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The fragile/resilience city represents a topic that collects itself all the issues related to the urban risks and referred to the different impacts that an urban system has to face with. Studies useful to improve the urban conditions of resilience are particularly welcome. Main topics to consider could be issues of water, soil, energy, etc..

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THE RESILIENCE CITY / THE FRAGILE CITY. METHODS, TOOLS AND BEST PRACTICES.

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Contents

TeMA Journal of
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CALL FOR PAPERS: TEMA VOL. 11 (2018)

The Resilience City/The Fragile City.
Methods, tools and best practices.

The fragile/resilience city represents a topic that collects itself all the issues related to the urban risks and referred to the different impacts that an urban system has to face with. Studies useful to improve the urban conditions of resilience (physical, environmental, economical, social) are particularly welcome. Main topics to consider could be issues of water, soil, energy, etc.. The identification of urban fragilities could represent a new first step in order to develop and to propose methodological and operative innovations for the planning and the management of the urban and territorial transformations.

The Journal also welcomes contributions that strategically address the following issues:

- new consideration of the planning standards, blue and green networks as a way to mitigate urban risks and increase city resilience;
- the territorial risks and fragilities related to mobility of people, goods, knowledge, etc.;
- the housing issue and the need of urban regeneration of the built heritage;
- socio-economical behaviour and the "dilemma" about emergency and prevention economy;
- the city as magnet of the next future's flows (tourism, culture, economy, migration, etc.).

Publishing frequency is four monthly. For this reason, authors interested in submitting manuscripts addressing the aforementioned issues may consider the following deadlines

- first issue: 10th January 2018;
- second issue: 10th April 2018;
- third issue: 10th September 2018.

CALL FOR PAPERS: GENERAL CALL.

Papers in Transport, Land Use and Environment

The Journal welcomes papers on topics at the interdisciplinary intersection of transport and land use, including research from the domains of engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science, and complex systems

INPUT 2018 conference

VITERBO, ITALY
5-8 SEPTEMBER 2018

10th International Conference on Innovation in Urban and Regional Planning
Environmental and territorial modelling for planning and design

INPUT2018 is organized by DAFNE – Department of Agriculture and Forestry Science, Research group on territorial and urban planning.
This Tenth Edition will purse multiple objectives with a holistic, boundary-less character to face the complexity of today socio-ecological systems following a systemic approach aimed to problem solving. In particular, the Conference will aim to present the state of art of modelling approaches employed in urban and territorial planning in national and international contexts.
Moreover, the conference will host the QGIS hackfest (8 th september).
INPUT is managed by an informal group of italian academic researchers working in many fields related to the exploitation of informatics and innovation in planning.

EDITORIAL PREFACE: TEMA JOURNAL OF LAND USE MOBILITY AND ENVIRONMENT 1 (2018)

THE RESILIENCE CITY/THE FRAGILE CITY. METHODS, TOOLS AND BEST PRACTICES

ROCCO PAPA
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The 11th volume of TeMA Journal consecrates the three issues of 2018 to promotes the scientific debate on the fragile/resilience city that represents a topic collecting itself all the issues related to the urban risks and referred to the different impacts that an urban system has to face with. Studies useful to improve the urban conditions of resilience represent the aim of our editorial work of this year. The identification of urban fragilities could represent a new first step in order to develop and to propose methodological and operative innovations for the planning and the management of the urban and territorial transformations.
The section "Focus" contains four articles. The first article, titled "Land use and climate change: Italian and European adaptation plans" by Floriana Zucaro and Rosa Morosini (University of Naples Federico II, Italy), deals on the reading of a sample of recent Italian and European adaptation plans, seeks to investigate the existence of environmental actions aimed at guaranteeing a sustainable use of natural and non-natural soil, in order to reduce the consumption of non-anthropized soil and also contribute to containing the effects of climate change.
The second article "Second law of thermodynamics and urban green infrastructure - A knowledge synthesis to address spatial planning strategies" by Raffaele Pelorosso, Federica Gobattoni, Maria Nicolina Ripa, Antonio Leone (Tuscia University, Italy) with a systemic review of Urban Green Infrastructure (UGI) planning and thermodynamics has been carried out to identify all the occurrences to date in the scientific literature. Secondly, a scoping review of second law of thermodynamics (SLT) related concepts of exergy, entropy and urban metabolism is presented in order to investigate the main applications of, and gaps in, urban spatial planning. Results indicate that UGI and ecosystem service planning based on SLT is a relatively new field of research. Moreover, some general indications are derived for the development of spatial UGI planning strategies based on SLT.
The third article, titled "The Adapting city. Resilience through water design in Rotterdam", by Maurizio Francesco Errigo (University of Enna Kore, Italy), focuses on the strategies and the initiatives that Netherlands has been developing to improve the water management in urban areas and make them efficient waterproof cities. In particular the Delta Metropolis project and the Rotterdam case study are described by paying particular attention to the solutions that public open and green spaces offer in terms of water defence and climate adaptation.
The fourth article, titled " Geographic determinism Vs urban resilience: italian scenario analysis " by Stefano De Falco (University of Naples Federico II, Italy), proposes a geographic approach in which the characteristics of urban resilience, synthesized by a wide review of scientific articles, are associated with determinants of geographic type (urban dimension, latitude and prevalent urban attribute). The proposed analysis both introduce methodological elements of evaluation useful for this topic and both shows, based on the stratification of real data regarding some main urban variables (Living, Environment, Mobility and Legality), the scenario of Italian cities characterized by high, medium and low resilience actions as a function of their geographical characteristics, trying to make clearer the question regarding the geographic

determinism paradigm declined to the urban frame, analyzing the eventual geographical influence on the processes of urban resilience.

The section "Land Use, Mobility and Environment" collects four articles. The first one, titled "Monitoring User-Based Accessibility Assessment in Urban Environments and in Public Buildings", by Gintaras Stauskis (Vilnius Gediminas Technical University), with a tool for facilitating the development of humane, socially sustainable and an inclusive urban environment. A group of users representing people with different kinds of disabilities, the elderly and families with children was created to assess the quality of access to various buildings with different functions and locations across Vilnius and in Singapore. A school, two hospitals, a rehab centre and two offices were selected for access monitoring in Vilnius City, while a hotel, a café and two metro stations with public squares were chosen for access assessment in Singapore.

The second article, titled "Regenerating Urban Spaces: A Brief Commentary on Green Infrastructures for Landscape Conservation", by Matteo Clemente (University of Rome Sapienza, Italy), Fabio Bianconi, Marco Filippucci (University of Perugia, Italy), Luca Salvati (CREA), debates on the issue of urban regeneration in contemporary cities, adopting a strategic vision which includes the use of vegetation and green infrastructure to create a network of public spaces. The authors focus on peripheral urban areas and they highlight how greening present cities may promote both biodiversity conservation and urban regeneration by recovering public spaces with social purpose. The case study refers to the city of Perugia and relates to the opportunities offered by the extraordinary program for the Italian peripheries.

The third article, titled "An analytical tool to support the pedestrianisation process: The case of via Roma, Cagliari", by Alfonso Annunziata (University of Cagliari) and Carlo Pisano (University of Florence), with focuses on the case of the modification of an urban road network: the transformation of a portion of an important distributor road in the urban area of Cagliari into a pedestrian space. By means of this case study the article aims to point out how pedestrianisation interventions have not been completely defined within a theoretical system that clearly establishes modes and conditions of implementation.

The fourth article, titled " Expectation management at the local scale: Legal failure of public participation for large urban planning projects" by Thomas Hartmann, Fennie van Straalen (Wageningen University & Research, Netherlands), Tejo Spit (University of Utrecht, Netherlands), investigates how planning law supports public participation in large planning projects that cross municipal borders. The juridical analysis of German and Dutch codified law is based on four elements: literal content, institutional positioning, historical context, and teleological meaning of a legal text. The paper furthermore distinguishes four rationales for participation in planning: support, legitimization, improving plan quality, and education.

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 Rosa Morosini describes three web resources of: (i) European Green Capital; (ii) European Green Leaf and (iii) Cresco Award.

. The Books section by Gerardo Carpentieri briefly reviews three relevant books related to the Issues' theme: (i) How To Make Cities More Resilient A Handbook For Local Government Leaders; (ii) The London Plan - The Spatial Development Strategy for Greater London and (iii) Cities Taking Action. The Law section by Maria Rosa Tremiterra keeps readers up to date with comparison between three legislative documents, in order to climate change adaptation of coastal areas in EU member states (Netherland, Germany and Denmark) . The Urban Practices section by Gennaro Angiello presents two case studies in the us for planning for sharing mobility: (i) Rotterdam and (ii) Thessaloniki. The News and Event section by Andrea Tulisi, proposes a selection of conferences on the topic of decision support tools where developed for supporting adaptation and mitigation policies at urban scale.

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SUSTAINABLE LAND USE AND CLIMATE ADAPTATION: A REVIEW OF EUROPEAN LOCAL PLANS

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ABSTRACT

Adaptation plans are the result of a political decision based on the awareness that climate change has altered environmental conditions and action is therefore needed in order to return to, maintain or achieve the desired outcome. A crucial role in defining adaptation actions is played by the use of resources, in particular of non-renewable resources such as soil. This paper, based on a sample of recent Italian and European adaptation plans, seeks to investigate the presence of actions aimed at guaranteeing a sustainable use of natural and non-natural soil, in order to minimize the consumption of non-anthropized soil andalso contribute to containing the effects of climate change.

The paper is divided into three sections: the first one describes the methodology employed; the second one focuses on the most up-to-date plans regarding the effects of climate change in some urban systems; the third one proposes hints for further reflections and useful recommendations to local decision-makers in the development of tailor-made adaptation actions aimed at guaranteeing an efficient use of both natural and anthropized soil.

The reading of the plans has exposed that soil consumption is not among the factors that need direct action to reduce the vulnerability of urban systems to current climate change, but rather it is a phenomenon that can be contained by increasing green areas and/or infrastructures and encouraging agricultural and environmental regeneration. The attention seems to be drawn to not yet sealed soil, thus leaving out the already anthropized one that, as such, would require, instead, greater adaptation efforts.

KEYWORDS:
Soil, climate changes, adaptation plans, overview, review.

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土地可持续利用与气候适应：欧洲规划回顾

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摘要

适应规划是基于认识到气候变化改变了环境条件的政治决策的结果，因而需要采取措施以恢复、维持或实现期望的结果。明确适应措施的关键作用是利用资源，特别是土壤等不可再生资源。

本文以近来的意大利与欧洲适应规划为样本，研究是否存在旨在保证天然与非天然土壤的可持续利用的措施，以使非人为化土壤的消耗降到最低，并且有助于遏制气候变化的影响。

本文分为三个部分：第一，描述所采用的研究方法；第二，聚焦在某些城市系统中有关气候变化影响的最新规划；第三，为当地决策者就旨在确保天然与人为化土壤的有效利用所量身定制的适应措施的发展提供进一步反思的线索与有用的建议。

这些规划的解读表明了土壤消耗并不是需要采取直接措施以减小城市系统对当前气候变化的要害/脆弱性因素之一，而是一种可以通过增加绿地和(或)基础设施以及鼓励农业和环境再生来遏制的现象。人们的注意力似乎只关注尚未封盖的土壤，而忽视了需要作出更大的适应努力的已经人为化的土壤。

关键词：
土壤；气候变化；适应规划；概览；回顾

1 SCIENTIFIC OVERVIEW AND OBJECTIVE

Climate on Earth has always undergone natural changes and so will be in the future. About 11.000 years ago, during the Holocene era, climate became progressively warmer and wetter thus determining more comfortable life conditions that facilitated the spread of flora and fauna and consequently the development of human activities (Gupta, 2004; Wanner, et al. 2008).

Nevertheless, in addition to these natural factors, others related to human activities arise. Over recent years, the scientific community has been investigating the rapid global warming phenomena that could potentially determine a 0.3 °C increase (at least) of global mean surface temperature by the end of the 21st century compared to the period 1986–2005 (IPCC, 2014a). This projection is related to the rate of greenhouse gases emissions caused by human activities that have increased by about 90% from 1970 (Le Que´re´et al., 2009; IPCC, 2014b) to 2011.

Even though modeling extreme weather events such as heat waves, floods, etc. may be difficult and the effects of climate change vary differently from one city to another (depending on place-specific micro-climatic, geomorphological, etc. charateristics), global warming is unequivocal and, as a result, many studies have focused on the urban scale.

In fact urban settlements are areas of high vulnerability mainly due to "a high concentration of 'elements at risk' to climate and weather impacts, such as people, critical infrastructure, and buildings" (Scatterthwaite et al., 2007; Reckien et al., 2014).

The vulnerability of urban areas can be due to three main factors: location, as they can be situated near the coast, mayor rivers, low-lying zones exposed to the risk of coastal erosion, flooding, sea-level rise, etc.; economy, as many activities and sectors can be weather-related; size, the biggest they are, the most aggregated risks they can have (Rosenzweig & Solecki, 2001; De Sherbinin et al., 2007).

According to several authors (Bigio, 2003; McEvoy, 2007; Wilby, 2007) who identified the main climate change effects on cities, these can be mainly resumed as follows:

– health: heat and cold mortality, food and water security and availability, increase of diseases;
– energy use: e.g. heating and cooling, energy price shock;
– accessibility and supply: critical infrastructure out of order;
– forced migration: e.g. due to disease, overcrowding;
– economic and fiscal crises: related to the concentration of economic activities;
– social instability.

In addition to the points listed above, the specific characteristics of each urban area can worsen both the climate change and extreme weather effects. For instance, focusing on the soil resource which is one of the research issues of this work, the high rate of non-porous surfaces can intensify the flood risk as a sealed soil is not able to retain large portions of atmospheric precipitations and hence contribute to regulating surface run-off (Whitford et al., 2001; Wood et al., 2005; Woods-Ballard et al., 2007). Indeed, it has to be considered that a natural soil can store up to 3,750 tons of water per hectare, or about 400 mm of rainfall and that the infiltration of rainwater through the soil should cause it to take longer to reach the rivers, thus reducing the flow rate and therefore the risk of flooding. Soil and artificial surfaces leaching by surface runoff waters also determines an increase in the solid load and the content of pollutants, causing a strong impact on the quality of surface waters and aquatic life (EEA, 2006; ISPRA, 2013).

The gradual expansion of urban areas and the consequent soil sealing causes less vegetal transpiration and an increase in the surfaces with a high heat refraction coefficient; moreover, the decrease of the evapotranspiration must be combined with the heat produced by the anthropic activities, determining the heat island phenomenon (EC, 2012).

These effects may have an even greater impact on the Mediterranean arid areas with consequent negative effects on human life (Salvati et al., 2011; Potchter & Ben-Shalom, 2013).

Soil is a fundamental natural resource for ecological balance and human labour productivity. However, a serious environmental problem detected in many parts of Europe is soil degradation caused by its improper use or poor management (European Environment Agency, 2006). The European Commission, on the basis of the Soil Thematic Strategy (COM(2012)46), carried out important research activities regarding land-take assessment and soil sealing monitoring (Joint Research Centre and European Environment Agency, 2012). According to Genske (2003) & Scalenghe et al. (2008), phenomena such as soil erosion, decline in organic matter, local and widespread soil contamination, sealing, compaction and salinization are the result of changes in the use of land that can adversely affect soil functions and ecosystem services (see, for instance, Sauer et al., 2011).

Furthermore, in the continuous effort to improve the resilience of urban areas and promote the integration of climate change issue into governance and planning practice, Europe has developed a Climate Change Adaptation Strategy in 2013 with the following three primary aims: encourage all Member States to adopt global adaptation strategies and their action plans, inviting them to make a commitment drawn on the model of the Covenant of Mayors and supporting them with funding useful to develop their adaptability; further promote adaptation in particularly vulnerable sectors such as agriculture; foster awareness in the decision-making process by addressing knowledge gaps in adaptation plans and increasing the European Climate Adaptation Platform (COM(2013) 216 final). The adoption of this strategy represents a further attempt of the European Community to lead the way towards sustainability and resilience to climate change at all levels (national and local) of territorial governance.

In particular, the adaptation plans provided are the result of a political decision based on the awareness that climate change has altered environmental conditions and action is therefore needed in order to return to, maintain or achieve the desired outcome (Parry et al., 2007). Everything should be renewed and redesigned to increase resilience, thus reducing the risk.

The adaptation should be undertaken and developed by the local authorities, as it is at the local level that the greatest impacts occur. Historically, efforts have focused more on mitigation but the challenge must be double (Blanco et al., 2009), that is to say, actions must be geared towards an integrated mitigation and adaptation perspective. A decisive role in defining these actions is played by the use of resources, as climate change will challenge the ability of the current reserve network to provide protection for biodiversity, to satisfy human basic needs and to carry out their ecosystem functioning (Lawler, 2009; Blanco et al., 2011). "For instance, changes in the global climate have a significant impact on local and regional hydrological regimes and processes, which in turn affect ecological, social and economical systems" (Lin et al., 2012). Protection of soil as a precious resource means being able to guarantee the functional capabilities of the land and, therefore, the ability to absorb water by infiltration in case of meteoric events and decrease the volume and speed of surface flow, improving water management in the event of floods that are much more frequent due to climate change. Furthermore, soil is the second carbon tank after the oceans, therefore ensuring a sustainable use of the soil means helping to reduce the presence of carbon dioxide in the atmosphere, with a consequent reduction of the greenhouse effect. Lastly, soils with a high content of organic carbon are more fertile and productive, more capable of purifying water and contribute to increasing the resistance capacity of livelihoods to the impacts of climate change. An exasperating soil sealing generates further negative effects on the quality of water, air and products consumed by both the population and animals, as well as on biodiversity and climate change. Preserving soil use by promoting, for example, interventions, such as green infrastructure, can represent an effective response to the impacts of climate change like flooding phenomena: "the climate adaptation benefits of green infrastructure are generally related to its ability to moderate the expected increases in extreme precipitation or temperature.

Benefits include better management of storm-water runoff, lowering incidents of combined storm and sewer overflows (CSOs), water capture and conservation, flood prevention, accommodation of natural hazards (e.g., relocating out of floodplains), reduced ambient temperatures and urban heat island (UHI) effects, and defense against sea level rise (with potential of storm-surge protection measures). The U.S. Environmental Protection Agency (EPA) has also identified green infrastructure as a contributor to improving human health and air quality, lowering energy demand, reducing capital cost savings, increasing carbon storage, expanding wildlife habitat and recreational space, and even increasing land-values by up to 30%" (Foster et al., 2011; Gargiulo et al., 2017).

