.

On the other hand, the economic framework since 2007 is having an impact both on real estate market and on urban planning, with unexpected phenomena still waiting for in-depth studies (Cutini, Rusci 2015).

In such a context, governing the territory in a broad sense (i.e. with regard to the economic dimension that makes governance possible) pose the risk for fiscal and economic policies to subordinate planning choices to budget needs. This is what has already happened in the past, in times of expanding market, thanks to the possibility to partly use urban fees for local expense financing, thus converting urban expansion into a fuel for public policies. Such a phenomenon is true even today, in an abnormally long recession, with the aim to raise funds in order to comply with budget obligations deriving from European policies.

Once again it seems that in Italy territory governance still remains linked to expansive and transformative dynamics, instead of conquering its own strategical and political dimension. This leads to operating tools more oriented towards projects and space than towards programs and systems.

In a phase when urban expansion and resources for urban planning and public works cannot be taken for granted, these are the reason why territory governance risks being out of game, replaced by more specialized disciplines, pertaining to the economic and legal field, which are less able to read and organically envisage the complexity of a territory.

Beside that, urban planning policies are traditionally pro-cyclic ones: the trend is to strengthen obligations and charges during stagnation, and to deregulate and de-tax when economy is growing (Curti, 2004). Such a trend reduces the capability of urban planning to identify new strategies for emerging problems. As an example, let's simply think of the many measures which were adopted to contain land consumption (e. g., Tuscany's Regional Law n. 65 of 2014), or to capture land capital gain: the paradox is that such measures were substantially missing during the big urban and economic expansion in the Nineties.

It is therefore interesting to study the influence that all the different elements pertaining to various disciplines are having on territory governance, with a clear impact in terms of land planning and policies. In this article we analyse from an urban planning viewpoint the consequences of new fiscal instruments on planning, paying special attention not only to problems, but also to unexpressed potential in management tools: urban equalization above all, transfer of development rights, and land consumption mitigation measures.

2 TAXATION AND TERRITORIAL GOVERNANCE

Local government taxation is obviously most directly impacting on territorial governance and can be divided into two broad categories: levies relating to urban development, i.e. the various forms of building fees (urban taxation); levies on real estate, basically IMU and ICI (property taxation). A third form of contribution has come into being recently, a non-strictly fiscal one: urban equalization, which - as we shall see - shares some traits in common with more traditional levy instruments.

The adoption of fiscal federalism at council level, together with a progressive – and programmed – weakening of transfers from the State, has led to a very strong link between council budgets and real estate: in 2012, IMU alone accounted for 30.69% of total municipal income (source: ISTAT, MEF – Ministry of Economy and Finance), thus establishing a direct dependence of local finance on economic cycle and real estate market (Ferri, Adobati 2011), as well as on urban growth as we shall see.

Urban planning taxation – meaning those charges for primary and secondary urban developments as defined in Law n. 10 of January 28, 1977 – represents a *una tantum* (one-time only) levy for building activities, according to the principle of quid pro quo in which a tax is due corresponding to the marginal benefit from private use of public good and services. Development charges plus a tax on construction costs – introduced by the aforementioned law – constitute the contribution to the making of a town. This link between tax (charges) and performance (works) was originally intended to exclusively cover the site development and land expropriation costs (art. 12 of Law 10/1977). However, this link has been weakening with the implementation of the law: since 2001, DPR (Presidential Decree) n. 380 allows for a part of those charges (varying between 50 and 75% in different years' budget laws) to cover current public expenditure. Many researchers (Ancillotti 2007; Agnoletti 2008; Pileri 2009; Curti 2004) think that eliminating such an earmarking of planning fees has led to promoting urban expansion, especially in market expansion times, with the risk of territorial policies being subject to budget needs, instead of strategy and sustainability goals (Curti 2004). The share of construction fees on total municipal income varies greatly depending on territorial specificity and market conditions and is quite limited if compared to other fiscal income. Let's take into exam the provincial capitals in Tuscany and Venetia (Tab.1).

Fig.1 Buildable area

MUNICIPALITY	TOTAL INCOME	CONSTRUCTION FEES	SHARE
Massa	100.171.819	1.524.856	1,52%
Lucca	99.261.485	2.959.762	2,98%
Pistoia	102.061.139	2.218.311	2,17%
Prato	223.577.386	8.052.736	3,60%
Pisa	146.951.385	6.927.818	4,71%
Firenze	717.942.846	6.870.868	0,96%
Livorno	185.702.887	8.266.554	4,45%
Arezzo	84.046.498	2.952.859	3,51%
Siena	106.017.175	2.141.037	2,02%
Grosseto	95.201.875	3.497.718	3,67%
		AVERAGE	2,96%
Belluno	33.485.810	395.387	1,18%
Treviso	90.640.667	2.883.175	3,8%
Vicenza	165.613.519	3.087.702	1,86%
Padova	350.199.886	6.061.571	1,73%
Venezia	724.533.007	11.282.233	1,56%
Verona	390.940.987	5.785.699	1,48%
Rovigo	51.899.953	838.564	1,62%
		AVERAGE	1,80%

Tab.1 Shares of construction fees on province capital budget in Tuscany and in Venetia, 2012. (Author's elaboration on data from MEF)

In the case of Tuscany, the share of construction fees was on average 2.96% in 2012; as for Venetia, the average was 1.80%. Noteworthy values are the peaks in Pisa and Leghorn, with a share close to 5%.

The ratio between construction fees and new authorised volumes – i.e. land take, as a matter of fact – is biased by several variables (intended use, urban typology, implementing party), and by the impossibility of taking into account fees paid in the form of direct works by the entrepreneur. This practice is quite common in Italy, where the promoter is often the builder himself.

In Tuscany, the comparison between the three-year periods after and before the implementation of DPR 380/2001 does not show any discontinuity to be attributed to the possible use of construction fees for public expenditure financing.

Thus, whereas a direct influence of charge revenue on planning choices is difficult to ascertain, it is clear that a policy of urban development containment would be contrary to the needs of local governments in terms of budget resources.

In areas where urban development pressure is traditionally higher, a policy for dramatic reduction of land take – though desirable – would lead municipal budgets to default. If we take a look at the municipalities on the coast of Tuscany (tab. 2), a Region which has recently adopted very strict legislation preventing the use of agricultural land for urban development (L.R. 65/2014), average share of construction fees in municipal budgets exceeds 5%, topping well over 10% in Forte dei Marmi, Montignoso, Castagneto Carducci and Capalbio. As elsewhere in Italy, this shows the need of an integrated management of territorial governance and tax policy: otherwise, good measures of landscape safeguard risk succumbing to the need of safeguarding budgets.

MUNICIPALITY	TOTAL INCOME	CONSTRUCTION FEES	SHARE
Capalbio	5.708.595	614.691	10,77%
Orbetello	32.139.241	505.043	1,57%
Monte Argentario	22.975.938	1.426.834	6,21%
Magliano in Toscana	5.513.043	290.378	5,27%
Grosseto	95.201.875	3.497.718	3,67%
Castiglione della Pescaia	24.521.657	1.670.609	6,81%
Scarlino	9.664.598	262.970	2,72%
Follonica	30.770.633	1.558.866	5,07%
Piombino	45.291.707	984.624	2,17%
San Vincenzo	16.232.596	981.368	6,05%
Castagneto Carducci	11.227.306	1.156.158	10,30%
Bibbona	7.640.488	450.000	5,89%
Cecina	28.718.587	1.907.530	6,64%
Rosignano Marittimo	50.642.492	1.507.215	2,98%
Livorno	185.702.887	8.715.718	4,69%
Pisa	146.951.385	6.927.818	4,71%
San Giuliano Terme	35.278.817	1.261.401	3,58%
Vecchiano	9.235.785	373.360	4,04%
Viareggio	174.881.761	1.894.146	1,08%
Camaiore	47.588.999	2.862.402	6,01%
Pietrasanta	54.964.418	1.713.615	3,12%
Forte dei Marmi	33.056.332	4.403.346	13,32%
Montignoso	10.712.525	1.286.427	12,01%
Massa	100.171.819	1.514.856	1,51%
Carrara	88.690.554	1.600.022	1,80%
		AVERAGE	5,28%

Tab. 2 Share of concession fees in budget of coastal municipalities of Tuscany, 2012. (Author's elaboration on data from MEF)

Non “one-off” taxes, i.e. levies on a tax base corresponding to property stock on the municipality territory, show a completely different picture. In contrast with planning fees, income deriving from this kind of taxation is determined a priori, as linked to the quality of existing building stock in the single municipality. Its tax base is therefore less mobile and more uniformly distributed on the territory. This allows a more precise fine-tuning of tax policies, both in terms of income and investment programming.

The percentage share of property taxation on total municipal income has greatly increased in the last years, owing to a combination of higher taxes and lower State transfers. Taking into exam the same sample of towns, here are the results (tab. 3).

MUNICIPALITY	TOTAL INCOME	TOTAL TAX ON PROPERTY	SHARE
Massa	100.171.819	22.261.970	22,22%
Lucca	99.261.485	26.700.000	26,90%
Pistoia	102.061.139	22.144.619	21,70%
Prato	223.577.386	40.951.000	18,32%
Pisa	146.951.385	35.742.552	24,32%

Firenze	717.942.846	176.545.092	24,59%
Livorno	185.702.887	54.785.232	29,50%
Arezzo	84.046.498	24.507.920	29,16%
Siena	106.017.175	26.100.001	24,62%
Grosseto	95.201.875	23.393.660	24,57%
		AVERAGE	24,59%
Belluno	33.485.810	8.305.246	24,80%
Treviso	90.640.667	21.504.590	23,73%
Vicenza	165.613.519	35.863.516	21,65%
Padova	350.199.886	110.722.267	31,62%
Venezia	724.533.007	105.863.849	14,61%
Verona	390.940.987	94.171.011	24,09%
Rovigo	51.899.953	14.840.612	28,59%
		AVERAGE	24,16%

Tab. 3 Shares of property taxes on province capital budget in Tuscany and in Venetia. 2012. (Author's elaboration on data from MEF)

Average share of property income on total municipal income is 24.59% in Tuscany and slightly lower in Venetia, topping at around 30% in towns like Padua, Leghorn and Arezzo.