The green infrastructure can provide more efficient and more flexible benefits compared to the "network of infrastructures and urban settlements, namely that system consisting of buildings and equipment connected by various types of linear infrastructures" (the so-called grey infrastructures, see Socco et al., 2008), as the improvement to adapt to the impacts of climate change.

In other words, soil and its vegetation contribute to mitigate and balance the local climate, regulating waterflows and energy between the Earth's surface and the atmosphere and storing large quantities of carbon. Conservation and sustainable soil management are therefore an important opportunity in the context of actions to be taken to mitigate and adapt to the effects of climate change and to offset emissions from fossil fuel consumption (Papa et al., 2016).

In this perspective, this paper proposes a reading of the most recent Italian and European adaptation plans in order to understand the effective role played by the containment of soil consumption in the choices of the urban setting and in the reduction of the negative impacts on climate change. There are many studies concerning the reading of successful tools and practices aimed at adapting to climate change, all of them faced in a broad and general way and at a supra-municipal level (Sovacool & Brown, 2009; Biesbroek et al., 2010; Baker et al., 2012; Carter, 2011; Reckien et al., 2014). The number of studies aimed at investigating the relationship between adaptation and specific components and/or characteristics of the urban system is lower than the above mentioned ones (Hamin & Gurran, 2009, Geneletti & Zardo, 2016).

The paper is divided in the following three sections: the first one describes the methodology employed; the second one focuses on the most up-to-date plans regarding the effects of climate change in some urban systems and the adaptation actions to be taken to contain soil consumption; the third one proposes hints for further reflections and useful recommendations to local decision-makers in the development of specific adaptation actions aimed at guaranteeing an efficient use of both natural and anthropized soil.

2 METHODOLOGY

This paper, through the reading of the adaptation plans of some Italian and European cities, seeks to investigate the presence of actions aimed at guaranteeing a sustainable use of natural and non-natural soil, in order to minimize the consumption of non-anthropized soil and also contribute to containing the effects of climate change.

It should be pointed out that the number of adaptation plans in force is still small, as they are "new" tools of territorial governance so far, which, together with the mitigation plans, define the actions to be implemented in order to reduce the risks to which the cities are subject because of the effects of climate change. In fact, on the basis of the national strategic guidelines, the cities have drawn up their own adaptation plans, since they have been affected – although in different ways - by the impacts of climate change in recent years.

The sample under investigation consists of 3 Italian and 5 European adaptation plans.

The choice of the Italian plans has been a rather simple operation, as the selected cities are the only ones to be provided with an existing adaptation plan. Having identified the Italian cities, the search for the related plan documents was carried out by consulting the websites of the municipalities chosen.

When the adaptation plan was not available online, local administrations were contacted directly. As for the choice of the European plans, the Covenant of Mayors for Climate & Energy platform was initially consulted. The platform was made available by the European Community in March 2011 and contains the initiatives and action plans adopted by the Member States to tackle the phenomenon of climate change. However, since these plans represent a rather recent initiative, those available on the platform are as yet very few and above all related to small municipalities (<5000 inhabitants). For the selection of foreign cities, the most vulnerable countries in terms of climate change and soil consumption have been identified, firstly, through the study of the National Adaptation Strategies (NAS); by the most vulnerable countries reference is made to those countries that since the publication of the Green Paper in 2006 began to develop the Strategies and update them over the years, and thus gaining a consolidated experience in terms of adaptation. Moreover, the Member States selected are also the ones that in their Strategies have referred to the soil sealing as one of the anthropic factors capable of increasing the negative impacts of climate change.

According to the most recent data (2016) by the European Environment Agency related to the Climate-Adapt platform, 29 EU Member States have already adopted a NAS: Austria, Belgium, Bulgaria, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, Luxembourg, Malta, Norway, Netherlands, Poland, Portugal, United Kingdom, Czech Republic, Romania, Slovenia, Spain, Sweden, Switzerland, Turkey, Hungary. In these countries, just some cities have drawn up the adaptation plan to climate change, but the ever increasing number of national strategies proves the awareness that climate-related extreme weather events are increasing in frequency and disastrous consequences, and the need for a concrete global climate policy that should encompass adaptation measures able to reduce and manage the risks associated with climate change.

In particular, Finland was the first European nation to develop a NAS in 2005, one year ahead of the 2006 Green Paper explicitly mentioning the need to reduce the use of non-anthropized soil.

"Better consideration of the impacts of climate change and natural conditions in general may require some adjustment to the planning principles applied to the use of areas and land. The damage risk posed by rains can be lowered by securing the capacity of drainage systems so that it corresponds to the heavy rains expected in the future. It will be possible to set restrictions and regulations for areas where flooding and a rising ground water level are expected in the future" (Finland's National Strategy for Adaptation to climate change, 2005).

Other countries such as Serbia, Germany, France and Great Britain do not relate directly to the issue of soil consumption, but their strategies include numerous green infrastructure interventions to deal specifically with flood risk.

"There is a need to step up soil protection with regard to the risks of erosion and declining humus content, especially in hydromorphic soils. To avoid conflicts of objectives, the federal and the Länder authorities discuss and coordinate protection objectives and adaptation strategies for the soil with all stakeholders on a cross-departmental basis (agriculture, forestry and water management, nature conservation, atmospheric and climate research)" (German Strategy for Adaptation to climate change, 2008). With regard to natural risks, France was marked by the occurrence of large-scale floods, some of which severe and violent in the Mediterranean regions (Aude en 1999, Gard in 2002).

Worth mentioning is the episode of the floods of the Somme in 2001, which gave rise to a report by the Senate 1. However, according to several meteorologists and hydrologists, it is impossible to link the increasing number of these disasters to climate warming; some anthropogenic reasons, such as soil sealing, use of agricultural land, occupation of floodplains, etc., may provide a better explanation to these phenomena (Strategie Nationale d'adaptation au Changement, 2007). For each of these four countries have been identified the cities that have drawn up, in the last 10 years, an adaptation plan that would recall the phenomenon of soil consumption in relation to climate change. Another criterion for selection has been the availability of the adaptation plan in the English language.

In accordance with these criteria, the sample consists of five European adaptation plans. Once the sample was built, each plan has been carefully analysed to identify the most registered risks for that urban area and all direct and indirect actions linked to the containment of soil consumption.

As regards the numerous risks resulting from climate change due to the different physical and geomorphological characteristics of the urban areas, and for which direct and/or indirect actions on soil consumption are foreseen, they can be classified into four categories:

– Landslide risk: this risk, although linked to natural factors such as geological and geomorphological conformation, is also strongly conditioned by the continuous anthropogenic interference on land modification which, on the one hand has increased the possibility of occurrence of these phenomena, and on the other has raised the presence of goods and people in areas where this phenomenon occurred, despite its catastrophic effects;

– flood risk: the increase in the frequency of this risk is undoubtedly linked to the high anthropization and to the widespread sealing of the territory which, preventing the infiltration of rain into the ground, increases the quantity and the speed of the water that flows towards the rivers;

– soil erosion risk: this risk, in addition to being linked to natural causes such as sea level rise, is also due to anthropogenic causes such as the increase of urbanization in the coastal strip for tourism and industrial purposes;

– heat waves: this risk depends on the climatic conditions and on the physical and environmental characteristics of a specific area and is defined not only by the air temperature and relative humidity but also by the duration of heat waves.

The general objective shall be achieved through the implementation of direct or indirect actions. Direct actions explicitly limit the use of soil, such as the definition of a threshold for buildability, protection of the green belt land or reuse of existing buildings/structures and infrastructures. Indirect actions, instead, are all those that do not directly concern soil protection, however they contribute to promote a more sustainable use of it, since the risk for which this specific action is expected can be reduced if less soil is sealed, for example the actions envisaged to implement the water drainage system as to limit the landslide risk which can be reduced by ensuring a greater deal of permeable soil. In summary, the reading of each of the adaptation plans collected was carried out (i) investigating the impacts of climate changes and the risks related to them in order to understand how a city intends to "adapt" in view of its vulnerabilities (in this regard, it should be noted that the reading covered only the impacts and risks mainly linked to soil consumption); (ii) identifying direct and indirect actions with a view to protecting soil consumption; (iii) using an integrated approach to the issue of soil consumption, where integration is understood as referring to the need to both preserve the natural soil and improve the use of the anthropized one, in order to overcome this issue from the point of view of governance of urban transformations, that is taking into account the dynamic development of urban systems which inevitably entails the consumption of this resource.

3 ITALIAN AND EUROPEAN ADAPTATION PLANS REFERRING TO SOIL CONSUMPTION

There is a growing recognition that climate change requires a substantial change in approaches to the urban and territorial transformations governance, both in terms of reducing the production of carbon dioxide emissions (mitigation) and in making urban systems more resilient to the gradual climate variability (adaptation). Adaptation plans aim to tackle the inevitable consequences of climate change on the cities to reduce them in order to secure the territory and infrastructures from the risks linked to climate change phenomena, and thus ensure the safety of the inhabitants. With reference to the methodology adopted (section 2), the following paragraphs propose a reading of the following selected plans: the Italian cities of Ancona, Bologna and Padua, the European Helsinki, Belgrade, Berlin, Paris and London. This reading can provide some clarification with regard to the risks related to soil consumption that arise from climate change

(table 1) and therefore require certain adaptation actions, paying particular attention to those actions that provide - directly and indirectly - a reduction in soil consumption.
The reading of the plans has also been complemented by land cover data currently available, as an attempt to measure the effects determined by the actions contained in the adaptation plans in terms of soil saving. Through the use of CORINE Land Cover mapping - established by the EU-, sealed surfaces and green areas in the GIS environment were calculated for each of the currently examined cities. These measurements aimed to compare the prevalence of land use before and after adoption of the adaptation plans, so as to measure their effects quantitatively. However, this objective could not be reached because the most recent data available date back to 2012, when most of the plans were drawn up.

3.1 ANCONA

Ancona, the capital of the Marche Region, has just over 100,000 inhabitants and is characterized (above all from the environmental point of view) by several critical issues. After the event of the great landslide, which hit a large area of the urban territory (1982), the municipal administration developed a progressive adaptation policy in order to increase the resilience of the community and the territory. This policy, which led to the development of the Adaptation Plan in 2012, was developed on the basis of a direct knowledge of the territory, with its problems, sustainability of the solutions adopted and the potential impacts of climate change - direct and indirect - in the medium-long term.
The major climatic events involving Ancona in recent decades brought about the following phenomena: the "great landslide", caused by persistent and heavy rains; the flooding that occurred as a result of several extemporaneous and short-term but considerably intense phenomena; coastal erosion accentuated by intense rainfall and long-term periods of summer aridity and heat waves rising.
To reduce the landslide risk, the plan, in addition to drainage interventions which will allow an optimization of water consumption thanks to the use of the water collected from the landslide instead of drinking water, also includes naturalistic engineering interventions (based exclusively on reinforced soil systems and gabions) able to preserve the non-urbanized soil and therefore the draining and stability functions of the soil itself.
As regards the erosion risk, besides being due to natural causes, it is also determined by anthropogenic causes due to the increase of urbanization in the coastal strip and the reduction/destruction of dune systems to make room for seaside resorts and marinas. To cope with this risk, the plan envisages a regulation scheme to rehabilitate the existing green areas by means of felling (where necessary) and a retreat of the seaside resorts and restaurants in order to gain unbuilt soil. The plan also entails the construction of new green areas that could lead to an increase in the rate of permeable soil -2.70% of the entire municipal area in 2012 (Copernicus, 2012)- and a reduction in the rate of the paved, built and therefore impermeable ones -which occupy 21.56% of the municipal area-, with the aim of adapting the urban system to the risk of floods and heat waves.

3.2 BOLOGNA

Bologna, the capital of the Emilia Romagna Region, has been seriously affected by the impacts of climate change in recent years, registering an increasing number of landslides, floods and heat waves: "The City has felt the need not only to avoid the intensification of meteoric events that damage the territory but also to preserve the resources linked to local climatic characteristics, first of all the water resource "(City of Bologna, 2015).
Under the influence of the Italian National Strategy, the city of Bologna drew up the adaptation plan in 2015 with a view to identifying the strategies pursued to improve the territory response to climate change and to coordinating the action of the City with the other local authorities involved in the management and protection of the territory. Bologna adaptation plan was drawn up after an accurate cognitive phase from which all the

vulnerabilities of the urban system to climate change have arisen, associating each one of them with one or more strategies accompanied by specific measurable objectives.
The greatest risks to which Bologna is exposed, in relation to soil consumption –which in 2012 involved 56.46% of municipal area (Copernicus, 2012)- are flood, hydrogeological risks and heat waves. The adaptation plan, in an attempt to limit the rising temperatures in urban areas, provides the widespread increase of green areas in such a way that the temperature gradient between built-up areas and vegetated areas determines an important air flow which allows to eliminate heat but also air pollutants from the city. The plan refers to other urban planning tools, the quantification of urban redevelopment projects and the enhancement of public space, which can be pursued through sealing reduction.
In fact, as regards the green areas, to which only 5.16% of the municipal district in allocated (Copernicus, 2012), the widespread qualification interventions will lead to an increase of about 15,000 square metres between public and private green areas, in addition to the realization of private green roofs as well as semi-permeable floors. Furthermore, the green spaces allow to reduce the vulnerability of the system to the other two risks: floods and the hydrogeological one. In this regard, the plan emphasizes the need to reduce soil sealing because it causes a significant increase in the Navile and the Savena Abbandonato flows, thus increasing the hydrogeological risk in the municipalities downstream. To this end, numerous actions are envisaged to make previously sealed surfaces, such as flooring, and areas of rainwater storage permeable once again, so as to slowly return it to the surface circulation or directly to the atmosphere through evapotranspiration.

3.3 PADUA

Padua, the capital of the Veneto Region, drafted an adaptation plan in 2016 and was the only Italian city to use a methodology built from those already existing at the international level. The methodology is articulated in 6 fundamental phases through which the city has identified the vulnerable areas in order to adapt urban areas to the effects of climate change, with the aim of studying the kind of vulnerability and then increase the capacity of reaction to the shocks generated by the ongoing climate change. Identifying vulnerable areas in the urban sector has helped to determine the risk generated by the impacts themselves and therefore the definition of adaptation actions.
The most detected effects due to climate changes in Padua are the floods and heat islands, and actions are planned to adapt to these risks, in order to mitigate and compensate the effects of land consumption, considering that the percentage of the area concerned was 77.27% in 2012, while only 0.59% of the municipal area was allocated to greenery (Copernicus, 2012).
The plan emphasizes the importance of soil protection, promoting actions able to lead to urban growth without sealing new natural soil but reusing already urbanized soils, thus redeveloping existing urban fabric and selectively "densifying" the most accessible urban places. Among the actions scheduled for the city in the plan, there are the new areas of reconversion and urban redevelopment, the new urban axes to be redeveloped both morphologically and functionally and the creation of many multifunctional green areas which, in addition to absorbing large amounts of CO_2, allow greater water absorption compared to sealed paved areas, as well as urban heat absorption, and if properly designed and built they can become areas for water storage in case of extreme weather events.
The plan also includes a map of impermeability (figure 1) with the objective of identifying the percentage of impermeable surfaces opposed to the permeable ones, showing the soil ability to infiltrate and absorb rainfall, thus avoiding water flow downstream and cause flooding. In this way the portions of soil to be kept free in order to reduce water and hydrogeological risk have been identified.
Finally, a plan of solar irradiation is presented in the plan where the areas that register a high level of irradiation are those where most of the solar radiation is absorbed and stored by the streets with consequent urban heat

island phenomena. Adaptation actions to reduce risks such as floods and urban overheating mainly involve actions that reduce soil consumption, such as respecting and increasing existing green areas and replacing floors (e.g. parking lots) with materials/techniques that make them permeable.

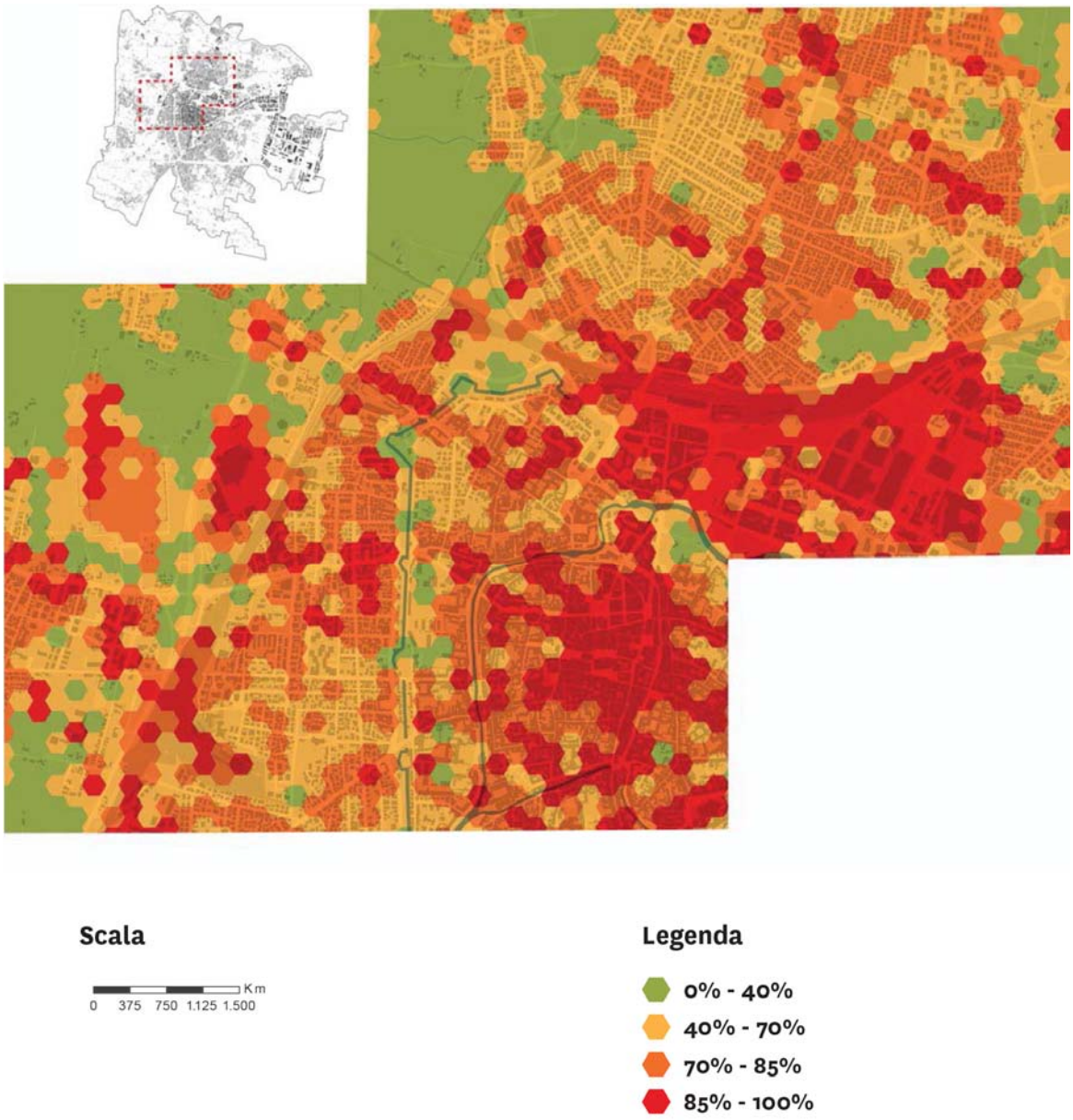

Fig. 1 Graphical representation of soil permeability percentage (Padua)

3.4 HELSINKI

Helsinki adopted a policy of adaptation in 2012 following some natural disasters, such as the storms of Summer 2010 and the Winter storm of December 2011, which showed the vulnerability of the Finnish city to climate change, in particular to the flood risk. Among the different actions proposed by the city, for flood risk there are also indications regarding soil consumption. In this respect, the plan proposes the construction of new

green areas, 6.74% of the municipal area (Copernicus, 2012), and the conservation of large forest areas able to withstand events such as storms. Green areas are also essential to improve water management.
If, on the one hand, the plan aims to safeguard the use of natural soil, in order not to increase the percentage of the sealed area, 17.25% in 2012, on the other hand the housing demand must be met, as the Helsinki urban plan foresees a population growth of around 600,000 residents in 2050, hence, to adapt the city to the risks of climate change with actions that meet the demand for housing without sealing other soil, the administration should suggest redevelopment of unused buildings, also providing for changes of intended use.
In fact, increasing sealed areas means increasing the risk of flooding, a risk that the city is particularly vulnerable to. However, this aspect within the Helsinki city adaptation plan is not addressed because the authorities can only suggest the protection of green and forest areas, instead it would be appropriate to define adaptation actions in a systemic perspective, starting to identify risks and considering the different subsystems that make up the entire city system.

3.5 BELGRADE

Belgrade drew up the adaptation plan in 2015 following extreme weather events which, according to data from the hydro-meteorological service of Serbia, occurred with increasing intensity: in the Summer of 1998, 2000, 2012 and 2013 heat waves caused a huge increase in temperatures (exceeding 39°C), carrying as a main consequence a great drought; in 2006 there were repeated floods caused by the melting of snow and heavy rains; in May 2014, heavy rainfall caused a large flood. Furthermore, in recent years the floods have increased significantly in intensity and severity.
With regard to these risks, the administration underlined all the main vulnerabilities within the adaptation plan (Figure 2) with the aim of identifying the most efficient actions to be taken. Green spaces, that in 2012 only covered 2.77% of the entire municipal district (Copernicus, 2012), have a high level of vulnerability to almost all the effects of climate change: extreme cold and drought can in fact cause a slowdown in the fundamental physiological processes of plants (such as photosynthesis, metabolism, transpiration and growth); heat waves slow down the growth of plants or even their drying; heavy rainfall leads to the physical destruction of plant tissues and green infrastructure.
There are a number of actions proposed by the administration in the adaptation plan which aim at adapting the city to these risks and do not directly refer to soil consumption, a phenomenon that until 2012 involved 13.34% of the entire municipal district (Copernicus, 2012).
It is possible to identify in the plan a series of indirect actions, transversal to the various types of risks identified, such as the creation of green infrastructures connected to blue structures (fountains, rivers, aqueducts), parks, gardens, forests connected to waterways, so as to encourage the infiltration and outflow of abundant rainfall, as well as the improvement of existing green areas. Creating green spaces means obtaining ventilation routes, which reduce the risk of heat waves that have proved to be very dangerous both for the ecosystem and for the health of local residents.

3.6 BERLIN

Berlin drafted the plan to adapt to climate change in 2016 to reduce environmental-related damage. In the city of Berlin the most recorded effects were the increase in temperatures, registered especially in the Summer of 2014 and 2015 when the heat waves phenomenon arose. Another phenomenon related to climate change detected in the German capital is the rainfall that has increased over the last decade; in fact, it is foreseen that "Berlin will experience an increase in the average annual precipitation of about 3 - 10% in the near future and 7.5 - 18% in the distant future" (City of Berlin, 2016). According to the forecasts performed, the strongest increase in rainfall should occur in Spring and Winter while it will be less relevant in Autumn and Summer

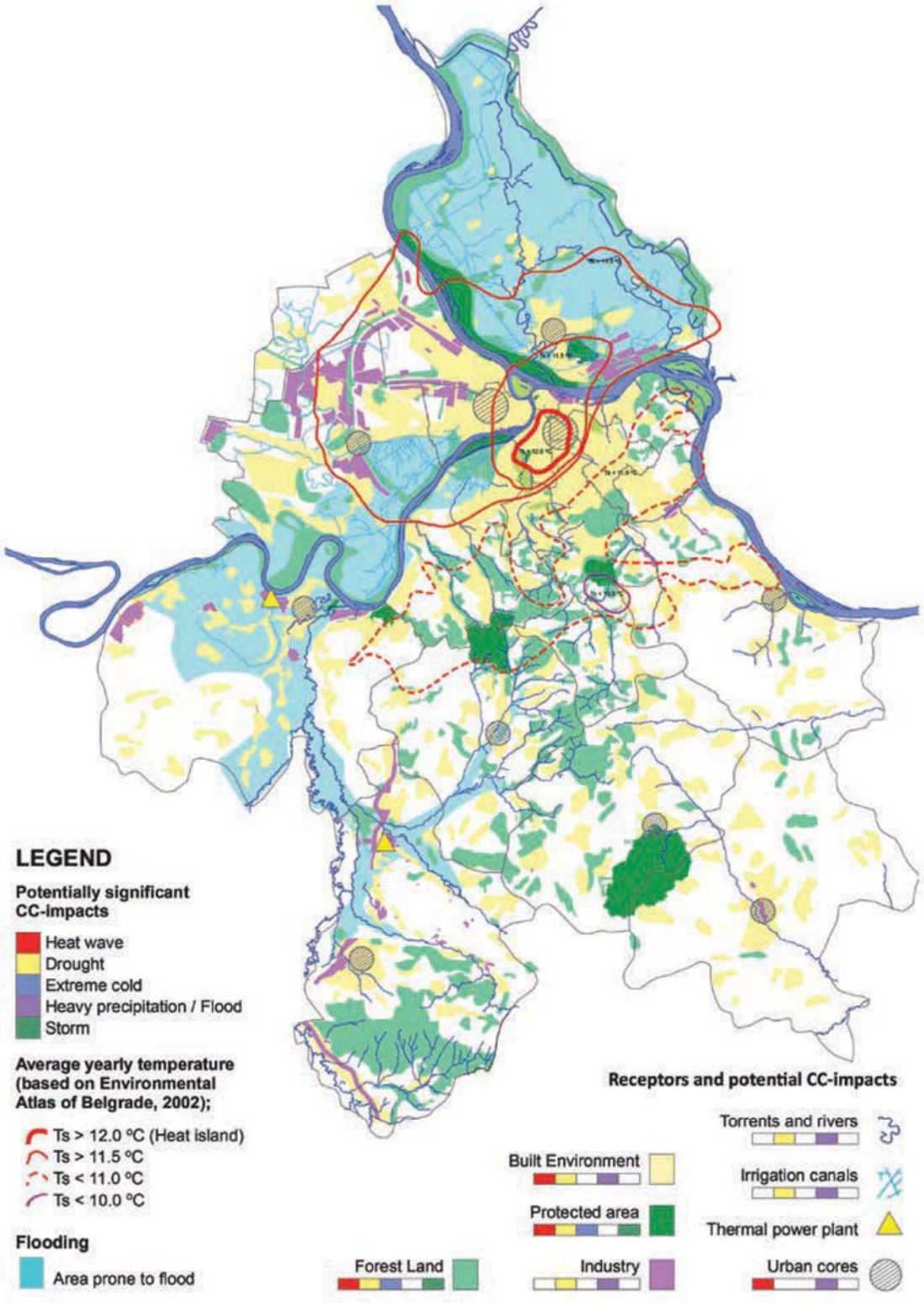

Fig. 2 Spatial distribution of potential climate change impacts related to the highly vulnerable receptors within the administrative territory of Belgrade

seasons, but the events of heavy rainfall will alternate, according to the City of Berlin forecasts, with drier periods. As temperatures rise above all during the winter, Berlin will have less snow in the future. Because of these two types of events, the municipal administration of Berlin has become aware of the fact that soil sealing, a process that in 2012 involved more than half (59.6%) of the entire municipal area (Copernicus, 2012), means

increasing the built area and, as a consequence, also the health risks for the inhabitants linked to the higher temperatures. Furthermore, the increase in heavy rainfall will lead to more flooding, especially in the most urbanized areas. In this perspective, the adaptation plan recognizes, on the one hand, the need to build new residential housing units - a demand that arises from the huge flow of immigrants towards this urban area -, on the other it proposes strategies for adapting to climate change by means of recovery of already existing structures and infrastructures and planning of green areas that are "strategically important", in order to benefit from them in terms of temperatures and evaporation cooling processes. The plan also suggests intensifying the permeability of the city surface to rainwater to adapt it to the increase in heavy rainfall so as not to exacerbate the sewage system. These interventions envisaged in the plan are aimed at adapting the city to the risks due to climate change by transforming the city of Berlin into a "Sponge City", increasing that 13.88% of the already present green area (Copernicus, 2012).

3.7 PARIS

Paris adopted the climate change adaptation plan in 2007, then updated in 2012 following an increase in existing risks and the emergence of new risks for both human and natural systems.

"Climate in Paris is changing and will continue to do so throughout the 21st century" (City of Paris, 2012) and among the most recorded effects of climate change on the Paris metropolitan area it is possible to identify: heat waves increasingly frequent and intense; floods due to heavy rains; the gradual loss of biodiversity; drought. Changes in temperature as well as alternating drought with heavy rains can also have an impact on the stability of the ground, with the risk of collapses or possible landslips.

Because of these effects, the administration proposes actions to protect citizens and the city, preserving existing services and resources. As regards the heat waves, aggravated by the phenomenon of urban heat island, the plan suggests the protection of green areas - which in 2012 covered 19.09% of the entire municipal area (Copernicus, 2012)-, as well as the opening times H24 all year round of municipal parks so that citizens can benefit from the freshness of these areas ideally connected by waterways or through green corridors such as hedges, gardens and escarpments, since water and the greenery help to cool the city and limit the effect of the heat island. Evaporation and plant evapotranspiration consume heat and contribute to reducing the surrounding temperatures. Moreover, other advantages could be the biodiversity conservation, the increase in permeable areas, the consequent mitigation of the sealing process that affects a whopping 78.58% of the municipal area (Copernicus 2012), and therefore a better flood risk management. In order to adapt the city to this type of risk, the plan also suggests other types of interventions on which this paper has not focused since they didn't take soil use into account.

3.8 LONDON

London, the capital of England, adopted the climate change adaptation plan in October 2011. London is very vulnerable to phenomena such as floods, droughts and heat waves, which are gradually increasing in intensity and frequency due to climate change. In the last decade, London experienced significant floods in 2002, 2004, 2005, 2007, 2008, 2009 and 2010, heat waves in 2003 and 2006, a severe drought in 2006 and unusually cold winters in 2009 and 2010. Each of these events affected residents' health and quality of life apart from having a negative impact on the economy. London is the engine of UK economy and an integral part of the world's economy, through providing workforce, energy, water and other consumables, thus any impact on London can have serious repercussions at the international level.

Among the various actions suggested by the plan, the one that takes soil use into account is related to the risk of flooding. In this regard, the plan identifies as possible actions the increase of green areas to absorb the flood water, in addition to cooling temperatures, and refers to the flood management plans (CFMPs) that identify actions to be taken for each London river. Another risk, as mentioned above, for London territory are

the heat waves. The plan, in this case too, suggests an implementation of the green areas -which in 2012 covered 1.42% of the entire municipal area (Copernicus, 2012)- in order to reduce the temperatures with a consequent reduction of overheating. Although the London City adaptation plan does not indicate direct actions to protect soil use, Britain was the first country to tackle the problems related to urban sprawl; in fact, the English land law is regulated by the "Town and Country Act "of 1947 which favored the creation of 14 green belts around the main cities, including London.

Among the various actions included in the plan, the increase of green areas to absorb the flood water is one of the most relevant too, but the plan doesn't provide other indications (from the point of view of soil consumption) to mitigate the other effects of climate change occurred in London territory.

	Landslide	Flood	Erosion	Heat waves
Ancona	x	x	x	X
Belgrade		x		X
Berlin		x		X
Bologna	x	x		X
Helsinki		x		
London		x		X
Padua		x		X
Paris		x		X

Tab.1 Risks detected in the cities where actions related to soil consumption are envisaged

	Sealed soil (ha)	Green area (ha)	Sealed soil (%)	Green area (%)
Ancona	2673,3	334,3	21,56	2,70
Belgrade	43582,4	9032,9	13,34	2,77
Berlin	51738,3	12049,6	59,58	13,88
Bologna	7962,9	727,1	56,46	5,16
Helsinki	54275,6	21192,3	17,25	6,74
London	130138,1	24663,5	7,50	1,42
Padua	7271,5	55,9	77,27	0,59
Paris	8244,9	2002,6	78,58	19,09

Tab.2 Sealed soil and green areas measured in 2012 in the examined cities, based on the Corine Land Cover Map

4 CONCLUSIONS

With regard to the risks to which each city is exposed because of climate change, the related adaptation plans include actions to reduce the damage associated with that risk.

In defining these actions aimed at reducing the vulnerability of urban areas to the present and future effects of "global warming", all those non-climatic factors should be also included, whose effects, combined with those of climate change, enhance the final impacts and/or condition the adaptive ability of the population and territory (see sections 1 and 2). Soil transformation processes are among the non-climatic factors that most influence local vulnerability (Cardona et al., 2012). For example, referring to the two effects of climate change Urban Heat Island and Pluvial Flooding, soil sealing increases these two phenomena due to the lower heat absorption and the lower water flow in the subsoil.

This work has been aimed at investigating actions to contain soil consumption included in the adaptation plans of the European cities under investigation, given that soil can play a crucial role to facilitate the adaptation of the urban system to climate change.

From the reading carried out, it is overall recognised that the soil resource plays an important role in the adaptation of urban systems to climate change, albeit indirectly. The limitation of soil consumption is explicitly excluded from the actions to be carried out, but there are widespread interventions such as the implementation of green areas and the mitigation and environmental compensation of impermeable surfaces, to encourage greater carbon storage in the subsoil and thus preserve the ecosystem functions of this natural resource. Only in the Italian plan of Padua, -which, among the three Italian cities currently examined, is the one that up to 2012 consumed a higher percentage of soil and is currently characterized by the lowest amount of greenery compared to all the case studies (tab.2)-, it is possible to find actions aimed at limiting soil use in a direct way, preventing new sealing interventions for the purpose of settlement expansion and aiming, instead, at the reuse of brownfields and reclaimed production areas; on the integrated regeneration of the existing building heritage, "where it does not interfere with the settlement safety, increasing, firstly, its drainage capacity"; on the integration of all urban-scale planning instruments able to guarantee emissions cut (in line with the Covenant of Mayors). As regards the most widespread risks that the eight cities under investigation are called to face, namely heat waves and floods (tab.1), the key actions to be promoted mainly concern the construction of green infrastructures. For example, the Helsinki plan proposes actions to protect green areas and agriculture, in order to preserve biodiversity and soil fertility; in the London adaptation plan green belts represent a fundamental support for cooling and the flowing of surface water, as well as for CO_2 capture. Greening 50% of the entire municipal area is a priority objective for the administration of London to be achieved by 2050 - foreseeing an increase of about 500 hectares in parks and green corridors (City of London, 2017)-, together with the one of a zero soil consumption that seems really feasible, given that in 2012 London showed a significantly reduced sealed area compared to that of the other countries examined (tab.2).

Each plan has also used a different approach for the definition of the system of actions to be implemented, in relation both to the risks and to the physical and environmental characteristics of each urban area. In particular, it is possible to state that except the city plans of Ancona, Padua and Belgrade, all the other plans have been developed on the basis of specific knowledge of the urban system and on the study of the natural disasters linked to climate change occurred in recent years. It is, basically, a qualitative approach which, as such, has led to the definition of adaptation actions "in broad terms" since they seem to be guidelines and strategies rather than concrete and effective actions to be carried out.

For example, the actions developed by the Ancona adaptation plan are defined starting from quantitative analyses related to three variables (temperature, precipitation and sea level), aimed at identifying the key sectors on which risk analysis and urban vulnerability should be focused. In practice, this plan used a quantitative approach to carry out, with a degree of uncertainty, the risk forecasts and define multiple and detailed adaptation actions for each risk. The Padua plan is based on a quantitative analysis too. Thanks to the support of digital tools such as GIS, this plan has conducted an analysis on the new vulnerabilities of the city system, obtaining data that allowed an accurate definition of adaptation actions to be implemented. Lastly, Belgrade performed a quantitative analysis of the vulnerabilities and impacts of climate change affecting the urban system, obtaining an assessment of risks and opportunities. Even in the case of Belgrade, the adaptation actions envisaged in the plan are more specific than those contained in the plans which use a cognitive approach.

Ultimately, it is possible to state that although the reduction of soil use is now a strategic issue in the international scientific debate on the sustainable management of urban systems, its key role in the adaptation actions to climate change is not yet consolidated, as called for more and more frequently by Europe in the steering documents for the Member States. In fact, soil consumption is not one of the factors that requires

direct action to reduce the vulnerability of urban systems to climate change in progress, but rather it is a phenomenon that can be contained by increasing green areas and/or infrastructures and encouraging agricultural and environmental regeneration.

Moreover, the adaptation actions concerning soil almost exclusively refer to the latter in terms of protection and preservation, considering this resource from a mostly ecological and naturalistic perspective.