The Imposta Comunale sugli Immobili – ICI, similar to property tax in the UK and the USA – was introduced in Italy in 1992 as an extraordinary measure made permanent in 1993 by Decree n. 504 of 1992, as an answer to public finance crisis. After a long set of integrations and modification, it was eventually replaced in 2012 by IMU (Imposta Municipale Unica, Single Municipal Tax), by summing up the old ICI with income tax on property. Tax base for IMU has remained the same as for ICI, but with a much higher levy since the multiplier on cadastral rent raised from 100 to 160, as tax rates also were increased: tax rate was 0,4% for ICI, but for IMU it may vary between 0,46 and 1.06%.

As tax base is made up by cadastral rent, the resulting income for a single municipality depends on the nature of its real estate stock: type of property (cadastral category) and reference market value (cadastral rent) are very important in this respect. Bonuses and exonerations exist for primary residence, whereas on other intended uses taxation is heavier and generates much more tax income (fig. 2).

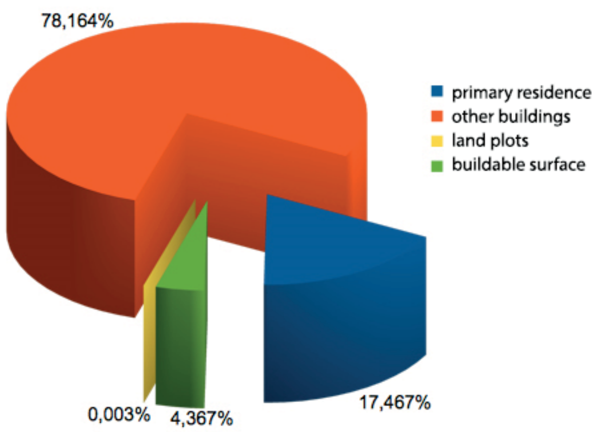

Fig. 2 IMU income distribution by cadastral category (Source: Ministero dell'Economia e delle Finanze - MEF)

This means that tax income of a single municipality is heavily influenced by the presence on its territory of intended uses other than primary residence (tertiary, production, commercial): the municipalities with more production and commerce on their territory will get higher revenue from property tax than, say, others with the same population, same provided services but less presence of those functions.

Since commercial and productive activities are more mobile and highly sensitive to tax differences (S.Piperno, S.Piazza, G. Pola 2006), local governments may have an interest in reducing tax rates in order to attract tax-paying activities, with possible tax competition phenomena.

Big shopping centres, for instance, receive customers from wider areas but contribute solely to the budget of their own municipality, even in case of a small one. They have thus a very variable impact on council finance: if we take some of Tuscany's malls (tab 4), the percentage goes from 0.33% for Centro Commerciale Aurelia Antica to higher values for bigger shopping centers (the so-called "outlets"): Val di Chiana (4,24%), or Barberino del Mugello (4,10%).

	CENTRO COMM. "I GIGLI"	BARBERINO DESIGNER OUTLET	VALDICHIANA OUTLET VILLAGE	CENTRO COMM. AURELIA ANTICA
municipality	Campi Bisenzio (FI)	Barberino di Mugello (FI)	Foiano della Chiana (AR)	Grosseto (GR)
population	45.279	10.840	9.552	81.536
total budget income	36.464.211	11.993.246	7.978.644	95.201.875
total tax income	23.577.578	7.666.010	3.578.463	60.911.333
cadastral rent	186.095,06	513.546,74	224.406,89	281.299,66
IMU rate	1,06%	1,06%	0.99%	1,06%
IMU due	113.918,09	314.367,64	151.626,13	203.506,24
share on tax income	0,48%	4,10%	4,24%	0,33%
share on total income	0,31%	2,62%	1,90%	0,21%

Tab. 4 Share of shopping malls on municipal tax income. (Author's elaboration on data from MEF)

In the above cases, municipalities decided to apply maximum rate to commercial activities, i.e. 1,06%, with the sole exception of Foiano della Chiana, meaning that there is no tax advantage. However, the relationship between highly contributing function and their location may trigger forms of territorial competition by which municipalities take the role of undertakings perfectly able to compete on the same territory (S.Piperno, S.Piazza, G. Pola 2006). It goes without saying that such competition does not necessarily lead to ideal location choices from a territorial point of view.

Even in term of tax legislation, this configures a distortion of fiscal federalism principles. Attribution to local governments of those taxes having a mobile tax base (e.g., construction fees) and an unequal geographical distribution is therefore not advisable, since this could engender phenomena of tax competition, horizontal treatment disparity and tax migration (Lattarulo 2012; Giarda 2002).

The strong link between municipal budget and nature of real estate stock even seems resilient to intermunicipal or wider area planning; on the contrary, it favours choices increasing fiscal independence of a given municipality.

In France, where this phenomenon is particularly evident, tax powers were transferred to supra-municipal bodies by the introduction of *taxe professionnelle unique*; a choice which seems quite difficult in Italy after the abolition of Provinces.

It is clear that the location of highly contributing structures goes beyond commercial and urban planning policies; policy making cannot ignore the influence of these structures on budget reality. In the past this kind of influence did not lead – at least in Tuscany – to tax competition policies, but in a future in which tax resources are bound to remain scarce it would be wise to identify instruments allowing control and integrated management of such aspects.

Beyond these two contribution modes, a third one came to be added in recent times: this is urban equalization, in a variety of possible forms in highly diversified regional models.

Urban equalization does not strictly belong to tax instruments; still, it has an impact on the public city through private sector involvement. Like planning fees, urban equalization is a one-time contribution for a development plan. Charges imposed by urban equalization vary on the basis of different local provisions and formulas: from monetary contributions (value equalization) to the more common transfer of areas or building rights (volume equalization) (Stanghellini 2013).

The classical goal of urban equalization is twofold: equality of treatment for individuals and bodies intervening in urban transformation, on one hand, and an efficient allocation of the resources it generates, on the other (Micelli 2011). In such way, urban rent can be redistributed among all owners of involved areas and a quota of this yield can revert to public sector. The different equalization formulas, which nowadays are well tested, originate form the diverse modulation of those aims.

Forfeiture and compensability of urban constraints, along with the ever growing difficulty for public finance to sustain expropriation costs at market value, have converted equalization into the normal and preferred method for acquiring public areas, a method that experienced a very quick diffusion and implementation in recent years.

Back to its two main aims, urban equalization has a double action: between individual owners of the areas to be transformed (horizontal equalization), so as to redistribute development right in an uniform way; and between individuals and public sector – vertical equalization –, by giving back to society part of urban rent through the transfer of public areas.

In the case of "horizontal" equalization we are dealing with a tool that is quite in line with the provisions of Law 1150 of 1942, whose Article 23 states that development quotas shall be distributed in accordance with land plot value, regardless of permitted uses on the areas. This form of equalization is not socially redistributive and has no influence on fiscal capability of municipalities, because the grand total remains unchanged. On the other hand, "vertical" equalization redistributes part of the yield through the transfer of areas or development rights. Vertical equalization can thus be compared to tax levy, albeit a non monetary one, as based on the quid pro quo principle.

It should be mentioned that, owing to its dependence on economic expansion, urban equalization in both varieties – compensative and redistributive – is highly vulnerable to market recession: if no new areas are to be transformed and economic yield remains unchanged, the quid pro quo between individuals and public authority cannot take place (Micelli 2011).

Urban equalization is sometimes coupled with various form of monetary equalization in order to guarantee better balance between private and public sector, or with aim-oriented forms of contribution for the execution of public works, or again with fees on added value to be used in different budget posts.

Without denying the difficulty of determining such added values – all the more in the turbulent market of a crisis time -, this latter kind of equalization seems most interesting nowadays, as it is less dependent on economic expansion and can be used in urban renewal programs. Last but not least, it can be used as an incentive or disincentive in particular urban strategies or interventions.

Fig. 3 Urban landscape

In more recent times, equalization has assumed an important role in redistributing costs and benefits of structures at an intermunicipal level. This form of equalization, called territorial equalization, does not happen between public and private sector, but between public bodies of same or different level.
As we have seen in the case of shopping malls, the presence of structures capable of capturing users form a wider area is determining for municipal finance, with possible phenomena of territorial and tax competition with no regard to efficient and sustainable spatial planning. These big structures use large-scale infrastructures, but they only contribute to their own municipality, thus completely distorting the fiscal federalism principles.
Just as urban equalization, territorial equalization as well has a double goal: firstly, it aims to equality through a correct distribution of the costs and benefits of a given structure on the territory; secondly, territorial equalization has a more economic objective, i.e. a better allocation of resources by taking advantage of all possible scale economies and agglomeration forms. Territorial equalization should therefore intervene in a very wide spectrum of disciplines: environmental, economic and financial, but also social and institutional ones (Piperno, Piazza, Pola, 2006), in order to assure coherence among different levels of governance.
Examples of territorial equalization remain very limited and mostly confined to the tax field, generally mimicking the French *taxe professionnelle unique* (TPU) by which administrations put in common those resources deriving from the productive structures they share; or even the US experience of tax base sharing (TBS), in which it is tax base what is shared. In Italy, the first example of such legislation is Emilia Romagna's Regional Law n. 2/2000, allowing the creation of mutual funds between local authorities to be financed by planning fees and tax revenue from shared structures. A similar provision was recently adopted by Tuscany (Regional Law n. 65/2014), prescribing territorial equalization for all plans on undeveloped land situated outside already developed areas. Also in this case a mutual fond is foreseen. In other Italian Regions (Venetia, Lombardy, Umbria) less explicit reference is made to equalization, which is left to negotiation and agreements between administrations (Mazzeo, Pinto 2011). Challenges in implementing such measures derive both from the difficulty of estimating monetary compensation for environmental

impact, and from the difficulty of identifying the managers of the shared resources. This latter difficulty became greater with the abolition of provinces. It is easy to demonstrate that the implementation of planning at wider area scale requires the contextual assumption of tax sharing instruments, in order to balance tax revenue and to avoid the risk of planning choices based on too high tax income expectations (Stanghellini 1999). The ultimate goal is thus to prevent forms of tax competition that would undermine institutional cooperation.

3 TAXATION OF AVAILABLE AREAS FOR CONSTRUCTION

Bearing in mind the goals of this article, building land represents an interesting element, for several reasons: first, it constitutes an intersection point between urban planning and tax and finance disciplines; besides, there is a link between planning and expansion resulting in areas for construction as an end product.; furthermore, building land is the economic factor around which urban rent is formed, thus representing the most important economic factor in the building development process. In past times, urban rent formation was the object of a lively ideological debate about taxing land added value. This debate, though, did not lead to real reforms and had the sole effect of introducing INVIM, a new tax on property revaluation (Decree n. 643 of 1972), finally abolished in 1992 and replaced by ICI, nowadays IMU.

In comparison to building taxation, whose tax base is defined by a revaluation of cadastral rent (Laws n. 662 of 1996 and 214 of 2011), taxation on building plots posed several challenges regarding both the conditions for the application of tax and the definition of tax base. The condition for such taxation depends, first of all, on the definition itself of building land for tax purposes. Such a definition was established for the first time with the introduction of ICI (art 2.1/b of Decree n. 504 of 1992): building area is defined as the "area usable for construction in accordance with general urban planning instruments, or on the basis of actual possibilities of construction...". This definition gave rise to several interpretation problems: for instance, there was disagreement on the prerequisite for taxing, successively identified as: the need for immediate use and thus the approval of implementing acts (Court of Cassation, decision n. 21644/2004); the regional approval of the general instrument (Court of Cassation, decision n. 16751/2004); the simple inclusion of that area in the general instrument even if not yet approved (Court of Cassation, decision n. 19750/2004). In the view of such uncertainty, it was initially clarified that a given area is to be considered as buildable "when it may be used for construction on the basis of the general urban planning instrument, even if the corresponding implementing act are still pending of approval" (art. 11/M.16 of Law n. 248/2005). Subsequently, Decree Law n .223/2006 came to add that an area is buildable on the basis of the general instrument, regardless of approval of said instrument and its implementing plans: this means that, for tax purposes, an area is to be considered buildable following the mere adoption of the strategic instrument.

Both legislating bodies and Court of Cassation (decision n. 25506 of 2006) did state that added value from urban development has its origin in the very moment when for a given area a transformation is foreseen even in a distant future.

Aside from legal interpretations, the consequence of such decisions led to a mismatch between the definitions of "buildable" in use in urban planning, on one hand, and in tax policies, on the other. As a matter of fact, if the mere adoption of a general instrument is sufficient for an area to be considered buildable and thus taxable, you need definitive approval of that general instrument, plus of operational and implementing ones, in order to have building rights confirmed on that very area. If we consider building rights as a productive cycle starting when first expenditure is made, this mismatch leads to longer timing because taxes are due sooner.

In the case of Tuscany, where a distinction between general and operational planning is made, the time lapse between start of taxation and approval of implementing plan is on average five years (fig. 4)

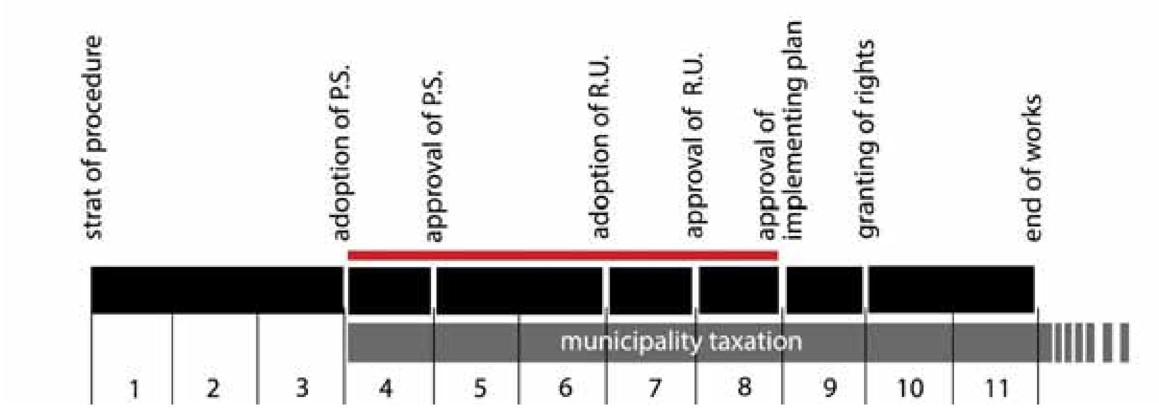

Fig. 4 Duration of planning process in Tuscany (Source: IRPET and Osservatorio permanente della Pubblica Amministrazione)

From a mere fiscal viewpoint, revenue levied in this time lapse, assuming a base rate of 0.76%, amounts to 3.80% of total value of the area, reaching 5.30% in case of maximum tax rate (a widely applied 1.06%). This is enough to erode a significant part of added value originated from the prevision of building on that land, and the erosion can become even bigger in case of further delay.

With such a definition of building land for tax purposes, time becomes an essential issue not only in terms of interest due on capital, but also – and above all – because of land rent eroding possible added value form the transformation. In economic terms, building land looses its value as shelter investment in favour of production. In a not so distant past things were different: numbers were different, and the impact of interest payments was sensibly lower than a yield whose obtainment was certain. Besides, the flowing of time didn't trigger extra costs: before 1993, transformation into building land didn't involve a change of tax regime.

This loss of value in time, plus uncertainty about land rent because of market changes, has been triggering unexpected phenomena: in Tuscany, out of a sample of municipalities (54% of regional total surface), 63% had received requests from individuals asking for revocation of building rights in areas which were already in planning instruments (Cutini; Rusci 2015).

In some cases (Altopascio, Arezzo, Bientina) this phenomenon took such proportions that public administrations have worked out specific instruments for facing revocation requests ("varianti in riduzione", variations for reduction). This phenomenon is unusual in Italy, a country where planning policies of the past fifty years were driven by a rush to transform land into building plots.

In order to mitigate distortions linked to advance tax paying, some local governments identified corrective factors taking into account specific conditions of a given area, thus reducing levy on land still awaiting development. From one side, this reduces the injustice of taxing plots which de facto do not constitute building land; from the other, a new factor of discretion and complexity is introduced in the determination of taxable values, thus giving rise to a great debate, currently still out of the courts.

IMU inherited from ICI the provision according to which the taxable value of a building plot equals its market value at January, 1st of fiscal year (art. 5 of Law 214/2011), in spite of the fact that common statistical or benchmarking data are missing. Tax determination is left to estimates, which, by their very nature, are influenced by evaluator's discretion and market fluctuation. For these reasons, local bodies were given power to autonomously determine reference values (Law Decree n. 446/1997), partly renouncing to their ability to conduct inspections if the owner accepts the estimate. Such estimate should ascertain market value keeping into account all implicit and explicit factors established by Law Decree n. 504 of 1992: geographical situation, urban parameters, intended use, charges and market prices for similar property. However, when examining municipalities' decisions, estimates often do not match market value: this is partly because defining and adapting estimates to every single transformation is objectively difficult, partly because there is a tendency to underestimate so as to avoid possible litigation. On the other extreme, cases are given in which pre-crisis estimates are much higher than market value.

In the absence of comparable statistical data, resorting to market value is inevitable for building plots. Nevertheless, it is self-evident that such a practice involves a very volatile tax base owing to market opacity (Morano 2014) and strong fluctuations, with high costs for both estimation and inspection. Proposed solutions (Morano 2014; Ciuna 2010) are based on the definition of uniform and codified estimation methods, with the risk those methods could not match real estate quotations.

4 CONCLUSIONS

For over twenty years now, local taxation and urban planning have been regarded as two strongly interconnected areas that do not dialogue. "Taxation and new urban planning legislation" was the title of a paper presented in 1995 at the 21st Congress of Istituto Nazionale di Urbanistica – INU (Stanghellini 1999). Since then, some proposals were turned into operational measures: such is the case of equalization, ICI-IMU and tax benefits (for principal residence and for renovations); other proposals still await implementation (e.g., cadastre reform).

This debate led to overcome the idea that, in decision making, urban planning must be subordinate to local taxation or vice-versa. Nevertheless, new forms of synergy and coordination between the two areas are still to be identified.

The widespread idea that urban planning taxation remains perfectible (Lattarulo 2012) is justified by the absence in Italy of a coordination between fiscal, productive and territorial policies. To scholars, it is clear that the impact of local tax policies (which often aim to respond to short-term budget contingencies) ends up having a determining and lasting influence on space planning, especially in terms of site choice and investment forms preferred by entrepreneurs.

Our analysis casts light on two important elements, bound to be crucial in the next future. On the one hand, the relationship between urban planning and local taxation: spatial and functional choices in planning have an increasingly strong influence on municipalities' fiscal capacity, and guidelines and options in the area of taxation decide the destiny of urban planning provisions. The second element, on the other hand, is the link between local taxation and real estate market as established by fiscal federalism: both revenue from planning fees and income from property taxation (IMU) are subject to real estate market fluctuations, just as local expenditure cycles depend on real estate cycles (Curti 2004).

Territorial governance and local taxation appear today like two equal but opposite forces in local policy: environmental and social sustainability in local governance often seems to collide with financial sustainability and autonomy imposed by fiscal federalism.

If we take into exam the main topics for the urban planning agenda of the last ten years, contradictions in this relationship are self-evident: land consumption mitigation, wider area planning, territorial equalization seem to be antithetical to the needs of financial autonomy imposed on municipalities by fiscal federalism.

As shown, revenue from new development (urban planning fees, construction fees) in some municipalities accounts for more than 10% of total municipal income, thus becoming indispensable for covering current expenditure with a parallel loosening of permitted use. This tendency to linking urban programming to budget needs involves undeniable challenges; but it is also true that dramatic measures of land consumption containment, as those implemented by Tuscany in recent times, might lead in present conditions to the collapse of many local realities.

Even in the case of real estate taxation, which is far more consistent than urban planning fees, there is strong contradiction between territorial and fiscal policies. The amount of tax revenue is dependent on the quality and above all the function of property stock; the more its prestige and the greater the number of other types than principal residence (second houses, production, commerce), the higher tax revenue will be. It is therefore clear that this strict link between special functions and tax revenue involves forms of tax competition, while hindering supra-municipal planning and the various modes of territorial equalization experimented today. If for urban planning one can envisage shared decision making between municipalities of a same geographic area, those same municipalities will be hardly open to share fiscal income deriving from location choices of wider structures.