The attention, in other words, seems to turn to not yet sealed soil, thus leaving out the already anthropized one that, as such, would require, instead, greater adaptation efforts: «if for a correct approach to the limitation of soil consumption it's absolutely essential to safeguard what is outside the urbanized space, it is likewise indispensable to redevelop what is inside the city" (Arcidiacono, et al., 2012). The actions aimed at preserving the natural and biodiversity features of soil not yet built on should be complementary to those aimed at ensuring a more sustainable use of the already transformed soil, that is, of the volumes and the adapted spaces that constitute that heritage of urban resources from which the improvement of urban resilience strictly depends. Measures mitigating and compensating land consumption can also be a lever to implement urban sustainability policies, in full agreement with the European Environmental Sustainability Strategy, and not to undermine the capacity of other natural systems as well as of some social and economic sectors to pursue adaptation (Fregolent, 2014; Filpa & Ombuen, 2014). The innumerable interrelations between «the top layer of the Earth's crust» (surface) (ISPRA, 2015) and all that has been realized and/or modified by man (abovesurface) with the possible negative effects that may derive from the climate and ecosystem point of view require a broader and more integrated approach to issues such as soil consumption, based on the systemic value of this natural resource. In this perspective, the government of urban transformations requires the definition of strategies and instruments capable of adapting to unforeseen phenomena that may occur in the urban system.

This paper can be a starting point for local administrations that have not yet drawn up a plan to adapt to climate change, in order to develop actions that take into account the multiple benefits that soil protection (and especially a more sustainable use of it) can determine in terms of improving urban resilience. Further elements useful to define strategies and measures to mitigate and compensate soil sealing with the consequent negative impacts on climate change, and to measure the effectiveness of existing adaptation plans, can be identified in a future research work based on most up-to-date European land cover data. Indeed, this paper has a limitation due to the fact that the open data used are updated to 2012 (Copernicus project), and consequently, it does not provide recent information on the processes of anthropogenic transformation of the soil and can't help understand if and to what extent the actions contained in adaptation plans examined (drafted mostly in 2012) have produced in terms of increasing the resilience and environmental sustainability of urban systems.

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IMAGE SOURCES

Fig. cover: picture of the authors. Central Park. New York; Fig. 1: adaptation plan of Padua; Fig. 2: Climate change: adaptation action plan and vulnerability assessment; Tab.1 and Tab.2: created by the authors

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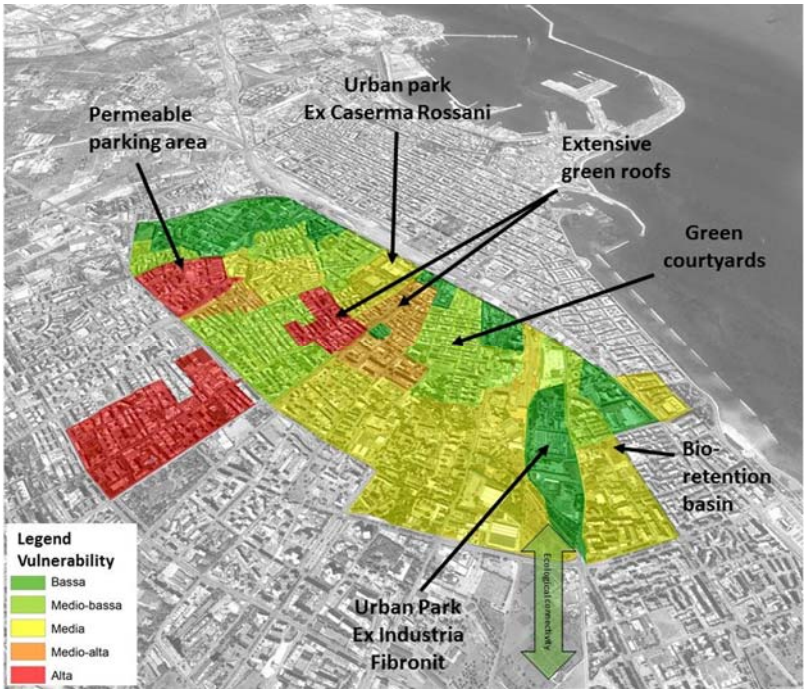

SECOND LAW OF THERMODYNAMICS AND URBAN GREEN INFRASTRUCTURE

A KNOWLEDGE SYNTHESIS TO ADDRESS SPATIAL PLANNING STRATEGIES

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ABSTRACT

Planning strategies driven by the second law of thermodynamics (SLT) are innovative approaches to sustainability but they are still in seminal phase. In this article, a coupled review of SLT within spatial planning is accomplished looking at the main applications in urban green infrastructure (UGI) planning. In particular, a systemic review of UGI planning and thermodynamics has been carried out to identify all the occurrences to date in the scientific literature. Secondly, a scoping review of SLT-related concepts of exergy, entropy and urban metabolism is presented in order to investigate the main applications of, and gaps in, urban spatial planning. Results indicate that UGI and ecosystem service planning based on SLT is a relatively new field of research. Moreover, some general indications are derived for the development of spatial UGI planning strategies based on SLT. The work then aims to contribute to the improvement and/or development of even more solid planning strategies supporting a SLT-conscious green transition of cities.

KEYWORDS:
Entropy; exergy; urban metabolism; urban planning; low-entropy city; ecosystem services

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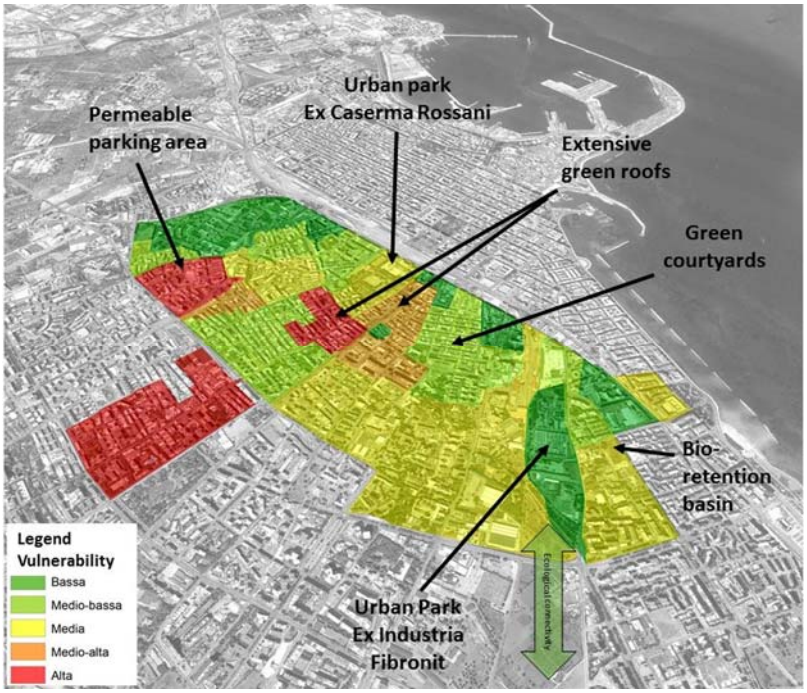

热力学第二定律和城市绿色基础设施

解决空间规划策略的知识综述

RAFFAELE PELOROSSO[a], FEDERICA GOBATTONI[b] , MARIA NICOLINA RIPA[c], ANTONIO LEONE[d]

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摘要

受热力学第二定律（SLT）启发的计划策略，是实现可持续发展的一种创新方法，尽管目前仍处于开创阶段。在本文中，对空间规划中的 SLT 进行了一次综合评估，并着眼于在城市绿色基础设施（UGI）规划中的主要应用。特别是对 UGI 规划和热力学进行了系统评估，旨在确定科学文献中的所有情况。其次，为了调查城市空间规划的主要应用和差距，对烟、熵和城市代谢的 SLT 相关概念范围进行了梳理。结果表明，基于 SLT 的 UGI 和生态系统服务规划是一个相对较新的研究领域。此外，基于 SLT 的空间 UGI 规划策略发展取得了一些进展。该工作旨在帮助改善和/或制定更加稳固的规划战略，为城市的 SLT 意识到的绿色过渡提供支持。

关键词：
熵、烟、城市代谢、城市规划、低熵城市、生态系统服务

1 INTRODUCTION

City sustainability is a multifaceted task that entails non-linear processes and system complexity on different spatial scales and with a long-term view. Moreover looking at sustainable development, the evaluations should involve transdisciplinary research dealing with the interactions between natural and social systems in order to meet the needs of present and future generations while substantially reducing poverty and conserving the planet's life support systems in changing climatic conditions (Kates et al., 2012). Several urban planning and governance strategies have been developed to reach sustainability objectives giving social, economic and environmental aspects different weight. Moreover, designers and architects have embraced different sustainability criteria in their urban projects. The current approaches to sustainable urban development are therefore multiple and complex while the relevant issues are intertwined (Hassan & Lee, 2015). Thus, we should select the proper direction for future city development, but also define strong grounds on which to base our moves to avoid expensive and/or late re-thinking. The thermodynamics of open systems, with the Second Law of Thermodynamics (SLT) in particular, is one of the most solid disciplines for the study of complex systems and several applications of it have emerged in social, ecological and economic disciplines (see Pelorosso, Gobattoni, and Leone 2017).

Following the SLT, cities are metabolic far-from equilibrium systems, which utilize energy and matter flows to maintain levels of complexity, organization, and functionality releasing entropy (disorder or waste) into the environment (Fath, 2017). In pursuit of diverse objectives, humans modify land use and the socio-ecological and technical infrastructures which regulate urban energy and matter metabolisms. In a sustainable and systemic SLT view of the urban metabolism processes, exergy (or work capacity) should be maximised and entropy discharges reduced (Pelorosso, Gobattoni, & Leone, 2017). The concepts of entropy, exergy and urban metabolism (UM) are therefore strictly linked to the SLT and several applications of them are present in scientific literature as well as in sustainable urban planning and design (Bristow & Kennedy, 2015; Leone, Gobattoni, & Pelorosso, 2016).

Urban sustainability can be augmented integrating Nature and ecosystems with the urban metabolism and the socio-economic activities. The fundamental functions of natural systems that support citizen life are mainly provided by the Urban Green Infrastructure (UGI). Indeed, UGI is defined as an interconnected network of natural systems and Nature-Based Solutions (NBSs), localised at landscape scale and fully integrated with the built environment, which provides a diversified array of Urban Ecosystem Services (UESs) to the urban socio-ecological system, thus increasing its resilience. NBSs are engineered green/ecological systems inspired or supported by, or copied from, Nature (EU, 2015). UESs are benefits that people derive directly or indirectly from natural and managed ecosystems (Pelorosso, Gobattoni, & Leone, 2017). Thus, UGI planning aims to enhance the sustainability and resilience of urban systems. Recently, Pelorosso, Gobattoni, and Leone (2017) have presented a seminal low-entropy UGI strategy which incorporates social and ecological aspects and new operational entropy indicators into an adaptive SLT planning framework (see fig. 1). The low-entropy city concept at the basis of the UGI planning strategy calls for innovation and more efficient urban systems, from compacted to sprawled, with a stronger nature integration, able to use local and renewable resources, to reuse wastes and to institute closed productive cycles. These new urban socio-ecological systems, by maximizing cyclic, non-dissipative flows while minimizing dissipative flows, would release less entropy out of the system and, like a complex living organism that tends to minimum entropy production (e.g. the more healthy, mature forests at later stages of succession), they would persist and even grow in an even more sustainable manner. The low-entropy city concept represents a first contribute to the development of a new systemic urban planning paradigm in which nature of, for and in the city converges together under a thermodynamics vision of which social domain can be considered a part (Pelorosso, Gobattoni, & Leone, 2017). In the low-entropy view, NBS will be then studied, planned and designed looking at their localisation and spatial distribution, the increased internal socio-ecological complexity (e.g. creation of a network of people, new enterprises, added

biodiversity), the importation of external sources of energy (e.g. for cooling systems as well as for crime control) and exportation/creation of entropy outside the urban system by wastes (e.g. pollution, runoff), to build Nature-Based Low-Entropy cities. The general low-entropy UGI strategy needs to be translated in real study cases with its embedded SLT principles (related to the concepts of entropy, exergy and urban metabolism) adopted in urban assessment and NBS planning. It is necessary therefore to know the main applications of, and gaps in, SLT planning with particular reference to urban systems and UGI in order to make the low-entropy concept operative. Despite numerous studies on thermodynamics, very little attention has been paid to SLT planning of UGI (Pelorosso, Gobattoni, & Leone, 2017). The objective of this article is then to provide essential information for the improvement/development of sustainable UGI planning strategies based on thermodynamic concepts and the low-entropy view. We adopted a coupled and sequential revision procedure to select the most significant papers and study cases able to inform UGI planning. A first preliminary systemic review has been carried out on scientific databases to select and investigate all the literature having explicit references to UGI and SLT planning within the title, keyword and abstract fields. Secondly, a scoping review was conducted to depth the knowledge on SLT planning even to cases not directly linked to UGI and not reported in scientific database. In particular, we sought for explicit spatial analyses with real study cases, which could facilitate the task of applying the research results to guide practical decision-support within planning processes. Indeed, explicit evidence of spatial anisotropies of land uses and indicators allow scenarios and urban projects to be designed considering the complex relationships among UGI components and urban systems (Pelorosso, Gobattoni, Geri, & Leone, 2017). The paper then provides evidence about the state of art of UGI and SLT indicating the main steps for the inclusion of thermodynamic concepts into UGI planning.

2 MATERIAL AND METHODS

To point out the links between SLT and UGI planning, a preliminary systemic review based on peer-reviewed papers or book chapters on the Scopus (http://scopus.com) and ISI Web of Knowledge (WoK) databases (https://webofknowledge.com) has been performed. A combination of terms was used to capture all the possible scientific products with ongoing research within the title, keyword and abstract fields. In particular, the search engines were used to explore the use of the terms thermodynamics, green, infrastructure, urban and planning (see the queries reported in Table 1). We then verified the relevance of the selected dataset with thermodynamics and real study cases of spatial UGI planning. Additionally, a second review framework, concentrated efforts on the most relevant SLT concepts related with urban planning and the sustainability of cities and landscapes. Thus, the use of exergy, entropy and urban metabolism concepts within planning has been investigated even though UGI were not considered directly. Since the scientific literature on these three research fields is abundant and diversified, a scoping review (Arksey & O'Malley, 2005) was carried out to build a knowledge synthesis regarding the following research question: what are the main applications of, and gaps in, SLT related concepts (exergy, entropy and urban metabolism) within spatial planning with particular reference to urban systems and UGI? The scoping review was carried out by Google Scholar search engine in order to widen the sample even to literature not included in scientific databases. Google Scholar was then used to search for published papers and books following the individual terms exergy, entropy and urban metabolism in an iterative process engaging with each stage in a reflexive way, repeating search steps in order to ensure a comprehensive coverage of the literature (Arksey & O'Malley, 2005). References reported in the papers identified were also checked following the same search engine. We focused in particular on the most recent literature in order to report significant update information.

The majority of the publications found were thus filtered out, taking into account only the most recent scientific products reporting spatially explicit quantifications, prioritizing works with practical applicability for urban planning.

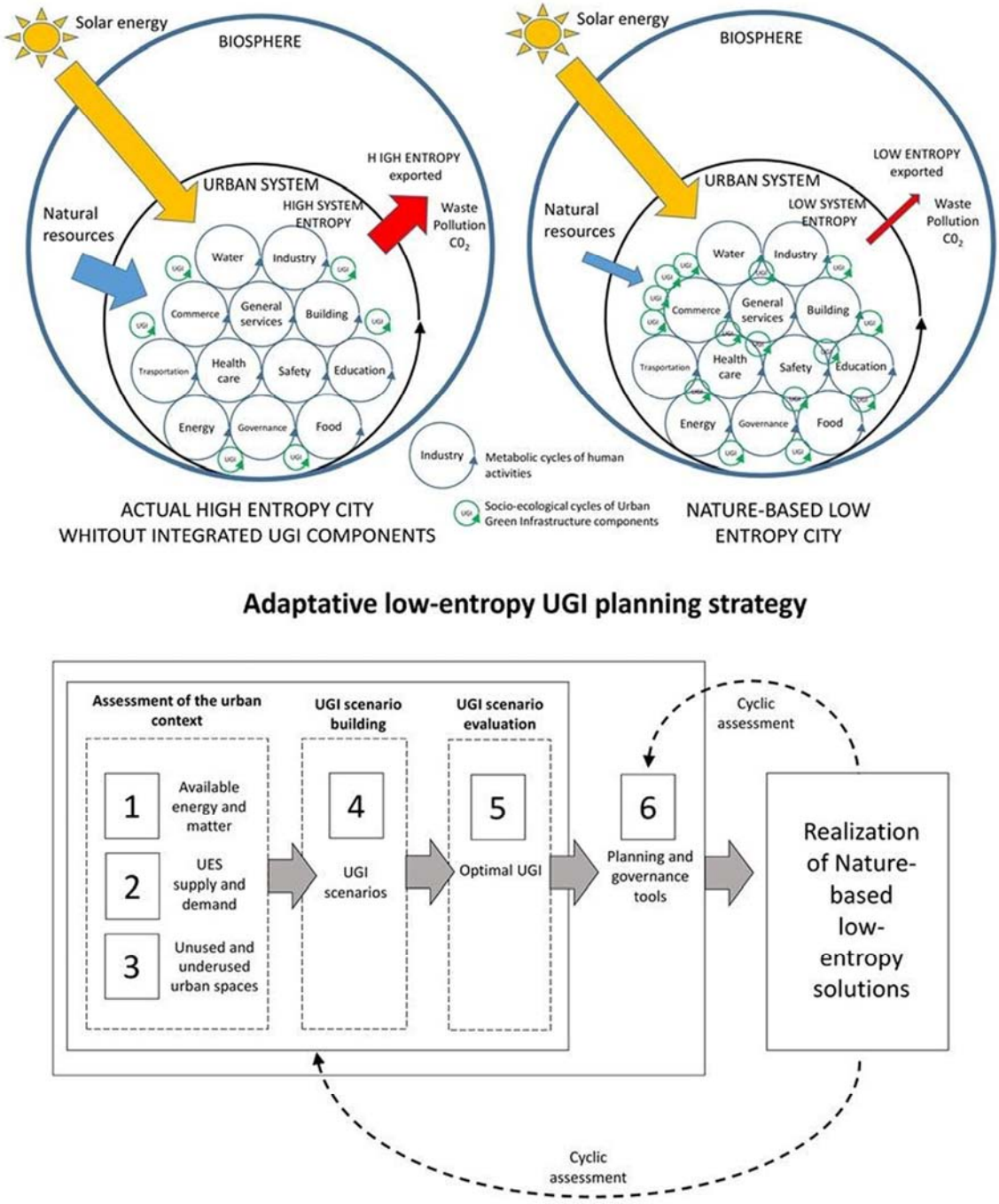

Fig. 1 Actual city without integrated UGI components compared with a theoretical nature-based low-entropy city with multifunctional UGI (top). The Conceptual framework of the adaptive low- entropy UGI planning strategy (bottom)

3 RESULTS AND DISCUSSION

3.1 THE SYSTEMIC REVIEW

The systemic review on UGI planning and SLT has brought to light few occurrences within scientific products for significant terms. In particular, no result was found considering UGI planning in urban contexts related to Thermodynamics (see queries 6 and 7, Table 1). Considering combinations of terms, the search provided a

total number of 77 papers. Then, excluding overlaps between the two datasets, we kept 66 papers (see appendix A). Amongst the 66 works selected, only one paper presented an interesting application for spatial urban planning, though it does not explicitly consider SLT (He, Shen, Miao, Dou, & Zhang, 2015). The work deals with the urban climate of Beijing and proposes to use the synergy between the urban-induced heat island circulation and green-wedge planning to deliver cool/fresh air from the suburbs to downtown Beijing (He et al., 2015). In particular, the paper proposes a novel numerical-simulation-based method for detecting fresh-air ventilation paths quantitatively by taking into account both dynamic and thermodynamic aspects. The work analyses mountain-valley breezes using hourly weather station observations and puts them in relation with the built environment and the green infrastructure. Finally, a series of key planning recommendations (i.e. mitigation measures and climatic spatial planning guidelines) are presented for improving the urban climatic conditions of five planning zones proposed with reference to the Beijing city master plan. The final product of the analyses is then an urban climatic map which includes essential spatial information for planning land uses and UGI from the urban climatic perspective (Fig. 2). The final urban climatic map represents an eloquent visual tool, able to translate complex modelling studies in information useful for planners and practitioners. However, it should be noted that explicit references to ecosystem services (even climate regulation services) provided by UGI are not present in the paper, demonstrating that a full integration among urban ecology concepts and physical urban planning is still lacking. Moreover, entropy, exergy, urban metabolism and SLT are concepts not included in the study.