Ultimately, gradual cross-linking between municipal revenue and property market variations in the last 20 years (Curti 2004) (this is especially true for planning fees) seems antithetical to stability in the provision of services.

The cadastre reform initiated with Delegated Law n. 23 of March, 11 of 2014 (at the moment the reform is blocked by Government awaiting local tax details) seemed to be an opportunity to establish a link between planning choices and local tax management, thanks to the proposals for a wider and richer property database, plus the correction of present cartography, thus enabling better data exchange between planning and collecting bodies. Many of the aforementioned structural challenges remain nevertheless unresolved: the relationship between rent and property market fluctuations, above all, with a clear contradiction between real market values, which are variable, and cadastral estimates, which are fix.

During these last twenty years, studies and proposals in the areas of taxation and urban planning – i.e. how to manage value added generated by planning – have aimed at two goals: (1) containment of public expenditure through fiscal federalism, making as far as possible provision of services conditional on fiscal capacity of a single municipality; (2) a fairer redistribution (private to private, private to society) of revenue generated by urban transformation, by identifying alternative formulas to those condemned in constitutional court decisions.

The building-up of a substantial urban rent from land regime has been amply studied and challenged by urban planners for over 50 years. It was the basis for the various forms of taxation in time (INVIM, ICI, IMU). This same urban rent fuelled (albeit minimally, owing to inadequate norms) changes in public town; with the introduction of equalization, nowadays it represents a reservoir for future local body resources.

Today, the goal of integrating tax and planning policies appears suddenly changed with the additional need to identify strategies for guaranteeing interventions in an economic context by which real estate investments and plans cannot be taken for granted: just think of the aforementioned example of building rights revocation requests.

This new framework, which apparently might suggest better environmental sustainability in the future, and which some people see as a desirable bursting of a real-estate bubble with no economic foundation, poses severe challenges to public authorities, because local finance and property market are so strongly linked. In this economic context, the first currency to be devalued is the urban planning one, i.e. money paid by private sector to municipalities to compensate for urban transformation through equalization and tax paying.

In other words, local bodies are today business partners running the risk of sharing with the private sector losses caused by the market weakness.

Without denying the challenges posed by the private acquisition of urban rent, it is also true that in recent years we have seen a complete overturning of the economic context without a similar overturning in urban planning action and goals, which remain bound to nowadays marginal topics.

In the light of the above analysis, the link existing between local taxation and urban planning is an indisputable fact. What is still missing is a correct management of this very link by those bearing the responsibility of managing and planning. Potentially positive synergies remain thus unexpressed, and challenges stay unresolved.

An integration between tax instruments and spatial planning appears both useful and necessary to reactivate public policies capable of guiding investments and interventions, even in the absence of expansive dynamics, through forms of tax modulations taking into account the main criteria (such as energy, social questions, location criteria etc); or through incentives and new tools for joint management at territorial scale. Quoting Robert Venturi, our challenge is to pursue a difficult whole through an inclusive process, instead of an easy whole through exclusion.

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IMAGE SOURCES

Cover image: Competition project – Spinea Italy S. Rusci, G. Ariganello, A. Cipriani

Fig. 1: Francesca Benelli 2015

Fig. 3: Francesca Benelli 2015

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REVIEW PAGES

CITIES, ENERGY AND MOBILITY

Starting from the relationship between urban planning and mobility management, TeMA has gradually expanded the view of the covered topics, always remaining in the groove of rigorous scientific in-depth analysis. During the last two years a particular attention has been paid on the Smart Cities theme and on the different meanings that come with it. The last section of the journal is formed by the Review Pages. They have different aims: to inform on the problems, trends and evolutionary processes; to investigate on the paths by highlighting the advanced relationships among apparently distant disciplinary fields; to explore the interaction's areas, experiences and potential applications; to underline interactions, disciplinary developments but also, if present, defeats and setbacks. Inside the journal the Review Pages have the task of stimulating as much as possible the circulation of ideas and the discovery of new points of view. For this reason the section is founded on a series of basic's references, required for the identification of new and more advanced interactions. These references are the research, the planning acts, the actions and the applications, analysed and investigated both for their ability to give a systematic response to questions concerning the urban and territorial planning, and for their attention to aspects such as the environmental sustainability and the innovation in the practices. For this purpose the Review Pages are formed by five sections (Web Resources; Books; Laws; Urban Practices; News and Events), each of which examines a specific aspect of the broader information storage of interest for TeMA.

01_WEB RESOURCES
The web report offers the readers web pages which are directly connected with the issue theme.

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02_BOOKS
The books review suggests brand new publications related with the theme of the journal number.

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03_LAWS
The law section proposes a critical synthesis of the normative aspect of the issue theme.

author: Laura Russo
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04_URBAN PRACTICES
Urban practices describes the most innovative application in practice of the journal theme.

author: Gennaro Angiello
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05_NEWS & EVENTS
News and events section keeps the readers up-to-date on congresses, events and exhibition related to the journal theme.

author: Andrea Tulisi
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TeMA 有关土地使用、交通和环境的杂志

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评述页

城市、能源与移动性

TeMA从城市规划和流动性管理之间的关系入手，将涉及的论题逐步展开，并始终保持科学严谨的态度进行深入分析。在过去两年中，智能城市课题和随之而来的不同含义一直受到特别关注。学报的最后部分是评述页 这些评述页具有不同的目的：表明问题、趋势和演进过程；通过突出貌似不相关的学科领域之间的深度关系对途径进行调查；探索交互作用的领域、经验和潜在应用；强调交互作用、学科发展、同时还包括失败和挫折（如果存在的话）。评述页在学报中的任务是，尽可能地促进观点的不断传播并激发新视角。因此，该部分主要是一些基本参考文献，这些是鉴别新的和更加深入的交互作用所必需的。这些参考文献包括研究、规划法规、行动和应用，它们均已经过分析和探讨，能够对与城市和国土规划有关的问题作出有系统的响应，同时还对诸如环境可持续性和在实践中创新等方面有所注重。因此，评述页由五个部分组成（网络资源、书籍、法律、城市实务、新闻和事件），每个部分负责核查TeMA所关心的海量信息存储的一个具体方面。

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01

CITIES, ENERGY AND MOBILITY

REVIEW PAGES: WEB RESOURCES

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In this number

SUSTAINABLE MOBILITY POLICIES IN EUROPE AND ITALY: REVIEW, RESOURCES AND TOOLS

In the last decades, sustainable mobility policies at urban scale have gradually seen an increasing interest by the European Commission as they represent some of the key strategies for 'sustainable cities' (Colucci, 2012). The first policy proposals, the "Citizens' Network", date back to 1995 and 1998. They resulted in the launch of a series of initiatives based upon a "best practice" approach. In 2001 Transport White Paper "European transport policy for 2010: time to decide" suggested 60 specific measures to be taken at EU level in the transport sector. In 2005, in order to reduce the energetic and environmental impact of transport, the European Commission adopted the Green Paper "Towards a new culture for urban mobility" whose key issues are: free-flowing and greener towns and cities, smarter mobility and urban transport which is accessible, safe and secure for all European citizens. In 2009, the European Commission adopted the Action Plan on urban mobility. In 2011, Transport White Paper "Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system", had a vision for the future of European transport until 2050. It recommended profound changes in the strategic planning and proposed a series of objectives and concrete measures that focused on transport integration. Moreover, a European Commission study on mobility plans, which were implemented in Europe, places Italy among the countries with a well-established transport planning with its regulatory support and availability of guidelines (Orchi, Valentini 2014). In Italy the Law 340/2000 (art. 22) introduced the PUM (Plan for Urban Mobility) as a long term (10 years), systemic and integrated planning instrument for managing mobility in urban areas. This law did not become immediately operational for lack of both necessary funds and the inadequate definition of the approval procedures for plans. This law and the national guidelines, issued in 2005, promote sustainable approaches aimed at reducing levels of congestion, pollutant and noise emissions and energy consumption. In addition, they promote other more general issues like safety, accessibility and the use of sustainable modes of transport, focusing on land use-transport integration. Such scientific and regulatory efforts in the field of urban mobility appear to assume an increasing emphasis. They underline the need to limit the environmental impacts of transport systems and to encourage sustainable mobility policies.

In this number we present three important web resources: the first one, the Transport Research and Innovation Portal, gives an overview of research activities at European and national level; the second one, Bump mobility, provides city planners, environmental and technical officers in local authorities, with the knowledge and skills to plan and manage sustainable mobility; the last one, Eltis portal, facilitates the exchange of information, knowledge and experiences in the field of sustainable urban mobility in Europe.

TRIP | Transport Research and Innovation Portal
http://www.transport-research.info/

The main objectives that lie at the basis of the development of the Transport Research and Innovation Portal (TRIP) are twofold. The first objective is to improve access to knowledge in the European Research Area and beyond through the appropriate dissemination and promotion of the transport research results. The second objective is to reinforce the link between transport research and transport policy through the provision of accurate, timely and complete information on key deliverables of transport research projects.
Once in the homepage, users can choose to give an overview to research activities at European and national level by clicking on the left navbar. *Country profiles* provide a summary on the organization of transport research in the European Research Area countries: 28 Member States of the European Union and Iceland, Norway and Switzerland. This section includes also overviews for some additional countries like USA, Brazil, etc. At European level, the most important research programme is the Seventh Framework Programme (FP7) which is a multidisciplinary programme devoted to responding to the challenges of making transport more sustainable over the seven-year period (2007–2013). FP7 will be followed by Horizon 2020 which is to run from 2014 to 2020. It is part of the drive to create new growth and jobs in Europe and it has three key objectives: excellent science, competitive industries and better society. Within the institutional framework of transport research, users can find some quick links to founding sources and support initiatives. By clicking one of the countries listed in Country profiles section, you can get information about the related government strategy for research and innovation in the field of transports and about the organizations responsible for the institutional framework and funding. The *Programme* and *Project* sections contain detailed information on national, European and international programmes and projects respectively. TRIP database for projects and programmes can be accessed by selecting the transport theme, the funding origin or the partner. Project information is provided on three levels: *Short profile* includes information on origin and funding of the project, thematic transport themes and available contact point; *Profile* in addition to the above includes background, objectives and methodology; *Results* provide information on key project outputs and final reports that can also be downloaded. In the *Publications* section the series of Policy Brochures and Thematic Research Summaries provide a broader overview of the research conducted at European level and its input into the policy-making process. *Compendium* presents an overview of transport research and funding organizations in the European Research Area. It is available in a digital mapping environment in which relevant organizations involved in transport research and funding are presented on the map of Europe. The *Research Summaries* are focused on transport themes, like "Climate policy and energy efficiency", "Multimodal transport", "Environmental impacts", etc. The *Policy brochures* contained in this section focus on the sustainability of the European transport system and can be downloaded. The themes are smart and competitive railway system, smart and sustainable logistics, employment in transport sector, etc. For each Policy Brochure some videos are regularly released by TRIP. The videos highlight the key elements of the related publication. The *Events* section encloses calendar of high-level international transport conferences whilst the *Newsroom* section contains news of the latest in transport research, policies and innovation, including monthly e-Newsletters. Totally, TRIP showcases over 7300 projects and their associated documents and more than 300 national, European and international transport research programmes. Research and business communities can identify research needs and business solutions; source ideas and partners for new transport research and demonstration projects; use the website to spread knowledge about your own project results. Public service providers can implement innovative solutions and share and find out about good practices in Europe. Investors and technology brokers can source investment opportunities.