Although explicit references between UGI planning and SLT are not present in large part of literature, many urban ecology and design studies are founded on physically-based methods and models that rely on physical laws such as Thermodynamics (e.g. climate or energy modelling studies) (e.g. Ambrosini et al. 2014 and Fig. 3). These works deal with the simulation of green scenarios aimed at mitigating the urban heat island effect or heat waves and, in general, to enhance the thermal comfort of urban environments, reducing the energy demands of buildings and, consequently, carbon emissions. The simulations are conducted at different scales but usually they pursue design objectives while large spatial planning applications are rare and conducted at a coarse resolution. Indeed, these modelling approaches still have the drawback of high computational cost and complexity, so their use is often limited to research purposes or/and transdisciplinary collaborations among experts and planners. However, from a technical point of view, the evolution of the modelling approach is ineluctable considering also the increasing pc calculation power and availability of free (and open) software as well as digital information (i.e. big data, spatial data). The main issue appears to be the difficulty of adopting these modelling approaches within urban planning practice, considering the complexity of the model simulations (i.e. cost-effectiveness) with respect to the planning process needs (Gobattoni, Pelorosso, Galli, Ripa, & Leone, 2017).

Searched terms	Occurrences	
	Scopus	ISI
Q1:"green" AND "thermodynamic/s" AND "urban"	39	9
Q2: "green" AND "thermodynamic/s" AND "planning"	25	8
Q3: "green" AND "infrastructure/s" AND "thermodynamic/s"	7	3
Q4: "green" AND "thermodynamic/s" AND "urban" AND "planning"	9	0
Q5: "green" AND "infrastructure/s" AND "thermodynamic/s" AND "urban	3	0
Q6: "green" AND "infrastructure/s" AND "thermodynamic/s" AND "planning"	0	0
Q7: "green" AND "infrastructure/s" AND "thermodynamic/s" AND "urban" AND "planning"	0	0
Total occurrences	59	18

Tab.1 Results from queries on SCOPUS and ISI Web of Knowledge (ISI WoK) (period: up to 25/01/2017)

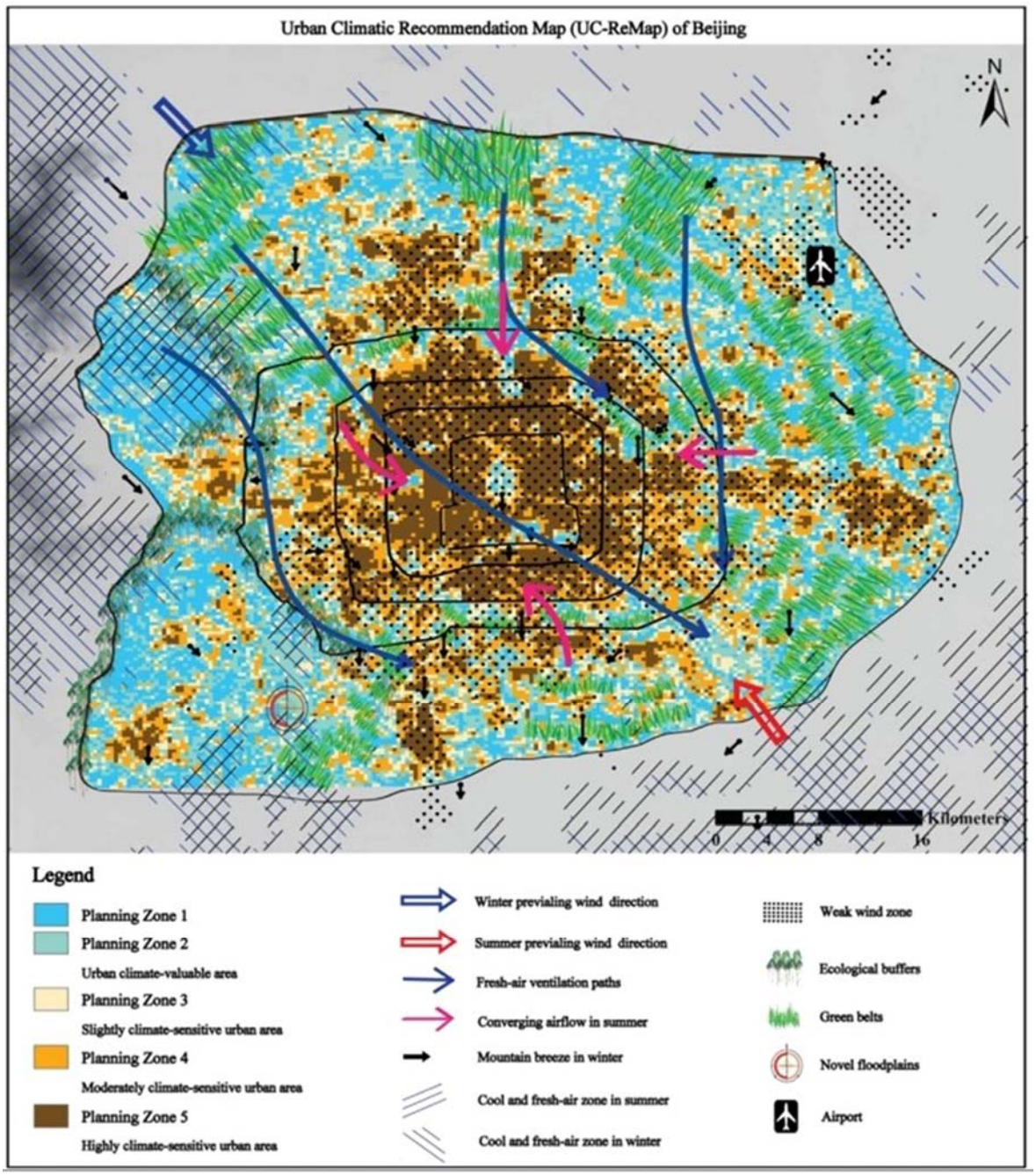

Fig. 2. Urban climatic map of Beijing

3.1 THE SCOPING REVIEW

Since few occurrences within scientific products emerged from the preliminary systemic review on UGI and SLT, a second review has been conducted in order to deep the knowledge relatively to SLT applications within spatial planning. This second review was then focused on three fundamental SLT concepts, namely exergy, entropy and urban metabolism highlighting, when possible, the planning implication for the urban systems and UGI. Table 2 reports a summary of the selected papers on SLT concepts and their field of application within spatial planning. The selected planning examples of Table 2 thus represent the state-of-art for further research developments and their applications in real case study are instances of SLT spatial planning.

	Definition	References	Field of application
Exergy	The maximum amount of work a system can perform when it is brought to the thermodynamic equilibrium with its environment. It represents the useful energy or work capacity embodied in the system (Stremke & Koh, 2011).	(Stremke & Koh, 2011; Stremke & Van den Dobbelsteen, 2013)	Renewable resources and sustainable energy landscapes. Several study cases of exergetic optimization in The Netherlands.
		(Leone, Gobattoni, & Pelorosso, 2016)	Exergetic optimization of a Mediterranean rural area. Foggia, Apulia Region, Italy.
		(Leduc & Van Kann, 2013)	Sustainable urban energy planning. Kerkrade-West neighbourhood, The Netherlands.
		(Balocco, Papeschi, Grazzini, & Basosi, 2004)	Sustainability of built up areas. Castel-nuovo Berardenga, Siena Province, Italy.
Entropy	A measure of the state of disorder of a system (Stremke & Koh, 2011). It is related to the dissipated energy (waste) during natural irreversible processes that trasform energy, move mass and drive the global biogeo-chemical cycles (Kleidon, 2009).	(Balocco & Grazzini, 2000)	Sustainability of urban areas in terms of energy. Florence, Italy.
		(Fistola & La Rocca, 2014)	Urban entropy assessment. Benevento, Italy.
Urban metabolism	The sum total of the technical and socio-economic processes that occur in cities, resulting in growth, production of energy, and elimination of waste (Kennedy, Cuddihy, & Engel-yan, 2007)	(Chrysoulakis et al., 2013)	Sustainability of urban planning interventions. Helsinki, Athens, London, Florence and Gliwice.
		(Codoban & Kennedy, 2008)	Design of sustainable neighbourhoods. Toronto, Canada.
		(Pincetl et al., 2014)	Urban environmental sustainability. Los Angeles, California

Tab.2 Spatial planning and second law of Thermodynamics: relevant applications of SLT concepts and study cases from scoping review

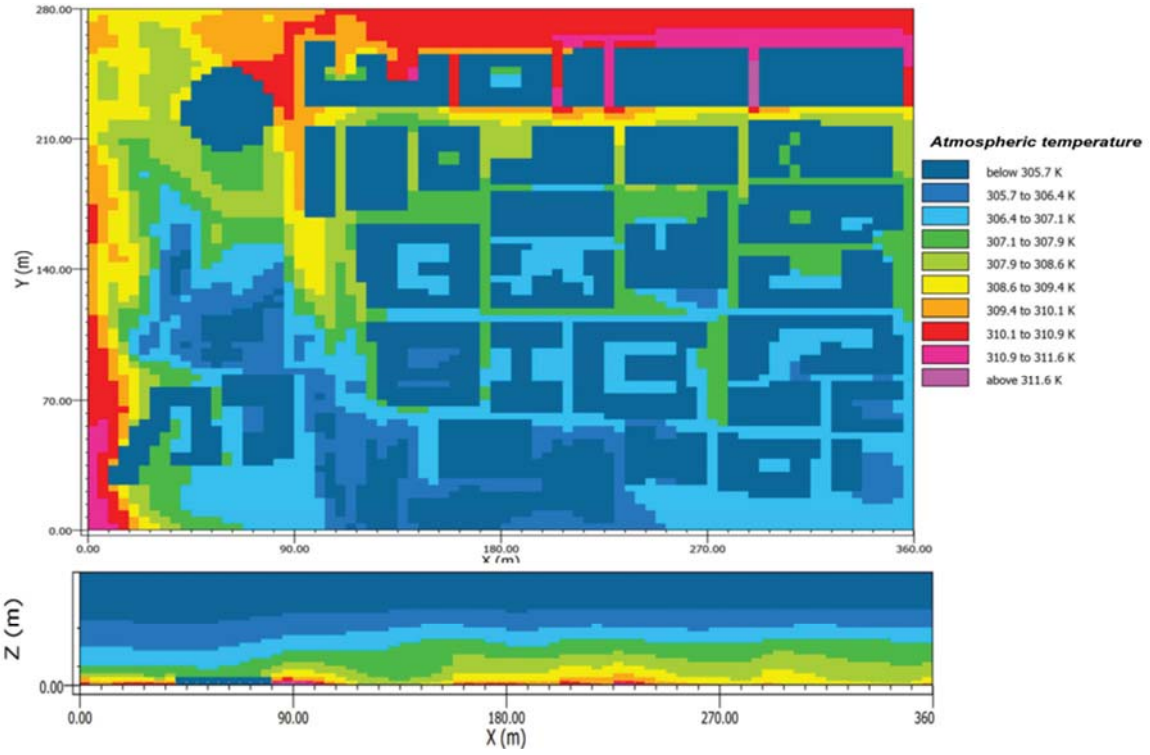

Fig. 3. Atmospheric temperature in a green scenario simulated with ENVI-met model, historical city center of Teramo, Italy

Exergy and urban spatial planning

From the consulted literature it emerged that exergy studies analyse mainly the energy aspect of cities and landscapes without specific interest in UGI spatial planning. The exergy assessment and SLT planning approach have been presented in the context of renewable resources and sustainable energy landscapes (Stremke & Koh, 2011; Stremke & Van den Dobbelsteen, 2013; Stremke, Van den Dobbelsteen, & Koh, 2011). The SLT planning approach aims to increase the exergy component of any process and, consequently, to reduce the production of pollutants (entropy) responsible for the alteration of ecosystem ecological functionality (e.g. climate change, freshwater degradation etc.). In general, the study cases on SLT planning based on exergy evaluations demonstrate how it is possible to evaluate the energy incidental to each land-use, obtaining significant productions, and increasing system resilience. Indeed, a conscious spatio-temporal organisation of the landscape based on the SLT, local renewable resources and smart energy systems increases the ratio of energy self-sufficiency and the resilience of the socio-ecological system. It allows local populations to have a greater capacity to persist and develop in the territory to which they belong through the mitigation of the negative effects derived from the fluctuations of the energy availabilities external to the system both on the productive processes and on the essential vital activities. SLT landscape planning studies have been conducted mainly in North Europe where SLT was firstly developed but the approach is attracting even more international interest. Worthy of note is the exemplificative SLT application in a Mediterranean rural area of Apulia Region (Italy) aimed at respecting landscape identity integrating traditional agricultural productions with a local industrial district and a residential area (Fig. 4) (Leone, Gobattoni, & Pelorosso, 2016).

Exergy analysis is also proposed in urban contexts. Two papers have been selected as exemplificative exergy applications because they aim to evaluate the sustainability of urban areas (Balocco et al., 2004) and guide spatial urban planning (Leduc & Van Kann, 2013).

Balocco et al. (2004) report an extended exergy analysis method in a small municipality of Central Italy, taking into account the mean life time cycle of building, to evaluate the sustainability of an urban area in terms of

gas emissions. Two thermodynamic indexes, η_I and η_{II} showing, respectively, the first and second law efficiency of buildings, have been proposed as thermodynamic indexes. The applied methodology provides a single thermodynamics environmental criterion for the selection of technological alternatives, strategies and designs that produce lower environmental impacts connected to higher exergy indexes η_{II} . The method appears innovative, but difficult to apply to spatial urban planning in practice, due to its high data requirements at local scale. Moreover, it needs to be further developed for other urban issues and specific green area assessments have not been considered.

The work of Leduc & Van Kann (2013) proposes using the Urban Harvest Approach (UHA) to reach a circular urban metabolism in terms of exergy. The UHA can be defined as a strategy to investigate possible options for harvesting local resources, such as materials, water, space, energy, and for transforming these resources so that they can be used efficiently and effectively, limiting waste or output both into and out of urban regions. The proposed UHA is based on the integration of different urban functions, multifunctionality, harvesting of local renewable and residual resources at regional scale (see Fig. 5). The method described in this paper combines exergy analysis with spatial planning to test the sustainability of urban areas, including industrial areas, and proposes new productive functions. The UHA method is tested in Kerkrade-West, a neighbourhood of the municipality of Kerkrade in the province of Limburg, in the south of The Netherlands. The municipality of Kerkrade is part of a region where coal mining took place for centuries. Kerkrade-West has almost 16,000 inhabitants in an area of around 1000 ha. The proposed final strategy aims to increase the multi-functionality and resilience of Kerkrade-West, by filling exergetic gaps and by creating additional energetic synergies: e.g., adding a brewery to make good use of remaining energy potentials, and to create new jobs. Thus, the proposed spatial strategy constitutes the base for successive urban design aimed at building a multifunctional urban fabric with short connections between functions to make optimal use of the remaining residual energy flows and to apply heat cascading. The UHA proposed by the authors shows interesting aspects for spatial planning, but further application to study cases considering different contexts (e.g. compact cities), green scenarios and characteristics (e.g. water and matter fluxes, ecosystem services) should be realised. Indeed, specific gaps and constrictions (also at governance level) need to be identified to make the proposed UHA fully operative in UGI spatial planning.

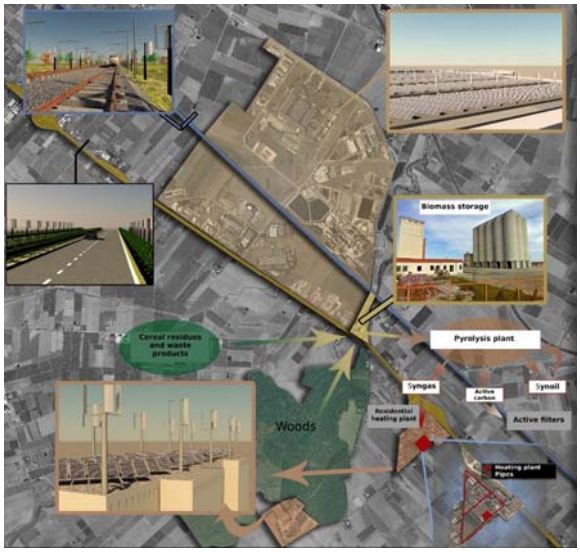

Fig.4 Scenario of exergetic landscape optimization by local renewable energies

Entropy and urban spatial planning

Despite numerous studies, only a limited number of papers present useful methods based on urban entropy aimed at supporting practical urban planning (Pelorosso, Gobattoni, & Leone, 2017). Indeed, entropy is a complex task that needs to be studied at different scales of analysis taking into consideration various urban system components such as energy, water, social aspects, waste cycles, etc. Few applications of the entropy concept have been presented in a context of spatial urban planning. The two most noteworthy ones are described below.