BOOSTING URBAN MOBILITY PLANS

http: // www.bump-mobility.eu/

BUMP provides city planners, environmental and technical officers in local authorities, with the knowledge and skills to plan and manage sustainable mobility in urban and peri-urban areas. Moreover, BUMP supports the most committed towns and cities to produce their own Sustainable Urban Mobility Plans.

In BUMP homepage banner, users can rapidly access to the four steps to make urban mobility more sustainable: learn, share, develop and raise. In *Learn* section, users can find a common training programme that can be delivered through six modules on the SUMP process. By clicking on the links provided it is possible to download the 'Integrated support package for the production of Sustainable Urban Mobility Plans (SUMPs)' leading the reader through the training program and providing details on individual issues and a full set of training materials. All training services were provided free of charge to the local authorities selected as beneficiaries through a public call. Local authorities then appointed their representatives as participants in project activities among their planners, environmental and technical officers.

Share section introduces the second step, which consists in the mutual learning stage. In this stage, participants can share expertise and viewpoints on mobility planning and management issues through a series of interactive activities (world-café and role-play sessions) aimed at fostering exchanges among participants coming from different countries. From this section, reader can also download the "Report on mutual learning activities".

In *Develop* section, readers can get information about the development stage of the SUMP. This stage includes professional help and advice from a team of experts appointed to meet the authorities' specific needs and requirements. *Raise* section inform about the opportunity to visit the best-performing towns and cities (the 'BUMP Pioneers') where the BUMP approach has been fully implemented and put into practice, leading to remarkable results in terms of sustainable urban mobility plans and realizations. In this section, people who is interested in can insert their contact to keep themselves updated.

In addition, BUMP home page contains a clear and effective summary that lists the reasons why to adopt a Sustainable Urban Mobility Plan. Another way to navigate the BUMP website is to select one of the sections listed in the upper web bar. *About BUMP* section includes short information about objectives, methodology and partners. In *Resources* section users will find all the useful documents being produced during the project. They will also find the best selection of relevant external links that can help them go deeper in detail on freshly updated contents related to urban mobility and available on the net. They are Eltis portal, SUMP Portal, CIVITAS, CH4LLENGE, ETC. This section is constantly enriched and updated. In the end, *News* section contains the latest news about the project.

BUMP website represents an important reference to support local authorities in the development of Sustainable Urban Mobility Plans for cities with a population ranging from 40.000 to 350.000 inhabitants. The project targets senior officers and directors within local authorities, allowing them to acquire the necessary skills to develop their SUMPs. The results of the project show that 36 new SUMPs have been produced during the project's lifetime (and another 60 by 2020); 180 directors/high-ranking officers and technicians from 90 cities in the 40-350.000 inhabitants range have been trained during the project' s lifetime (and another 200 trained by 2020); 50 new cities have joint the CIVITAS Forum Network during the project's lifetime; 2.000 municipalities in the 40-350.000 inhabitants range have been informed about project activities during the project's lifetime.

ELTIS - THE URBAN MOBILITY OBSERVATORY
http: // www.eltis.org/

Eltis facilitates the exchange of information, knowledge and experiences in the field of sustainable urban mobility in Europe. It is aimed at individuals working in transport as well as in related disciplines, including urban and regional development, health, energy and environmental sciences. Created more than 10 years ago, Eltis is now Europe's main observatory on urban mobility. It is financed by the European Union under the Intelligent Energy - Europe (IEE) programme. Eltis homepage lets readers choose among key themes: *DISCOVER*, *RESOURCES* and *PARTICIPATE*. Through them Eltis provides the information, good practices, tools and communication channels needed to help you turn your cities into models of sustainable urban mobility. The dedicated *MOBILITY PLANS* section offers a hub of information on how to develop and implement Sustainable Urban Mobility Plans (SUMPs) as the need for more sustainable and integrated planning processes in Europe grows. Within DISCOVER section: *News* offers a regular round-up of local, regional and European news related to sustainable urban mobility; *Case studies* presents and analyses successful local examples of sustainable urban mobility initiatives and strategies; *Facts & figures* provides a range of statistical data on sustainable urban mobility topics; *Topics* outlines the key sustainable urban mobility related subjects covered on Eltis; *EU legislation & policies* contains important legislation and policy developments on sustainable urban mobility. The section RESOURCES supports users to act and promote sustainable forms of mobility in their region or city. It consists of six subsections: *Tools* contains guides, handbooks and reports to support and inform urban mobility professionals in their work; *Photos* hosts a gallery of images you can use to promote urban mobility; *Videos* features outstanding examples of sustainable urban mobility approaches; *Training materials* presents training and educational materials produced in the sustainable urban mobility fields; *EU funding* brings together the current EU funding streams and programmes that are accessible for local governments; *Press & promo* contains Eltis and Mobility Plans platform promotional materials (such as logos, templates) as well as materials from events and seminars.
Moreover, Eltis website, in *PARTICIPATE* section, allows readers to share examples of best practice and discuss new and innovative ideas on sustainable urban mobility. As a registered *Friend of Eltis* you can submit content and comment on your colleagues' ideas and initiatives and read more about the benefits of becoming a member; *Events* presents a calendar of important conferences, meetings, workshops and networking sessions; *Job* offers is a noticeboard of current sustainable urban mobility related employment opportunities; on the *Forum*, users can discuss all matters related to sustainable urban mobility.
Eltis website is very engaging and informative.

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IMAGE SOURCES

The images are from: http://www.greenstart.it/; http://www.transport-research.info/; http: // www.bump-mobility.eu/; http: // www.eltis.org/

02

CITIES, ENERGY AND MOBILITY

REVIEW PAGES: BOOKS

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In this number

FROM SMART CITY TO SMART MOBILITY

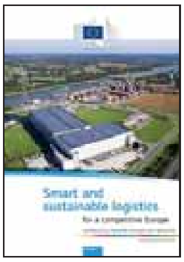
Urbanization is accelerating at pace, placing new, intense pressures on city resources and infrastructure. Urban Mobility will be one of the toughest challenges for cities around the globe. In many cities, existing mobility systems are already inadequate, yet urbanization and increasing populations will increase demand still further. Cities have traditionally sought to solve such challenges by adding new capacity to match demand. However, a capacity-building approach alone is neither efficient nor sustainable.

Mobility underpins everything we do as individuals, as communities, as regional, national and international economies. People need to move around to secure basic human needs, but mobility is also a luxury, contributing to quality of life by enabling exploration, leisure and recreation. In the city, high quality mobility is a necessity for the success of other urban sectors and the creation of jobs, and plays a key role in cultivating an attractive environment for residents and business. The demand for mobility is growing around the world. People expect safer, easier, healthier and more pleasant solutions. These demands are especially strong in cities, where demographic pressure is causing the main economic, social and environmental challenges of the future to converge.

In a rapidly changing world, mobility is key to sustainable development. Increasing economic, ecological and social aspirations of citizens worldwide, changing consumption and production patterns, and limited natural resources are driving innovation in the transport sector. Transport services and infrastructure are no longer seen as simple means of moving people and goods, but mobility and logistics are increasingly perceived as key agents of change.

Technology has been fundamental to transport throughout human history, but recent rapid advances in information technology promise to transform transport management in ways that would have been inconceivable until recently. Just as information and communication technologies are crucial for sustainable development, so can their use accelerate the "greening" of transportation.

According to these short considerations, this section proposes three documents that help to better understand the issue of this number: The policy brochure Smart and Sustainable Logistics for a Competitive Europe; Urban Mobility in the Smart City Age; 50 BIG IDEAS - Shaping the Future of Electric Mobility.



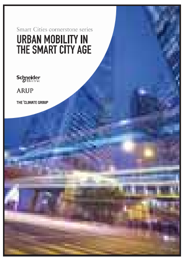
Title: Smart and Sustainable Logistics for a Competitive Europe
Author/editor: European Commission
Publisher: European Union
Download: http://www.transport-research.info
Publication year: 2015
ISBN code: 978-92-79-43913-1

This policy brochure presents an overview of current and future policy on smart and sustainable logistics and EU-funded research to support development and implementation of this policy. Additional information on transport research programmes and related projects is available on the transport research and innovation portal website at http://www.transport-research.info.

Logistics is central to the EU economy, contributing to economic growth and playing a key role in international competitiveness. With the predicted growth in freight transport, the challenge is to raise the efficiency and competitiveness of the logistics sector and to reduce the sector's environmental impacts. Europe is currently a leader in logistics, with six EU Member States in the global top 10 in logistics performance in 2014 (World Bank, 2014). With the steady growth in freight volumes throughout Europe, the long-term forecast is 80% growth in freight transport by 2050.

In the last two decades, transport-related greenhouse gas emissions have increased substantially, one third of these emissions is attributed to freight transport. With increasing growth in freight transport, EU policy is to improve freight logistics while simultaneously minimising the negative impacts of this growth. The policy focus is to reduce the heavy dependence on fossil fuels (EC, 2011). Constant high levels of CO_2 emissions threaten the EU target of 60% reduction in greenhouse gas emissions in the transport sector by 2050 with respect to the 1990 level (EC, 2012). Currently, 74% of Europe's population lives in urban areas, and the percentage is expected to increase (UN World Urbanization Prospects, 2011). As a result, high density urban areas are increasingly confronted with the impacts of freight logistics in the form of congestion, noise hindrance and air pollution. The urban environment also presents a special challenge for logistics companies. The last mile of the logistic chain, which accounts for a large proportion of shipment costs and complexity of operations, is o en the most inefficient. Thus, distribution and logistics from production sites to distribution warehouses and to customers in urban areas need to be improved. Logistics in urban areas can be improved by implementing new organisational concepts in combination with innovative vehicles. For example, electric vehicles that are particularly quiet are highly suitable for night deliveries to reduce road congestion during rush hours.A priority goal in EU transport policy is to improve the efficiency and to reduce the environmental impact of freight logistics. In support of this policy, research priorities include development and launch of smart logistics concepts especially in urban areas, using advanced information and communication technologies, and promoting eco-innovation in freight transport. Goods delivery accounts for a significant proportion of traffic in urban areas and contributes disproportionately to congestion, air pollution, and carbon emissions. EU policy and research are dedicated to developing efficient freight delivery concepts to reduce congestion and to lower emissions. Research focuses on the introduction of clean freight vehicles and innovative logistics concepts for urban areas.

EU-funded research has developed new approaches to urban freight logistics that contribute to strategies to safeguard the 'liveability' of cities. These approaches include improving vehicle load capacity, raising the efficiency of transhipment operations, and integrating delivery operations in city traffic management. These solutions have been validated in business cases and pilot studies with stakeholders including large and small companies, city authorities and transport authorities. The EU is providing implementation support through research projects and the CIVITAS initiative, which tests and evaluates measures to stimulate efficiency in urban transport logistics.



Title: Urban Mobility in the Smart City Age
Author/editor: Arup, The Climate Group and Schneider Electric
Publisher: CHENGDU 2014 GLOBAL SUMMIT
Download: http://digital.arup.com/wp-content/uploads/2014/06/Urban-Mobility.pdf
Publication year: 2014
ISBN code: n.d.

This publication explores how we will move from a reactive approach to mobility services, to a proactive model that anticipates future change and takes advantage of new opportunities. The aim is to provide city and mobility decision-makers with reflections and guidance on developing and adopting sustainable strategies that meet current and evolving challenges.

This publication is articulate in six different chapters: The challenge of Urban Mobility; The promise of Smart Mobility; The structure of Smart Mobility; Smart Mobility and the Role of Data; Bringing the value chain to Life; Mobility: A corners tone of the Smart, Sustainable City.

This chapter establishes the challenge of urban mobility in today's cities. It sets out why mobility is such an important element of the urban sphere, and identifies the drivers which de ne the need for a new approach to mobility.

The first chapter explores the potential for smart mobility to meet the actually challenges. It explains how smart mobility can lead to more efficiently use of transport infrastructure, and alter the way people use transport services by offering them with more and better information.

The second chapter describes some of the services that arise from a smart mobility system, and the advantages that these products can create for travelers, transport operators, urban planners and city governments. Also, this chapter considers the toolkit for building a smart mobility system, which enables the creation of smart services.

The third chapter describes the technology foundations of smart mobility solutions, and introduced the concept of data as the raw material for new mobility services. This chapter describes how smart mobility services are made, focusing on the role of data and how data is used and services are created through an information value chain that brings together stakeholders from across different sectors and verticals. This will help city government, transport operators and industry understand how they need to start thinking about data and operational technologies when commissioning new services-either infrastructure like control centers, or transport modes such as new bus contracts to allow additional economic and social value to be created.

The fourth chapter defines how the new mobility services, building on operational technology and data, are starting to address problems related to peak hour travel demand, while also offering the potential to make cities more livable and successful. Delivering the benefits of these services to a wide range of actors requires multiple data streams from multiple data sources and technologies. This requires an ecosystem approach, in which commercial, organizational, social and technical components are aligned.

This paper show the potential benefits for the mobility sector. But cities are made up of a complex web of overlapping systems, of which Mobility is just one. Energy, Water, Public Services, Buildings & Homes, and Information and Communication Technologies to name but a few are all part of the essential fabric of cities.

This report has considered the opportunities available for cities to improve the operational efficiency and traveller experience of their mobility systems, while generating new economic value. Smart technologies offer incredible potential for sustainable mobility. However, the key messages of this report can also be applied to the other urban sectors.

Title: *50 BIG IDEAS - Shaping the Future of Electric Mobility*
Author/editor: Urban Foresight
Publisher: Urban Foresight
Download: http://www.cleanenergyministerial.org/Portals/2/pdfs/EVI_2014_EV-City-Casebook.pdf
Publication year: 2014
ISSN code: n.d.

Cities, businesses, and governments around the world have recognized electric vehicles as an essential part of a smarter and more sustainable future. The multiple environmental, economic, and energy system benefits offered by electric vehicles and hybrid have shaped a broad consensus on why this transformation is essential. The goal of this casebook is twofold to demonstrate the significance of what has been achieved to date and to show how innovative solutions can create new opportunities for electric mobility in the future. Experience suggests that it is unlikely that a single breakthrough or policy intervention will bring about this transformation, but rather a combination of different measures.

This is the second edition of the electric vehicle city casebook explores these future-facing questions. It pro les 50 examples of transformative policies, projects, technologies, and business models that have been implemented in 23 countries across six continents. The 50 Big Ideas presented in this casebook are by no means an exhaustive list of factors that will contribute to this change. However, they do highlight areas of considerable promise for the future of electric mobility.

The impact of each of the Big Ideas has been evaluated against six dimensions to explain its expected contribution to advancing Electric Vehicle adoption and realizing the associated benefits that this will bring:

- RELATIVE ADVANTAGE - Does it give electric vehicle’s a distinct advantage over internal combustion engine (ICE) vehicles?
- EASE OF USE - Does it make electric vehicle’s more convenient and enjoyable to use?
- VEHICLE PERFORMANCE - Does it enhance the design, construction, and performance of electric vehicles?
- AWARENESS - Does it help people to better understand electric vehicle’s?
- ENVIRONMENTAL - Does it provide direct environmental benefits?
- ENERGY SYSTEM - Does it enhance the management and operation of energy systems?

For each Big idea is indicated the degree to which will has a direct impact on each of the six dimensions.

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03

CITIES, ENERGY AND MOBILITY

REVIEW PAGES: LAWS

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In this issue

REGULATORY FRAMEWORK TOWARDS A MORE SUSTAINABLE URBAN MOBILITY

Urban areas face today the challenge of developing more sustainable transport systems in order to support both their economic competitiveness and environmental health. Indeed, the shift towards a more ecological mobility may considerably reduce greenhouse gas emissions as well as pollution and congestion, having positive consequences to address the issues related to climate change.

By sustainable mobility we mean the mobility model that enables movement with minimal environmental impact while at the same time addressing social interests, in other words, a model whose means of transport consume the least energy and produce less pollution as well as respond to health problems, foster social cohesion and consider a priority the needs of *wick people* (Tiboni, Rossetti, 2012).

In the last decade a great number of measures have been promoted all over the world to improve the sustainability of mobility systems and, in particular, the European Union has played a significant role at international level coming up with various initiatives to make urban transport throughout Europe more efficient and effective. Specifically, this issue analyzes:

- the European Action Plan on Urban Mobility, adopted by the European Commission in 2009;
- the 2010/40/EU Directive on the framework for the development of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport, adopted by the European Commission in 2010.

The Action Plan proposes several actions to help local, regional and national authorities in addressing specific issues related to urban mobility in a coordinated way; it promotes the exchange of best practices amongst the member states and provides funding in order to support the implementations of innovative policies.

On the other hand, the 2010/40/EU Directive aims at accelerating the coordinated deployment and use of Intelligent Transport Systems in road transport across Europe, identifying four priority areas in which work should be further pursued and six priority actions to be promoted.

In order to have a wider framework of the commitments towards the development of a more sustainable mobility system at international level, the last document described in this issue is the new Mexico City's Mobility Law, adopted in 2014 with the goal of promoting public transport, cycling and walking in one of the largest cities in the world. The three documents provide a diverse perspective of the various measures developed to catalyze sustainable transport worldwide.

COM (2009) 490: EUROPEAN ACTION PLAN ON URBAN MOBILITY

The growth of cities and the irreversible consequences of climate change make it necessary to ensure an efficient transport network among European cities as well as within urban areas, where most transport starts and ends. Improvement in transport systems may indeed lead to a significant reduction in congestion, which means less greenhouse gas emissions, pollution and noise and, at the same time, may foster territorial competitiveness ensuring higher level of economic development.

In this framework, and based on the consultations following the presentation of the Green Paper in 2008, one year later the European Parliament drawn the Action Plan of urban mobility up. This Plan "sets out a coherent framework for EU initiatives in the area of urban mobility while respecting the principle of subsidiarity". The aim of the document is give support to policy makers and local administrators both financially and operatively, by providing funding and examples of short and medium term practical actions to be activated within the different geographic contexts.

The plan proposes twenty actions structured in the following six themes:

- *promoting integrated policies* – integrated planning affords insights into the interconnections between the various transport, environmental, urban and industrial sectors, ensuring a wider approach which is more suitable for the complexity of the urban space;
- *focusing on citizens* – the efficiency and attractiveness of urban transport system depend on its reliability, accessibility and safety and for this reason UE wants to improve travel information, accessibility for passengers with reduce mobility and support the spread of a new ecological culture for urban mobility, through different communication tools such as awareness-raising campaign;
- *greening urban transport* – the promotion of environmentally friendly strategies focused on the diffusion of lower and zero emission vehicles represents a key factor for the success of the Action Plan, which confirms the EU financial support for research and demonstration projects related to "green" technologies, vehicles and infrastructures;
- *strengthening funding* – the Commission is aware of the grower need for investments in order to improve urban mobility and for this reason it strengths EU existing funding sources like the Structural and Cohesion Funds, the sub-program STEER and the CIVITAS initiative;
- *sharing experience and knowledge* – exchange of information is fundamental for achieving the ambitious goals of sustainable urban mobility strategies, so the UE encourages the national and international share of best practices and projects developed by virtuous cities. Moreover, the Commission is committed to improving data collection in order to address the lack of statistics about transport and mobility;
- *optimizing urban mobility* – the optimization of urban mobility involves various aspects, for example improving modal shift towards more sustainable modes of transport, facilitating urban freight transport, or encouraging the application of Intelligent Transport Systems (ITS) within the European context.