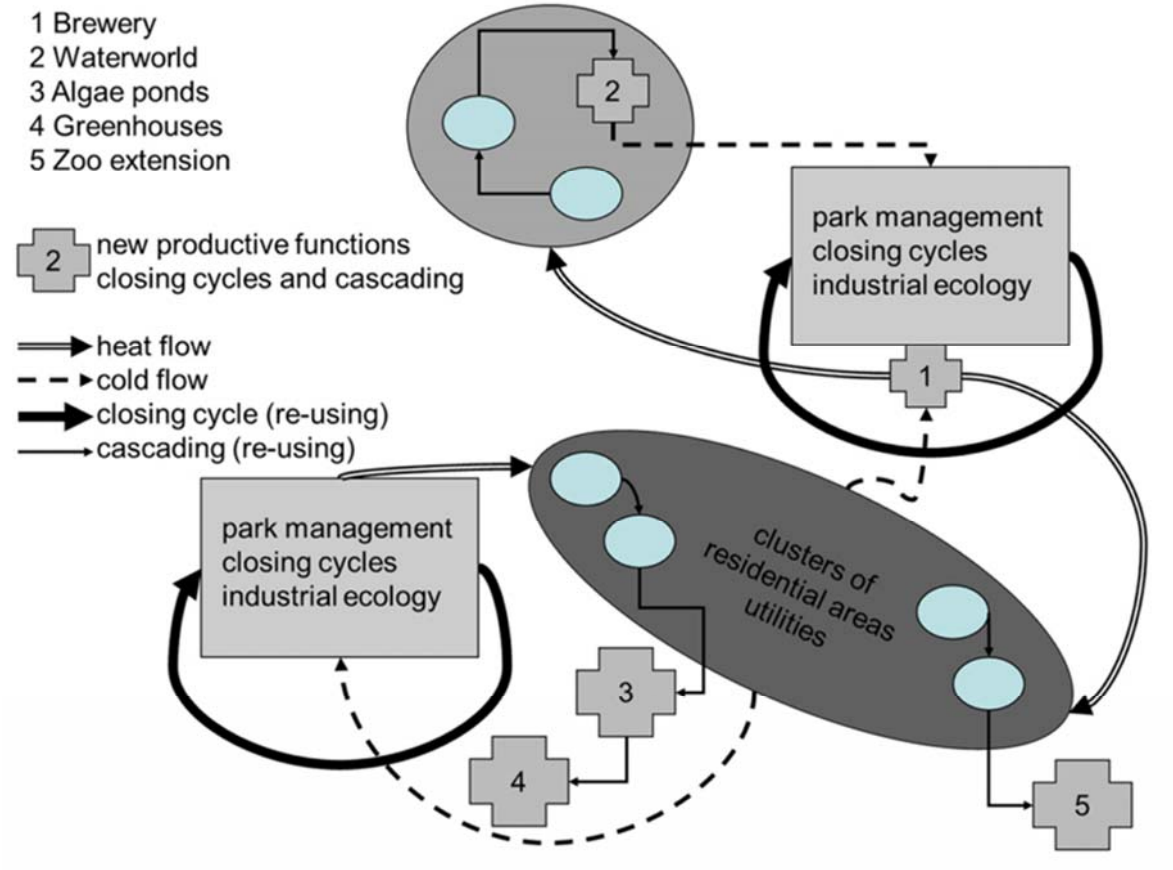

Fig. 5 Spatial energy strategy for productive urban regions

Balocco and Grazzini (2000) propose GIS and entropy indicators to study the sustainability of urban areas in terms of energy. The paper provides some indicators useful for measuring the energy sustainability of urban areas and defining planning criteria starting from an energy balance of a reference volume obtained in GIS by superimposing a grid mesh (200m x 200 m) on the built-up area under study. The work is based on the concept that real sustainability can only be obtained if total irreversible entropy is lower than the negentropy flux from the sun. A first entropy indicator is presented as the ratio between the entropy variation due to the total energy losses of buildings and the entropy variation due to the solar energy gain. The authors assert that a reduction of this indicator is necessary to reach sustainability. Moreover, another thermodynamic indicator is presented to take into account the entropy generated by building heating which considers the different sources of energy (i.e. fossil fuels or renewable sources). Even if not directly applicable to planning and evaluating the impacts and effects of green urban areas, the two thermodynamic parameters, expressed using the second law of thermodynamics, can be useful to analyse and design different sustainable urban energy scenarios. The proposed indicators are not closely connected to energy quality; nonetheless, they could be useful for analysing different energy efficiency scenarios at a defined reference scale. The definition of the

assessment scale is a relevant issue for this entropy evaluation method. Indeed, urban planning requires high spatial resolution of information and reducing the mesh size of grid, the proposed entropy assessment could be not cost-effective in supporting localised interventions planning.

Fistola and La Rocca (2014) propose a different approach to urban entropy assessment within system theory and urban planning, by applying reversed sustainability indices as proxies of urban entropy. The research thesis speculates on the possibility of defining indicators of urban entropy acting in reverse: sustainability is a positive state and it is evaluated by "positive indicators" while entropy is measured by parameters describing negative states or having negative impacts on urban systems. The assessment method has been applied to the ancient part of the city of Benevento, subdivided into 59 census tracts and 572 buildings. Thematic maps and analyses were carried out by using GIS technology considering five main urban subsystems: anthropic, functional, physical, psycho-perceptive and geomorphologic sub-systems. The five sub-systems are described by a static and a dynamic component (see tab. 3) that when properly balanced indicate that a city is in a sustainable dynamic state. For each sub-system several indicators of sustainability have been identified as proxies of entropy and a composite entropy indicator has been mapped to guide urban planning (Fig. 6). The map of the composite urban entropy indicator showing the spatial distribution of critical areas was developed to support planning choices aimed at reducing specific and local sources of urban entropy. Thus the work of Fistola and La Rocca (2014), developed for urban planning aims, appears operative in the spatial planning of cities, but needs further research to confirm the usefulness of the proposed indicators in relation to thermodynamic principles which would allow a stronger theoretical foundation to be developed.

Sub-system	Static component	Dynamic component
Physical	Adapted spaces	Physical channels of communication (streets, networks, mains, etc.)
Functional	Urban activities	Communications
Anthropic	Players	Interactions
Psycho-perceptive	Images	Interpretations
Geomorphologic	Territorial areas	Connections (physical networks of interconnection)

Tab.3 Static and dynamic characters of urban sub-systems

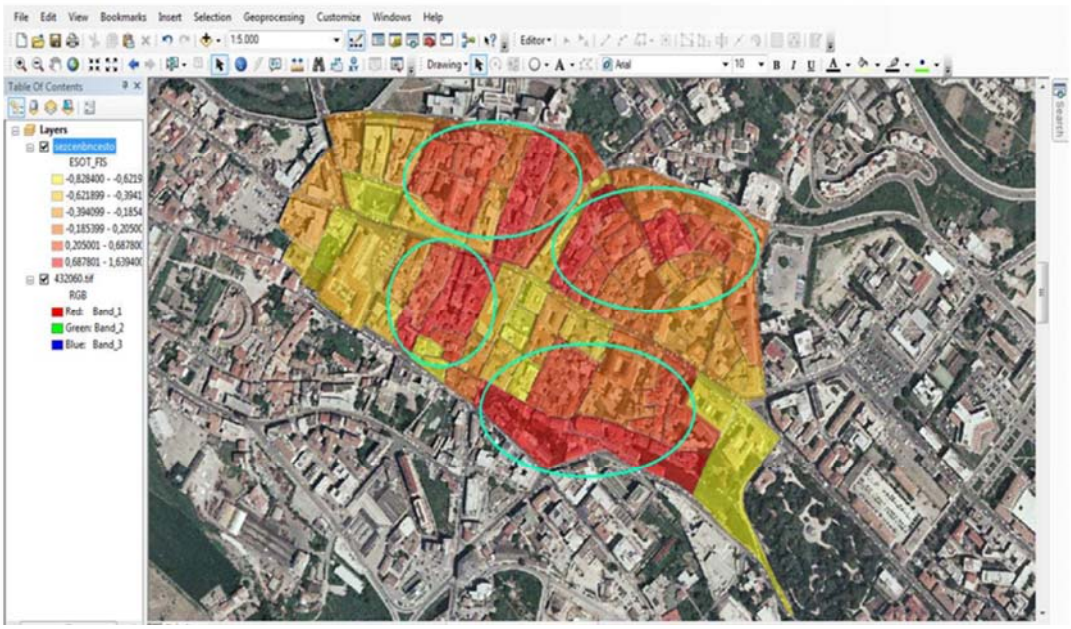

Fig. 6 Urban entropy for the physical urban sub-system

Urban metabolism and urban spatial planning

A City, like any other ecosystem, cannot be a self-sufficient system: it always requires an exchange of matter and energy to grow and evolve, and depending on its metabolism, it needs different amounts of energy, materials, water and nutrients to provide sustenance and shelter to its citizens, to produce goods and services, to grow and to eliminate waste and pollution.The regulation of the UM is therefore a priority to increase the sustainability of a city (Beloin-Saint-Pierre et al., 2017).

Two main schools of UM exist: one describes metabolism through energy equivalents (emergy), while the second studies the flows of water, materials and nutrients in terms of mass fluxes (C. Kennedy, Pincetl, & Bunje, 2011). The scoping review conducted did not reveal emergy assessment studies aimed at supporting practical spatial planning in urban contexts. In general, most UM studies use a top-down approach and coarse or highly aggregated data which cannot be correlated with specific locations, activities, or people (Chrysoulakis et al., 2013). Indeed, obtaining and managing huge amounts of data at a sufficiently downscaled level for planning purposes is often difficult (Pincetl et al., 2014). Only a few studies have presented UM as the baseline for effective designing and planning aimed at optimizing urban flows (Chrysoulakis et al., 2013; Codoban & Kennedy, 2008; Pincetl et al., 2014) and they do not specifically address UGI.

Chrysoulakis et al. (2013) report the results of the FP7 BRIDGE project aimed at defining sustainable urban planning decisions accounting for urban metabolism. The project developed a Decision Support System (DSS) based on a Multi-Criteria Analysis approach and GIS interface that aids the evaluation of the sustainability of urban planning interventions coping with the complexity of urban metabolism. Targeted end-users were involved to define planning objectives and future development scenarios were assessed in relation to the interactions between the environmental elements (fluxes of energy, water, carbon and pollutants) and socioeconomic components (investment costs, housing, employment, etc.) of urban sustainability. Five different case study cities participated in the BRIDGE project: Helsinki, Athens, London, Florence and Gliwice. For each city, several scenarios of development were defined (Fig. 7).

The evaluation of each scenario in the city study case was carried out in a participatory way in order to allow end-users to recognize the relative importance of sustainability objectives and indicators. Finally, planning alternatives in each case study were ranked in order of performance (environmental and socioeconomic components) and user preferences. Project results highlight a general positive effect of green spaces on many aspects of urban sustainability: cooling, CO_2 sequestration, water buffering and air quality. On the other hand, the develop of buildings and roads had the opposite effect. The innovation of the BRIDGE project is that these evaluations are quantified and related to urban sustainability targets and physical flows (see Fig. 8). The BRIDGE DSS thus represents a first example of a pragmatic tool for the sustainable land use decision making process at local scale based on urban metabolism. Another application of urban metabolism assessment for urban planning/design purposes is reported by Codoban & Kennedy (2008).

The study provides an analysis of the metabolism of four representative Toronto neighbourhoods, focusing specifically on the flows of energy, water, and food. Three particular metabolic processes within neighbourhoods are studied: operation of buildings, preparation and consumption of meals and beverages and transportation. The inflows to neighbourhoods include water, food, electrical, and fossil fuel energy; the outflows are solid waste and wastewater (see fig. 9). The authors report some general suggestions for the design of sustainable neighbourhoods.

These include the construction of energy-efficient buildings, development of public transit, replacement of inefficient water fixtures, the conversion of solar energy to building operational energy, the closure of waste-cycle growing urban forests and recycling grey water. The work shows a high detail of analysis, but it was not translated to specific and spatially defined actions within neighbourhoods. Thus, despite the considerable assessment efforts, the use of the information produced for practice urban planning appears is still limited to general considerations. The causes of the reduced employment of UM studies in practice urban planning have

recently been investigated by Voskamp et al. (2018). The authors present an application of SIRUP tool – "Space-time Information analysis for Resource-conscious Urban Planning" in a case study of Amsterdam, focused on the investigation of energy and water flows. The purpose of SIRUP is the identification on the optimal spatiotemporal resolution of information on resource flows that stakeholders need for assessing urban interventions. In other words, the paper examined at which spatial and temporal resolution urban metabolism should be analysed to generate results that are useful for the implementation of urban planning and design interventions aiming at the optimization of resource flows.

Moreover, an investigation was performed to find out whether a lack of data currently hampers analysing resource flows at this desired level of detail. The urban planning and design measures considered were chosen among a number of interventions aimed at urban climate adaptation, climate mitigation and/or resource efficiency. The measures selected range from the conversion of cellulose in waste into power, to the realisation of PV on roofs, from parking garage as battery, to a regional smart grid. Specific water-related measures consider dike reinforcement, the concentration of sewerage flows, cooling capacity, water infrastructure improvement and the realisation of water squares.

The selected green/NBS measures are the creation of a park on a brownfield site, phytoremediation, rainwater buffering and infiltration and small scale parks. Results show that most urban planning and design interventions envisioned in Amsterdam require information on a higher spatiotemporal resolution than the resolution of current urban metabolism analyses, i.e., more detailed than the city level and at time steps smaller than a year. Energy-related measures generally require information on a higher resolution than water-related measures. Moreover, for the majority of measures, information is needed on a higher resolution than currently available. For energy, the temporal resolution of existing data proved inadequate, for water, data with both a higher spatial and temporal resolution is required.

Finally, the authors claim that for urban planning and design, the development of new types of UM analysis is necessary, rather than performing a conventional one on a finer spatiotemporal scale. The new UM analysis should thus be based on modelling and monitoring techniques that can provide a systemic understanding of urban resource flows and that are tailored to urban planning and design objectives. In particular, the use of modelling approaches, even if they are not fully accurate and simplify reality, may produce accurate enough data to inform the assessment and planning of interventions. We report the work of Pincetl et al. (2014) as the state of art in UM studies for spatial land use planning in line with the approach and issues pointed out by Voskamp et al. (2018).

The article presents an UM study using mixed methods and multiple sources of data for Los Angeles, California. In particular, electric energy use in buildings and greenhouse gas emissions from electricity are examined calculating infrastructure life cycle effects, water use and solid waste streams. The assessment is being conducted to help policy-makers better target energy conservation and efficiency programs, detect the best locations for distributed solar generation, and support environmental sustainability policies. Fig. 10 shows an example of UM spatial assessment for water use conducted at parcel level.

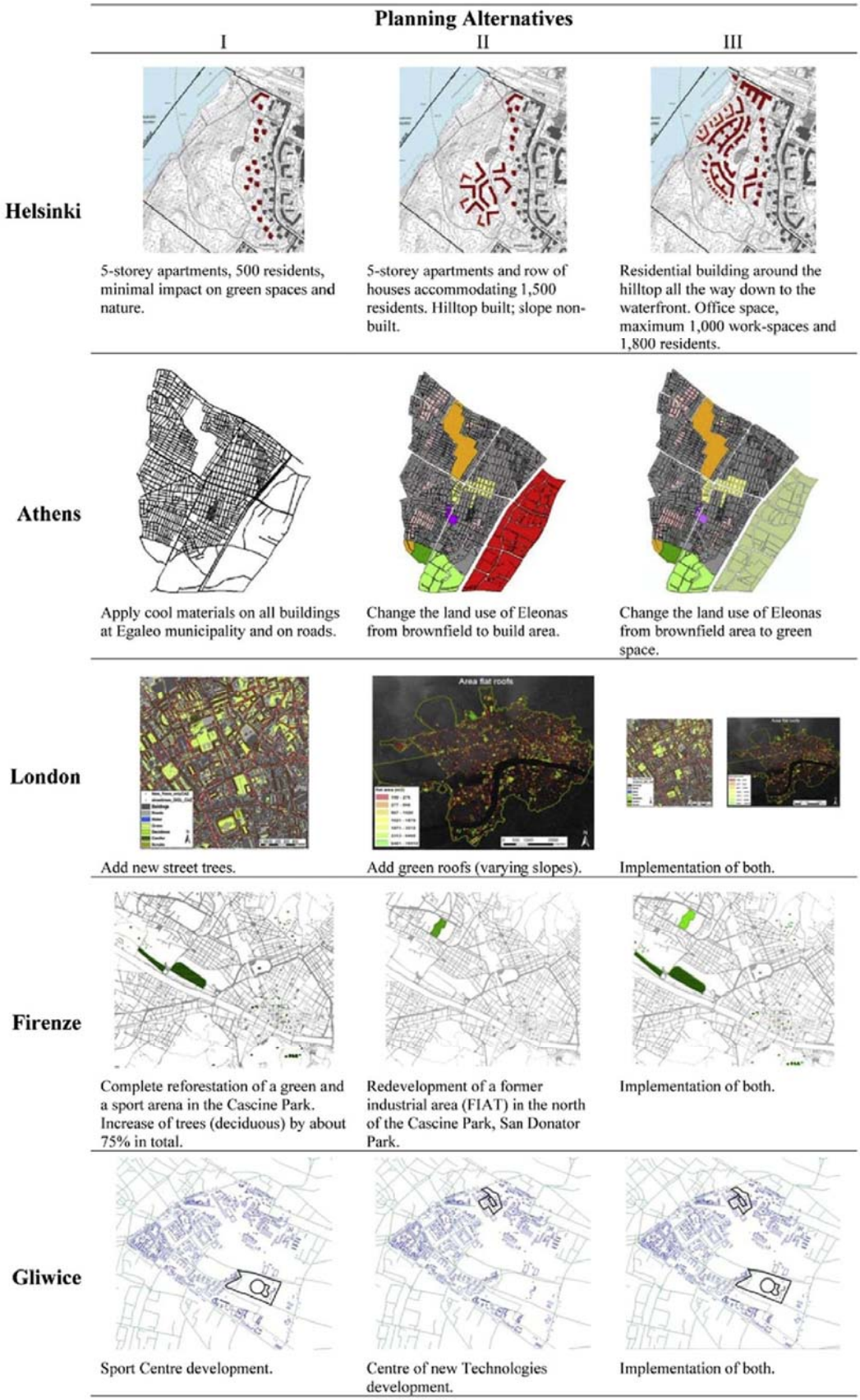

Fig. 7. The urban planning scenarios evaluated within the BRIDGE project for the five city study cases