Each theme represents a specific line of strategy the UE wants to develop for the promotion of a more environmental friendly urban mobility throughout the Continent and up to now several initiatives have been implemented to achieve the previously mentioned goal. The contribution of the UE is of particular importance because authorities and policy makers need support, both economically and operationally, for the development of efficient and innovative solutions.

DIRECTIVE 2010/40/EU ON THE FRAMEWORK FOR THE DEPLOYMENT OF INTELLIGENT TRANSPORT SYSTEMS IN THE FIELD OF ROAD TRANSPORT AND FOR INTERFACES WITH OTHER MODES OF TRANSPORT

In 2008 the European Commission adopted the Action Plan for the Deployment of Intelligent Transport Systems (ITS) in Europe in order to accelerate the implementation of ITS in road transport. In presenting the ITS Action Plan, the Commission also proposed a Directive, which has been formally adopted in 2010.

The 2010/40 EU Directive establishes a framework for the promotion of the coordinated and coherent deployment and use of Intelligent Transport Systems within the European Union.

Specifically, "Intelligent Support Systems means systems in which information and communication technologies are applied in the field of road transport, including infrastructure, vehicles and users, and in traffic management and mobility management, as well as for interfaces with other modes of transport (art. 4). The application of these innovative technologies to the road transport sector represents a crucial step towards energy saving, better environmental performance and the reduction of congestion of road infrastructure.

The main goal of this Directive is to ensure a coordinated implementation of these tools within Europe as a whole, giving priority to the following four main areas of ITS deployment (art. 2):

- optimal use of road, traffic and travel data;
- continuity of traffic and freight management ITS services;
- ITS road safety and security applications;
- linking the vehicle with the transport infrastructure.

For each priority areas, the Directive identifies a number of priority actions (art. 3):

- the provision of EU-wide multimodal travel information services;
- the provision of EU-wide real-time traffic information services;
- data and procedures for the provision, where possible, of road safety related minimum universal traffic information free of charge to users;
- the harmonized provision for an interoperable EU-wide eCall;
- the provision of information services for safe and secure parking places for trucks and commercial vehicles;
- the provision of reservation services for safe and secure parking places for trucks and commercial vehicles.

Since the adoption of the ITS Action Plan first and of the 2010/40 Directive later, most member states show active engagement at some level, as described in the Report on the implementation of Directive 2010/40/EU released by the European Commission in 2014, which offers an overview of the twenty-seven national reports provided by the member states in 2011, as requested by art. 17(1) of Directive 2010/40.

The report highlights that numerous initiatives have been developed by the member states in order to promote the application of ITS, responding both to end users' needs as well as operator tasks. Most member states have focused their investments into the first priority area of ITS deployment – the optimal use of road, traffic and travel data – while very little attention has been devoted to the fourth priority areas by now. However, overall, European states are demonstrating a strong interest to promote ITS application throughout Europe.

MEXICO CITY'S MOBILITY LAW – LEY DE MOVILIDAD

Mexico City, with an estimated population of nine millions in 2014, is part of the most populous metropolitan area in the Western Hemisphere, with over twenty million people. When we think of virtuous examples of sustainable transport in cities, we immediately think of European cities such as Amsterdam and Copenhagen, or highly dense realities such as Singapore or Hong Kong. Nevertheless, this list should also include the capital of Mexico, which has made significant efforts in improving the sustainability of its mobility in the last decade by developing new metro lines and limiting the use of private vehicles. Various measures have been implemented to shift focus towards citizens instead of cars: the Metrobus rapid transit system (BRT) has been created, together with the ECOBICI public bike-sharing system and several downtown areas have been pedestrianized. In addition to these considerable strides, the new Mobility Law has made greater improvement in promoting walking, bicycling and public transport with the ambitious goal of turning Mexico City into an example of sustainable mobility.

Among the most important innovations introduced by the new Mobility Law are (OECD, 2015):

- the introduction of mobility as a right – "Mobility is the right of each individual and of society to move freely and access goods through the different modes recognized in this law";
- the prioritization of road space and financial resources according to a new user hierarchy, which places pedestrians at the top, followed by cyclists;
- the enactment of explicit sustainability principles to guide policy.

Furthermore, the new Mobility Law aims at the creation of a "regulatory body" for transportation operators, so to eliminate the existent fragmentation of the system; this new body would also be responsible for the promotion of a more efficient, safer and inclusive public transport service.

Resilience represents an additional aspect considered by the Mobility Law that, indeed, emphasizes the importance for the city's mobility system to be able to quickly adapt to extreme weather events that are becoming more and more widespread.

Mexico City's commitment for the development of a more sustainable mobility system proves that also enormous urban conurbations can reduce their contribution to climate change and become positive examples of sustainability.

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IMAGE SOURCES

Fig. 1: https://eu-smartcities.eu
Fig. 2: https://en.wikipedia.org/wiki/Environmental_impact_of_transport
Fig. 3: https://en.wikipedia.org/wiki/Intelligent_transportation_system
Fig. 4: https://en.wikipedia.org/wiki/Trolleybuses_in_Mexico_City

04

CITIES, ENERGY AND MOBILITY

REVIEW PAGES: URBAN PRACTICES

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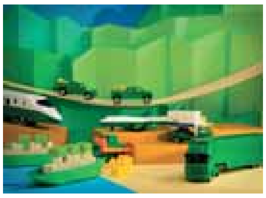

In this number

SUSTAINABLE CITY LOGISTICS: TWO CASE-STUDIES

According to the United Nations Population Fund, in 2009 the proportion of the global population living in urban settings exceeded 50% for the first time in history, with an estimated 3.4 billion people living in urban areas, more than the entire global population in 1960. This trend is expected to continue, with urban areas absorbing all of the expected population growth over the next four decades (UNFPA, 2014).

Due to their large populations and extensive commercial and industrial establishments, urban areas required large amounts of goods and service for commercial and domestic use. The growing importance of urban freight transport is related to increase in urban population and continued economic growth in urban areas. This results in increasing level of demand for freight transport services. Urban freight transport and logistics covers all activities involved in the transport of goods in a city. It involves the delivery and collection of goods and provision of services in town and cities. It also includes activities such as good storages and inventory management, waste handling, office and households removals and home delivery services (Nuzzolo et al., 2013).

Freight transport constitutes a major enabling factor for most economic and social activities taking place in urban areas. In particular, an efficient freight transport system plays a significant role in the competitiveness of an urban areas and represents an important element for the local economy regarding the employment and income that it generates (Russo & Comi, 2010). However, it is a major contributor to environmental impacts, particular to local air pollution, congestion and noise and, as a result, it has an important impact on public health and quality of life. Indeed, as confirmed by several empirical studies, urban freight vehicles account for 6–18% of total urban travel (Figliozzi, 2010), for 19% of energy use and 21% of CO2 emissions (Schoemaker et al., 2006). As a result, environmental sustainability has become a critical issue in the context of urban freight in the last two decades and many cities around the world have implemented measures to mitigate the negative effects of freight transportation.

In the next sections, two relevant case studies of sustainable city logistic solutions are illustrated:

- The Cityporto of Padova (Italy);
- The Elcidis Urban Consolidation Center of La Rochelle (France);

The analysis presented in the next sections illustrate how an integrated approach to urban logistics can help solve complicated and difficult problems and pave the way to a more sustainable urban freight transport by combining modern technology factors within conventional urban planning tools.

PADOVA

Padova is an Italian medium city (about 250,000 inhabitants) that has a historical city centre recently classified as Human Patrimony by the UNESCO. The main urban transport problems in Padova are traffic congestion and noise, low air quality and large commercial road traffic into the city centre. Like other medium Italian cities, the municipality has defined a restricted access zone (ZTL) to deal with this congestion. For most freight transport vehicles, the access hours to the ZTL are from 10:00 to 12:00 only in working days. Out of these periods, only the residents and authorised categories of vehicles are allowed to enter. An electronic tag identification system has been adopted to increase the access control at the gates of the zone.

In 2004, Cityporto, an innovative city logistics system, was established in Padova's periphery. The Cityporto, proposed by Interporto di Padova S.p.A., the real state and management company related to the intermodal platform, aims to enhance the delivery flows of goods as well as to improve the quality of the city life (Gonzalez-Feliu & Morana, 2010). The project is the result of more than 18 months of an experience that involved the Municipality of Padova, the Interporto di Padova S.P.A., the Province, the local Chamber of Commerce and the transport operators.

The model, laying on the basis of an urban consolidation centre, is extremely simple: logistics operators, above all carriers, deliver their goods to the logistics platform where eco-friendly low impact methane and electric vehicles are loaded. Then these vehicles distribute the goods to the city centre, the so-called "last mile" in the transport chain. The low impact vehicles used to distribute the goods to the city centre have free access to the restricted traffic zone, preferential lanes and are able to park inside the limited traffic zones at any time of the day. The service is dedicated to the subcontracted and direct goods hauliers who work in the city, and will be extended shortly to perishable goods delivery.   The tariffs of the service are contracted with each customer, in base of the quantity of freight to be delivered.

A key element of this project is the use of ITC. Indeed, as a support to tactical and operational planning, a strong information system has been developed. The system allows to track in real time the vehicle fleet position, using automatic vehicle location (AVL) web-based tracking system. This allows management to meet customer needs more efficiently. Vehicle location information can also be used to verify that legal requirements are being met.