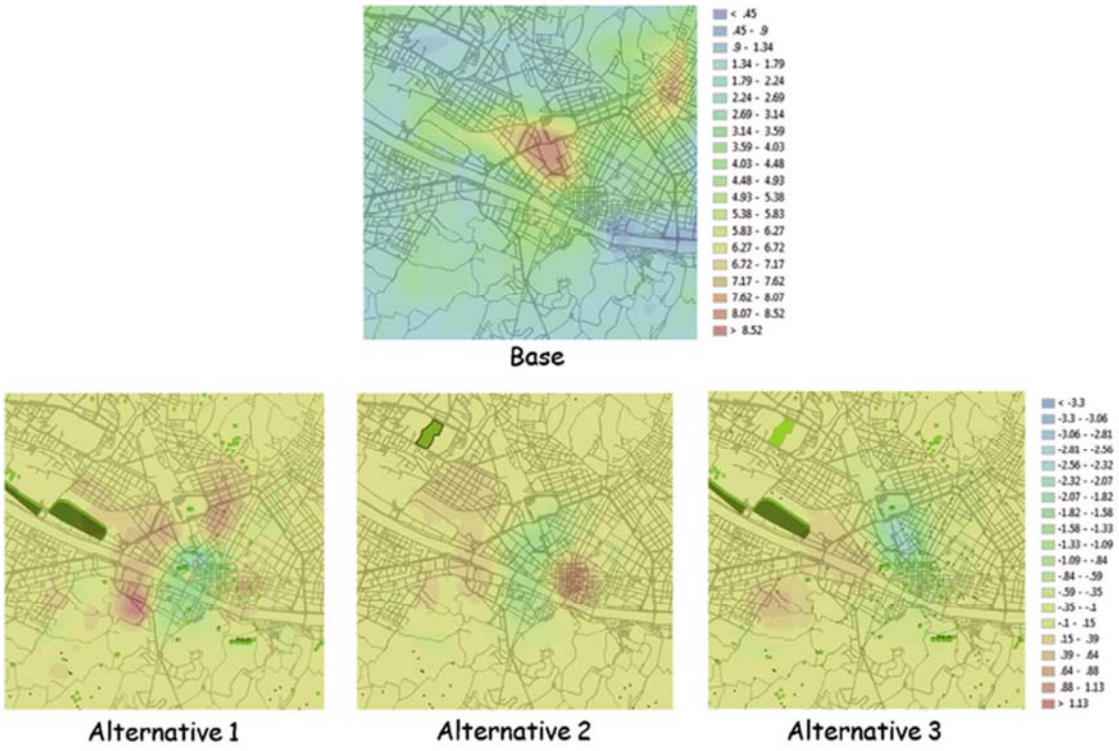

Fig. 8. Example of urban metabolism analysis conducted in the BRIDGE project. Mean surface runoff (mm h^{-1}) for summertime for the Firenze study case. The alternative scenarios (bottom) are evaluated as runoff difference with respect to the base case (top)

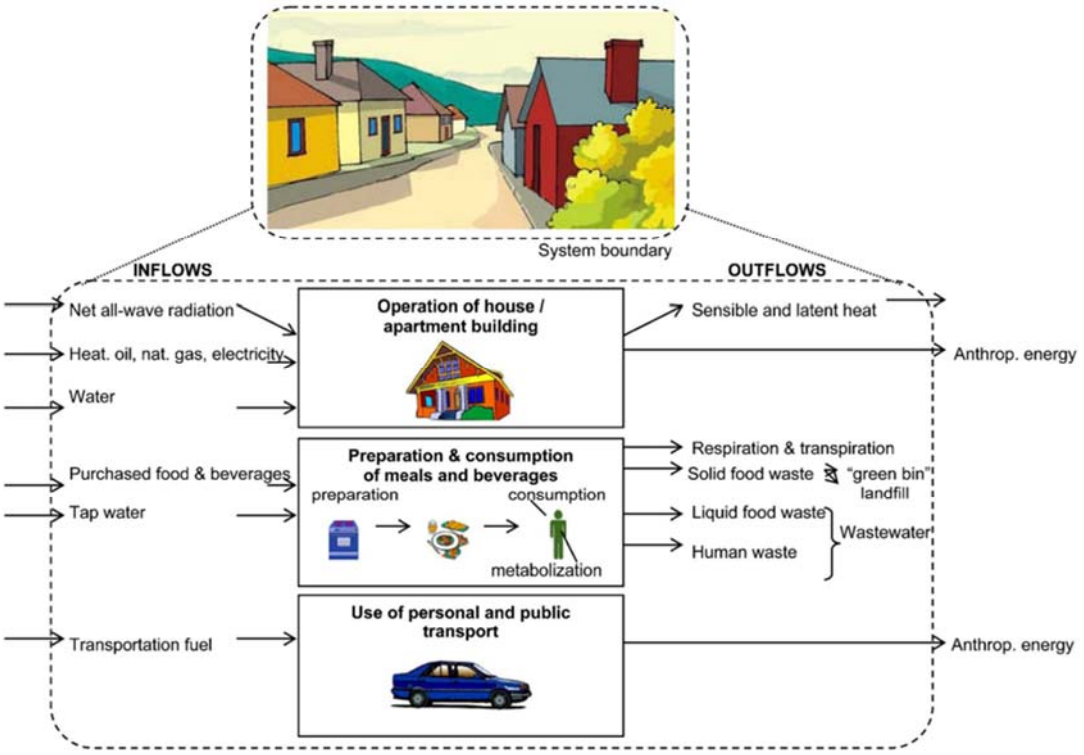

Fig. 9 Key metabolic processes analysed within the four Toronto neighbourhoods

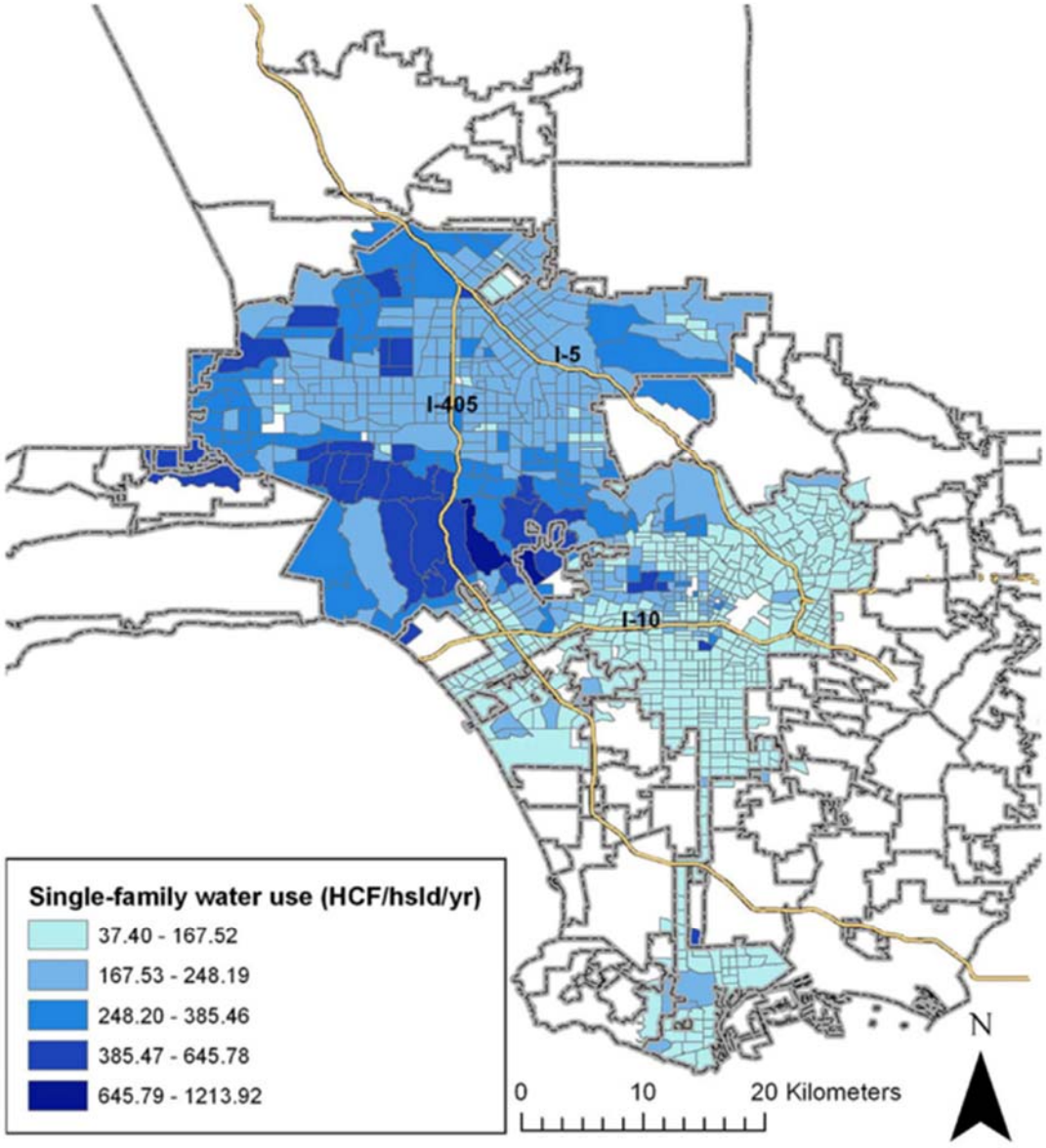

Fig. 10 Ten-year average single-family water use by census tract for Los Angeles

4 DISCLOSING SLT KNOWLEDGE FOR UGI PLANNING

From the literature review conducted, it emerges that beside technical issues, the integration of SLT into UGI planning requires a different systemic approach able to deal with different analysis scales and socio-ecological processes. As Voskamp et al. (2018) well highlighted, each UM assessment to be useful in spatial urban planning should aim to describe the urban system by linking the physical, quantitative knowledge of resource flows to its interaction with (current and historic) environmental, social and economic conditions. We think that this concept for UM can be translated for the general SLT approach. Indeed, human regulating and governing mechanisms play a critical role in urban ecosystems where policy, planning, and management decisions influence both anthropogenic and ecological processes within and beyond the city (Bai, 2016). A systemic understanding of urban resource flows must therefore be reached in order to provide insight both into the social and ecological processes affecting resource flows and into the interlinkages between processes and resource flows (Voskamp et al., 2018). Chrysoulakis et al. (2013) have shown that the choice among interventions on urban systems is not easy, even with the most accurate spatial assessments. Indeed, the

dimensions of the urban sustainability are multiple, and each project has complex outcomes and trade-offs: such trade-offs are contingent to end-users' preferences and they are not fixed over time. SLT planning, especially at local scale, should then include stakeholder participation and cyclic assessment phases to adapt it to the changing socio-ecological system, allowing the best solutions (in our case NBS) to be selected and realised. Thus, two intertwined paths might be followed by researchers for the inclusion of SLT in UGI planning: a technical and a strategic path. The former consists in the further development of methodological frameworks (e.g. considering ecosystem services assessment, the integration of different SLT concepts, the proper spatiotemporal assessment scale), new applicable cost-effective indicators (in particular for entropy), the implementation of modelling approaches and the assessment of social domain related with ecological and physical processes. Among the several study cases reported, the spatial representation of the assessments has demonstrated to be a valuable support for planning. Mapping significant indicators of entropy, exergy or energy and matter fluxes at the proper scale and resolution can then represent a key aspect to facilitate SLT inclusion into UGI planning. The second path should aim to study how these technical aspects have to be considered in governing mechanisms, transforming the quantitative information produced by SLT assessment into effective and lasting urban interventions capable of increasing the quality of citizen life and the resilience of socio-ecological systems. Within this second path we should consider, for example, innovative policy and regulating approaches (e.g. compensatory measures) to encourage private owners to adopts NBS following performance-based criteria instead of conformance and prescriptivism norms (Frew, Baker, & Donehue, 2016). Finally, during recent years, several SLT planning approaches have emerged from scientific literature within different research fields such as, energy landscape planning, sustainable urbanism and urban metabolism studies. Since different field objectives, exergy, entropy and UM concepts have been applied, they have evolved separately. Even though some possible research pathways for a unifying thermodynamic-based urban planning have been suggested (Bristow & Kennedy, 2015; Filchakova, Robinson, & Scartezzini, 2007), more efforts are required to define solid spatial planning strategies able to embrace different SLT approaches above all for UGI.In this intertwined view, the low-entropy city concept and the proposed UGI planning strategy (Pelorosso, Gobattoni, & Leone, 2017) appears to be a promising cross-boundary tool which could provide a flexible integration of assessment methods taking into consideration ecosystem service frameworks, urban metabolism, social impacts and SLT-based planning. In particular, the proposed low-entropy UGI planning strategy emphasizes the role of modelling in the assessment phase and identifies several entropy indicators able to be easily applied by planners. Recently, the low-entropy approach has been applied in a exemplificative study case within the context of sustainable urban storm water management in Bari city, South Italy (Pelorosso, Gobattoni, & Leone, 2018). This research paper demonstrates the potential operativity of the low-entropy concept within the indicated technical path representing a first case of low-entropy UGI planning integrating modelling approach and entropy evaluation.

5 CONCLUSIONS

Although several scholars have investigated the role of Nature and SLT in making cities more sustainable, UGI planning based on SLT is a relatively new field of research with few real applications to urban systems. The paper, through a coupled review (scoping and systemic) of scientific literature, reports the main applications of thermodynamic concepts and approaches in urban planning. In particular, we searched for significant applications of SLT on study cases and we focussed on three key concepts related to SLT, namely exergy, entropy and urban metabolism (UM), to highlight gaps, constrictions and applicability for UGI planning. Finally, from the analysis of the selected contributions, some essential considerations have been derived with the aim of addressing and supporting future spatial planning. Exergy is an indicator of sustainability employed mainly for energy planning and several real study cases of exergetic landscape optimization exist at different planning scales. However, more efforts are required to investigate how exergy assessment can be used within specific

UGI planning, considering also the provision of ESs. Entropy appears a promising indicator of urban sustainability, but its operative application has still to be realised as well as the definition of proper and cost-effective entropy indicators able to spatially evaluate the effectiveness of green interventions at different urban scales. UM is recognised by many urban planners as the frontier for innovative land use decision making. Several issues hampering UM integration in urban planning have been highlighted by literature (e.g. demand of high resolution data) but a consolidated UM-based UGI planning is not present yet. Moreover, from the literature review, some general indications summarized in two levels of intervention (i.e. technical and strategic research paths) can be derived for the development of spatial UGI planning strategies based on SLT. From a technical point of view, practical UGI planning requires operative and integrated exergy, entropy and UM assessments with accurate descriptions of the urban socio-ecological complexity at the temporal and spatial scale at which practitioners work. In addition, modelling and mapping of SLT processes appear pivotal approaches for the inclusion of SLT in UGI planning. Strategical actions should instead look at defining adaptable governing mechanisms (e.g. compensatory measures) enabling SLT and performance-based planning criteria to be accepted and widely used among citizens in order to operationalise effective and shared interventions on UGI. The knowledge synthesis on SLT and urban planning thus confirms the innovative character of the low-entropy city concept and the proposed seminal UGI planning strategy (Pelorosso, Gobattoni, & Leone, 2017). In addition to further theoretical developments, practical implementations on exemplificative study cases or the creation of *ad hoc* urban living labs are welcomed to provide useful information to test the low-entropy strategy, and in general the SLT approach, in UGI planning. Several efforts are thus required to build theoretically sound but also operative thermodynamic-based UGI planning strategies able to integrate different approaches and to translate them into real UGI study cases. In conclusion, planning strategies driven by SLT are innovative approaches to sustainability, but they appear to be still in a seminal phase. The presented knowledge synthesis of actual SLT implementation in urban contexts and the proposed paths of action aim to address future spatial planning strategies and to support a SLT-conscious green transition of cities.

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APPENDIX A- SUPPLEMENTARY MATERIAL

List of the papers selected through ISI Web of Science and Scopus databases (period: up to 25/01/2017)

37th Joint Propulsion Conference and Exhibit 2001 (Conference Review); Salt Lake City, UT; United States; 8 July 2001 through 11 July 2001; Code 102854

Advanced Materials Research. Volume 748, 2013. 4th International Conference on Material and Manufacturing Technology, ICMMT 2013 (Conference Review); Seoul; South Korea; 11 May 2013 through 12 May 2013; Code 99779

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Applied Mechanics and Materials. Volume 409-410, 2013. 2nd International Conference on Civil, Architectural and Hydraulic Engineering, ICCAHE 2013 (Conference Review); Zhuhai; China; 27 July 2013 through 28 July 2013; Code 100434

Applied Mechanics and Materials. Volume 423-426, 2013.3rd International Conference on Applied Mechanics, Materials and Manufacturing, ICAMMM 2013 (Conference Review); Dalian; China; 24 August 2013 through 25 August 2013; Code 100385

Applied Mechanics and Materials. Volume 507, 2014. 3rd International Conference on Civil Engineering and Transportation, ICCET 2013; Kunming; China; 14 December 2013 through 15 December 2013; Code 102766

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IMAGE SOURCES

Fig. 1: Pelorosso, Gobattoni, & Leone, 2017; Fig.2: He et al., 2015; Fig.3: Ambrosini et al., 2014; Fig.4: Leone, Gobattoni, & Pelorosso, 2016; Fig.5: Leduc & Van Kann, 2013; Fig.6: Fistola and La Rocca, 2014; Fig.7: Chrysoulakis et al., 2013; Fig.8: Chrysoulakis et al., 2013; Fig.9: Codoban & Kennedy, 2008; Fig.10: Pincetl et al., 2014.