The logistic platform aims to reduce the negative effects of goods distributions by improving the efficiency of the supply chain. A study of the CLAS Group for the Italian Ministry of Environment pointed out a reduction of the length of the delivery trips and of the total amount of kilometres covered by freight vehicles and related emission. In particular, over a 24 months period, the study has pointed out a reduction of 561,400 km (1,216 km/day on average), a reduction of 58,200 litres of gas consumption (due to less freight transport vehicles circulating) and a reduction of pollutants (51.4 Kg of PM10). Furthermore, in the period 2003 - 2009 (i.e. before and after the opening of the Cityporto) there was a reduction of approximately 67 % of greenhouse gas emissions.

Cityporto of Padova is one of the few experiences of this kind successfully operating in Italy. The model has been taken as an example by many other Italian towns (e.g. Modena, Albano Terme and Como), and every year it is studied by numerous foreign delegations. The Cityporto plan provides a robust economic argument for timely and preventative measures for energy and C02 emission saving in urban good distribution.

LA ROCHELLE

La Rochelle is a medium city (about 80,014 inhabitants) and one of the most important French seaport. It has been the first European city which organized an electric car-sharing system in the city centre and the first French city which organized a public bike rental system. Despite a strong political support for an environmentally approach to transport planning, the city has experienced an increase in traffic congestion and noise over the last twenty yeas (SUGAR, 2011).

In 2001, the Communauté d'Agglomeration de La Rochelle initiated an urban consolidation centre (UCC) in La Rochelle. The objective of the project was to optimise goods distribution in the city's historical centre with an environmentally friendly approach. In particular, the project aims to improve economic and environmental performance of the goods distribution by reducing the number of trips and by maximizing the loading rates of vehicles and the usage of low-pollution urban freight transportation vehicles.

As for the case of the Cityporto, the project lays on the basis of a simple scheme: the transport operators or the self-transporting stakeholders deliver their goods to the urban consolidation centre, located by the train station and next to the historic centre, where they are temporary stored. From this site, low-emission vehicles depart for the distribution of goods in the city centre. In particular, deliveries from the urban consolidation centre are made using nine electric vehicles of which two are equipped with dedicated temperature control for the delivery of perishables. Beside this service, the UCC also offers other auxiliary services with electric vehicles. The manager, Transports Genty, is a private company founded by a competitive tender.

The project is the result of a long process of participation that involved important stakeholders in the process at a very early stage. The success of the La Rochelle UCC is in the first place due to the shared sense of urgency of all stakeholders involved in the process. The good participation is presumably also due to the funds provided by the municipality. Indeed, subsidies are provided by the local government for the infrastructure and a fixed amount per package.

The platform was designed not only to promote delivery using electric vehicles, but also to relieve traffic congestion in the centre by reorganising deliveries. To that end, a new traffic regulation was passed. According to this regulation, heavy freight-delivery vehicles (i.e. GVW exceeding 3,5t) are allowed to deliver within the perimeter only between 6:00 and 7:30 a.m. The time-window management of the municipality encourages transport companies to drop of their goods at the urban consolidation centre.

Today the UCC of La Rochelle serves 1300 businesses and around 30% of the deliveries to the city centre are handled by the urban consolidation centre. This is approximately 450 parcels/day and between 5 and 10 pallets per day. Delivery from the urban consolidation centre to the inner city costs 3.75 euro/parcel. According to a report from the SUGAR project (SUGAR, 2011) the Elcidis Urban Consolidation Centre has brought significant environmental benefits. In particular, the use of electric vehicles has brought a huge benefits regarding exhaust gas emissions, noise emissions and C02 emissions (61% saving). The UCC is successful according to most stakeholders and there are 61% less vehicle kilometres with conventional trucks in the city centre (Patier, 2006). Carriers can avoid wasting time in delivering in the city centre and retailers and residents appreciate better traffic and parking conditions and noticed the general improvement of their local environment (SUGAR, 2011).

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IMAGE SOURCES

The image shown in the first page is from http://logiseconomy.tistory.com; the images shown in the second page is from http://wikipedia.org; the image in the third page is from http://www.linternaute.com.

05

REVIEW PAGES: NEWS AND EVENTS

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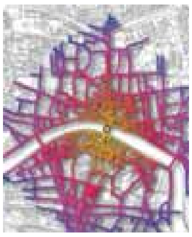


In this number

TRANSPORT ENERGY CONSUMPTION: A DISCUSSION FOR A WIDER MOBILITY VISION

Nowadays energy consumption is one of the main themes of transport policy. A number of strategies have been designed over the last decades in order to reduce current energy consumption trends in the transport sector. They include fuel taxes, more efficient technologies and changing travel behavior through demand regulation. Indeed, technology progress alone is not able to improve effectively the energy efficiency of the transport system (Lopez et al., 2012); this is mainly due to the structure of the current mobility system, designed for the use of private transport; it is confirmed by the analysis conducted by the European Commission on energy consumption in 2010 in the old continent, according to which the majority (82 %) of the energy is consumed by road transport, and about 2/3 of the total consumption are due to passengers transport. This approach is no longer sustainable: In a simulation made with the *business as usual* method the dependence on oil is expected to remain slightly below 90% and CO2 emissions remain higher than a third compared to their 1990 level. Next to these numerical data on environmental cost the research finds other interesting data: the cost of congestion would increase by 50%, the gap in accessibility between central and peripheral areas would increase, and the social costs of accidents and noise would continue to grow. Therefore, the challenge is to decouple the transport system from oil dependence without sacrificing its efficiency; it calls into question the whole system and the classical view of efficiency of movements linked exclusively to a non-integrated management of road infrastructure, seeking alternative approaches to optimize the use of all modes of transport and to organize a better complementarity (co-modality) of different transport modes both public and private. Rules that help the transport mode that needs less energy should be implemented. Several studies consider as central point of the question the analysis of the interaction of urban pattern characteristics – such as population density, settlement size, distance from urban centers and transport networks, jobs and housing balance, local neighborhood design, public transport accessibility – and socio-economic characteristics – such as income and car ownership, house tenure and attitude to travel – in relation to the impact on energy consumption of the transport system. In a nutshell it is essential to address the issue of sustainable mobility considering the transport system inextricably linked to all the other main elements of the wider urban system (Gargiulo et al, 2012).

For this reason, in the international conferences selected, the issue of mobility is the core point for the development of broader strategies for sustainable and energy efficient development on a urban and regional scale.

6TH EUROPEAN TRANSPORT RESEARCH CONFERENCE. MOVING FORWARD INNOVATIVE SOLUTIONS FOR TOMORROW'S MOBILITY

Where: Warsaw, Poland

When: 18-21 April 2016

The TRA conference represent one of the most important transport research event in Europe, gathering every 2 years the main stakeholders among the researchers, experts, and policy-makers. Its scope covers all modes of surface transport: road, rail and waterborne, as well as co-modality, in urban, inter-urban and long-distance settings. One of the main assumption of the conference is that the transport represent an important factor for the global competitiveness of Europe. For that reason the organizing committee will give priority to researches and implementation challenges that take into account the following goals:

- The development of common schemes and standards for the interoperability of European transport systems;
- The development of cooperation and competitiveness mechanisms between transport systems in Europe and in the world, to address the evolving needs in the education system to better tackle future industrial and societal needs;
- Ensuring, through a wider vision of transport system, the mobility of people and goods, and thus freedom in the political and economic sense;
- Enabling a better spatial planning so that transport systems provide mobility for people and goods at the highest level of energy efficiency, reliability, and safety.

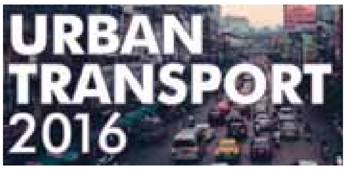
21ST INTERNATIONAL TRANSPORT AND AIR POLLUTION CONFERENCE (TAP 2016)

Where: Lyon, France

When: 24-26 May 2016

Reduction of fossil energy and the increasing demand for mobility are the central topics of this conference born with the aim of bringing together public authorities and state or local government agencies with jurisdiction over transport or air quality, community groups, operators, commercial carriers, nonprofit and other business entities to share their contributions on the current scientific knowledge of air pollution due to emissions from transport system. The conference goal address the main challenges in transport with respect to energy, environment and economy issues and aims to explore the most advanced research works and innovations, the latest technological and industrial developments and implementations, and innovative policies, in Europe and worldwide, with an emphasis on the following topics:

- Exhaust and non-exhaust emissions from transport modes: measurements and modeling;
- Emission control and Technologies;
- Transport, energy consumption and greenhouse gas emissions;
- Urban and suburban air quality;
- Transport policies and mobility challenges towards cleaner cities.



22ND INTERNATIONAL CONFERENCE ON URBAN TRANSPORT AND THE ENVIRONMENT

Where: Crete, Greece

When: 21-23 June 2016

The complex interactions between urban transport and the environment is the starting point of the conference which aims to provide opportunities for establishing practical action strategies for resolving urban transportation problems.

Clearly the issue of providing effective and efficient transport systems in the urban settings remains an acute challenge with financial, political and environmental constraints limiting the ability of transport system planners and operators to deliver the high quality outcomes expected by the public. Therefore the interaction between academic and practical perspectives is emphasized: theories and ideas are debated and their practical applications rigorously tested. The range of subjects proposed in this conference is really wide covering classical topics of the mobility world as transport security and efficiency as well as more actual one connected with the most pressing challenge of the modern society as climate change, land use reduction and energy efficiency.

INTERNATIONAL CONFERENCE ON TRANSPORTATION & DEVELOPMENT 2016

Where: Houston, Texas, USA

When: 26-29 June 2016

The conference will focus on projects and best practices around the topic of smart transportation that contribute to the development of innovative tools for competitiveness and prosperity. Presentations and panel are called to illustrate how the researches are improving performance to meet the critical mobility and development challenges of a changing operational and competitive environment. It will cover transportation and development planning, financing, functional design, construction, operation, and management.

2016 ACT INTERNATIONAL CONFERENCE

Where: Portland, USA

When: 31 July-3 August 2016

The conference theme is "Mobilizing our Communities"; The ACT International Conference aims to be a collaborative learning community composed by practitioners, government officials, students, researchers, and educators called to develop the next generation of transportation demand and mobility management leadership, technologies, analytics and strategies. The main topics of the conference are:

- Mitigating congestion;
- Enhancing mobility;
- Economic benefits of TDM;
- Energy conservation;
- The future of transportation funding sources;
- Commuter and employee safety.

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