AUTHOR'S PROFILE

Raffaele Pelorosso

Qualified as Associate Professor by National Scientific Qualification, in Urban and landscape planning and design (Disciplinary Sector 08/F1). Dr. Pelorosso has hold several Lectures in ecology, cartography, environmental and urban planning at the Tuscia University. Main research interests: urban storm water management and climate regulation by NBS; Low-Entropy Cities; planning of energy systems; landscape perception assessment and participatory planning; landscape dynamics assessment by historical maps and remote sensing data; management of abandoned; impact of agriculture on the water resources; urban green infrastructure connectivity. He is authors of more than 90 scientific works and peer reviewer for many international journals as: Land Use Policy, Landscape and Urban Planning, Environmental Management, European Planning studies, Habitat international, Sustainability.

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Master Degree in Environmental Engineering at University of Perugia, PhD, she is a post-doctoral researcher and lecturer in landscape architecture and landscape planning at the Tuscia University. Her research activity is mainly concerned with landscape dynamics, environmental modelling in GIS environment, participatory planning, decision support systems for planning and management of urban and rural systems, development of mathematical models for landscape evolution and equilibrium scenarios assessment. Author of several scientific articles on the main international journals related to the landscape and urban planning and environmental management. She is peer reviewer for many international journals as Land Use Policy, Landscape and Urban Planning, Ecosystem Services.

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THE ADAPTING CITY

RESILIENCE THROUGH WATER DESIGN IN ROTTERDAM

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ABSTRACT

The Netherlands is a fragile and vulnerable land; spatial planning is very important, just as important is the resilience of the system and its adaptation to climate change. Rotterdam is a delta city and, in a period of heavy climate change, it will experiment more extreme weather conditions, such as heavier rainstorms, longer periods of drought and more heat waves, as well as higher water levels in the river Meuse; so is important to know that it is a deep vulnerable city and need right strategies to overcome the problem and to be adapted to conseguences of climate change. The results presented in these manuscript were developed through some academic course at TUDelft; the main aim is to arrive at shared ambitions for climate proof urban development and to make specific concrete agreements about this defining a strategy able to enforce urban beauty and absorb excess rainwater and improve urban resilience through the implementation of some adaptive measures linking this strategy to the whole urban governante of the city. There is the need to implement a conscious and smart urban governance and to undertake urban awareness actions that aim at the awareness of the communities, which becomes an active part in promoting urban resilience policies and in creating the sustainable city. The strategy is characterized by some main innovation that could be recreated in other countries, such as the inclusion of resilience's theme in all levels of government and in all urban planning instruments and in spatial and strategic development policies; the deep cooperation between all stakeholders and public administrations; and the role of urban design that is able to create a waterproof city, enhancing the quality of public space.

KEYWORDS:
Resilience; water management; waterproof city.

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适应城市

通过鹿特丹的水设计提高城市复原力

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摘要

荷兰是一个土地脆弱的国家，空间规划非常重要；但同时，系统的复原力及对气候变化的适应也非常重要。鹿特丹是一座三角洲城市，在气候变化严重的时期，它将经历更加极端的气候条件，如暴风雨加剧、干旱时间更长、热浪更多以及默兹河水位更高等情况；因此需要了解这座城市的脆弱性并需要制定正确的战略来解决这些问题，适应气候变化的影响。本文中的结果是通过 TUDelft 的学术课程获得的，主要目标是达成城市发展中对气候变化的共识并就这一战略达成具体协议，通过采取适应性措施美化城市并吸收多余的雨水，提高城市抗灾能力，将这一战略应用到整个城市管理中。有必要采取意识明确的智能城市治理，开展旨在提高意识的城市行动，这将成为促进城市复原力政策及打造持续发展城市的重要环节。该战略中的创新特点也可以实践应用到其它国家，如在各级政府和所有城市规划工具及空间和战略发展政策中纳入抵御能力的主题；在所有利益相关者和公共行政部门之间展开深入合作；以及城市设计的作用，打造防水城市，提升公共空间的质量。

关键词：
复原力、水管理、防水城市.

1 INTRODUCTION

Water has always played a key role in the dynamics of growth and in the development of a territory; the waters have always been at the center of the history of civilizations; the territories furrowed by the great "water infrastructures" were the first to be urbanized by man and marked the first human settlements; water has been at the center of the classical mythology of the gods and has been at the center of religious rituals that have exalted its sacred nature linked to its recognized healing abilities. The water space is a place of intense vitality, a space of relationships, of exchange, a connective tissue, a fluid environment in which flows of people, of goods and of knowledge are realized; the water space, the limit between land and water, is a strategic space, often protected, where a strong landscape and environmental value are recognized; but it is also a strategic space for the transformation of the city. Often this space is a place of comparisons; the water spaces are public spaces characterized by high recognizability and identity; they are places defined in a very clear way by the cognitive approach of mindscape; places of relationship in which social well-being is not only dictated by the urban project but also by its fluidity, by its becoming, by its being a territory in rapid and continuos evolution and transformation. The water, in its countless garments, is the center of the city and of the urban project and it is often precisely the element that qualifies it, making it sustainable and resilient; water has to be used but it is also the main component of a series of hydrogeological risks from which we need to protect ourselves. Climate change is taking place in a changing world; in the water cities, urban projects that are aware of the fragility and vulnerability of the territory must be promoted (Galderisi, 2012). It is necessary to implement urban resilience actions able to mitigate natural risks by converting territorial problems into territorial resources and opportunities. There is a need to implement a conscious and smart urban governance and to undertake urban awareness actions aimed at the awareness of the community; a community which becomes an active part in promoting urban resilience policies and in creating a sustainable city (Moraci & Fazia, 2013). The global population has grown exponentially over recent centuries (Eger, 2009); more than half of all people now live in towns and cities, most of which are vulnerable to climate change (Newman, Beatley & Boyer, 2009). In particular, the densely populated and economically prosperous cities in the large river deltas that open out into the sea will be directly affected by the consequences of climate change. It is necessary to promote the development of a sustainable city, a resilient city, able to adapt to climate change and to face its effects, trying to mitigate its risks and to develop its potential for development and urban use. Concerning climate change and resilient city (Sennet, 2014), flood safety is just one of the tasks confronting the city. Major effects of climate change will develop on water cities where is important the theme of flooding; but climate change will also lead to more frequent periods of high temperature with effetcs on citizens' health, on Energy consumption, on air quality, water quality and problems on biodiversity. The Netherlands is a fragile and vulnerable land because it is located at the delta of three european rivers: the Rhine that flows from Holland to the Alps, the Meuse, which arrives in France, and the belgian Scheldt; from the geological point of view the area is shaped by the presence of sandy banks that were deposited about twelve thousand years ago and have allowed the first human settlements that are currently the historical centers of the cities; the outskirts of the contemporary city rise on peat or heavy clay soils. The dutch landscape consists of a dense network of polders characterized by key elements such as dams, windmills and farms; it is a unique landscape but, at the same time, is very fragile and constantly changing, been characterized by a deep relationship between man and nature; the polders are in sharp contrast with the massive urbanization of recent years.

The city-water relationship in the Netherlands is particularly important and strategic because 20% of the country is made up of water, whose presence affects every urban and architectural project; Netherland is, among the countries with the highest population density in the world, ranked 14th according to WorldAtlas[1], with a population of just over 17 million inhabitants on an area of 41.543 square kilometers and an average

1 www.worldatlas.com/aatlas/populations/ctypopls.htm

density of about 412 inh/sqkm. Spatial planning is very important, just as important is the resilience of the system and its adaptation to climate change; the relationship with water, as mentioned, is strategic and at the center of the policies of VROM, the Ministry of Home, Spatial Planning and the Environment. Aware of the fact that the existence and the survival of the territory itself depend on the infrastructures that determine it, dutch planners and designers have developed, especially in the twentieth century, policies and strategies to develop and maintain a "sustainable" balance between urbanization, landscape and infrastructures that have guaranteed the recognized leadership in the field of water management and defense, with a system of dams that is the largest in the world[2].

At the end of the eighteenth century, the dutch Parliament decided to introduce a more effective central organization for flood defense; on March 27th, 1798, an agency for public works and water management was established, which took the name of *Rijkswaterstaat*, which currently manages 3.260 kilometers of national roads and 1.686 kilometers of national waterways. On the whole of the national defense works, all the most important dunes and dams constitute the "primary water defenses", since they protect the country from the floods of the Ijsselmeer and Markermeer rivers, lakes and rivers. The "secondary" defenses are also important but if a dam of this system collapses no dramatic consequences will occur. In order to cope with the current climate change, in 2007 the national Government issued its "Vision" on the water policy entitled "Reclaiming the Netherlands from the future" (City of Rotterdam, 2008), which underlines the need for a sustainable management of the water resource in relation, above all, to climate change; in 2008 the Second Report of the Delta Commitee entitled "Working with water" was published (Delta Commissie, 2008), it contains twelve recommendations to guarantee national defense and security; in 2009 the "National Water Plan" (Ministry of Infrastructure and the Environment and Ministry of Economic Affairs, 2014), came into force whose slogan is "Move in accordance with natural processes where it is possible, offer resistance where necessary and seize opportunities to promote prosperity and well-being". To achieve these aims the theme of water will have a central importance in spatial planning.

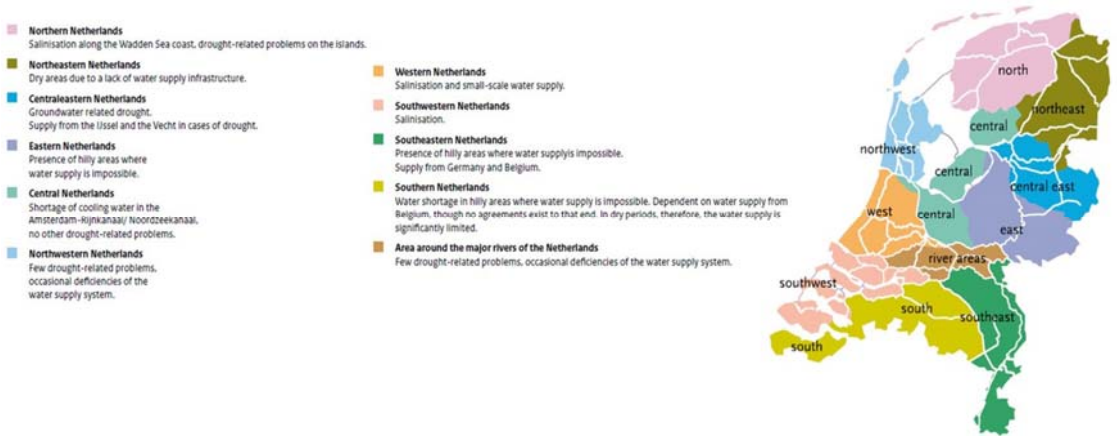

Fig. 1: Water in the Netherlands

The Netherlands is getting wetter, dryer and saltier. The sea level is rising. While rainfall is getting heavier at times, it may also at other times hold off much longer. Soil subsidence continues, due to both geological influences and human activities. Land use is changing as well, the economic sectors are continuously changing and, societally speaking, new demands are made on water. All this can hardly indicate anything else than the necessity for a change in water management and water use.

Adaptation involves solutions being found in all aspects of the urban environment that make it possible to alleviate the system and make it more resilient. Adaptation means that we must also focus on adapting the

2 In the Netherlands the dams are extended for 16.500 kilometers and panels about 300 structures.

city to make it less vulnerable and more resilient. Through the different experiences described in this manuscript, the authors want to contribute to the construction of an urban methodology that can allow the construction of a resilient urban system. This strategy also aims to contain storm water runoff in case of extreme rainfall, if possible in combination with measures to improve and enhance the green quality of open spaces in the city. The strategy combines sustainability efforts with resilience and urban transformations. The theme of resilience is included in all levels of government, in municipal plans and in spatial and strategic development policies, such as in some projects concerning public and private space.

Climate adaptation assumes the role of a real urban strategy that can innovate the city, making it more fascinating and modern. The approach pursued throughout the manuscript aims at fostering resilience and flood protection by means of the architectural and urban projects. Moreover, it considers the use of the public areas as strategic spaces where the resilient city can be developed, employing engineering technical climate defences as new public zones for citizens and communities. Urban governance (Deakin, 2013) is the best place to establish goals and objectives that must be pursued for the creation of a resilient city (Hollands, 2008); the city must be a unique, resilient project and every part of it, both public and private, must be seen as a potential space in which to pursue climate adaptation policies. To make smart planning implementable and equip it with the new paradigm of urban resilience, all levels of government and all the stakeholders must be involved. The resilient city is an urban challenge, but it is also a political and economic challenge. It is also important to link defense design with other spatial planning tools, to allow the better integration and implementation, a right cost reduction and an increased innovation. The challenge is to link climate adaptation to other urban measures, projects and initiatives such as the management and maintenance of roads and public spaces. It is also important to develop appropriate strategies to improve awareness within the population, to promote the active collaboration of the smallest "backyard actions." To engage the community, it is necessary to ensure people are aware of the benefits they will have if they contribute to the pursuit of climate adaptation. It is necessary to implement urban resilience actions that are able to mitigate natural risks by converting territorial problems into territorial resources and opportunities. Implementing a conscious and smart urban governance and undertaking urban awareness actions are fundamental. The aim is to create a community actively participating in promoting urban resilience policies and in creating a sustainable city.

2 WATER MANAGEMENT IN THE NETHERLANDS

Water management in the Netherlands is a complicated issue (Rijkswaterstaat, 2011); the Netherlands could be considered as a gateway for water; all the water that is carried across its borders by streams and rivers must be discharged into the sea. The same applies for rainwater, which makes its way to the sea overland or underground. The Dutch model of water services management is entirely public; the tasks related to the integrated water service are not the responsibility of a single entity, but the aqueduct service is managed by water companies, companies with entirely public capital. The sewerage service is managed by the municipalities while the wastewater treatment is entrusted to waterschappen, functional public bodies that deal, on a regional scale, also with the management of water control works, fundamental for the very existence of the country. These subjects interact closely with each other and with other organizations that deal with the planning and management of the territory, given that the management of all water services (and not only that connected to civil and industrial uses) is strongly integrated in the Netherlands and, for historical and morphological reasons, it is also integrated with the planning and management of the territory. Responsibility for water management in the Netherlands is entrusted to the Rijkswaterstaat (the executive branch of the Ministry of Infrastructure and the Environment) and to the water control Committees; the Rijkswaterstaat (RWS) is responsible for the management of the main waters, such as the sea and rivers, and ensures that the responsible authorities are promptly warned in the event of floods or stormy seas.

Furthermore, RWS maintains dams, dunes, cages and overvoltage barriers and protects the coast by regimenting and expanding the floodplains and building secondary canals.
Dutch have started to use modern wastewater treatment techniques since the 1970s; currently all homes have access to drinking and chlorine-free water, while 99.4% are connected to the sewage system; moreover, the level of recycling of industrial wastewater is high and the water is of sufficient quality to be used in the food and beverage industry. The regulatory framework of the Dutch water management legislation consists of a 2011 law ("Drinkwaterwet") which prevents the private sector from directly managing water resources. In relation to current climate change, the national government, since the early years of the 21st century, is trying to promote the formation of a resilient city, able to cope with the ongoing natural transformations and to create a less vulnerable and more resilient city. For dutch people is possible to link the adaptive measures to other spatial development projects in the city and to intelligently combine them with existing management and maintenance programmes with an intensive cooperation with other partners who are active in the city. The general aim is to promote the creation of a waterproof city through joint responsibilities and smart management and urban governance. In 2007, the government published its vision on water policy, entitled 'Reclaiming the Netherlands from the Future', a document in which the government wanted to operate in the field of National water policy, encouraging the formation of sustainable water management. The Water Vision specifies five spearheads for which the cabinet would like to intensive its policies. One is resilience to climate change. The Delta Committee, in 2008 published its report 'Working with Water' (Delta Commissie, 2008) containing twelve raccomendations to help to face the threat of an excess of sea and river water and to safeguard freshwater supply in the long term; this study anticipated the National Water Plan that was published in 2009 (Ministry of Infrastructure and the Environment and Ministry of Economic Affairs, 2014); with the aim to enforce the National Water Policy stressing the importance of the pursuing of sustainable water management and giving to the water greater significance in spatial development; for this reason this plan is considered as a frame work vision based on the Spatial Planning Act. This Water Plan has integrated eight previous sectorial water acts of the Netherlands, addressing all relationships within water systems. For example, the relationship between the quality and quantity of water, between surface water and groundwater, but also the relationship between water, land use and water users. Integrated water management is also characterised by its relationship with other policy areas such as nature, environment and spatial planning.

3 A RESILIENT PROJECT: THE DELTA METROPOLIS

As we have already highlighted, the territory of the Netherlands is very fragile and vulnerable, placed on average 5 meters below sea level; for this reason about 75% of the Dutch coast is protected by sandy dunes that vary their length from 100 meters to several kilometers; 15% of the coast is made up of "hard" man-made constructions such as dams and artificial reefs, while the remaining 10% is characterized by flat and very wide beaches. Dikes and dunes ensure that Netherlands and its inhabitants could feel safe. All the dunes and the most important dikes are called primary water defences, because they protect mainly from flooding by the sea, the main rivers or Lake IJsselmeer and Lake Markermeer. The secondary defences are also important, but if a dike in this category collapses, the consequences are not as dramatic. If the primary water defences were breached, the consequences would be considerably greater. The Flood Defences Act indicates the safety standards for every dike ring area. The standard is higher if more economic activities take place within the ring and if the number of inhabitants is high. Other important factors are the size of the area liable to flooding; the height to which the water may rise and whether the flood water will be fresh or saline. Flooding occurs when water levels are so high that the streams, lakes or waterways bursts their banks. In the main water system, floods are deemed to occur if national waterways are not sufficiently capable of storing or discharging regional water discharges. In the field of hydraulic works and

hydrogeological management, the most famous flood protection projects are the Afsluitdijk dam and the Delta Works, a system of dams, sluices and mobile barriers in the two Zeeland and Zuid-Holland provinces. The two most important works of the Deltaworks are the Oosterscheldekering dam, inaugurated in 1986 between two islands, in the Zeeland Province, and the Afsluitdijk dam, a 32-kilometer dam, designed as early as the seventeenth century, but completed only in 1932, which separates the inland sea from the North Sea and connects the Friesland and Noord-Holland provinces. This dam protects the coasts of four provinces from maritime floods, and creates the large inland lake IJsselmeer, a freshwater basin that is used in periods of drought. The Delta Project is impressive and was designed and built in response to the catastrophe that struck the Western Netherlands in 1953. The area devastated by the storm was that on the southern coast, called Zeeland, affected by the mouths of three major European rivers, the Rhine, the Scheldt and the Meuse; the project, which involved the construction of eleven dams that blocked the main estuaries of the Delta, had the ambition to increase the safety of the topographically most depressed areas of the delta of the Rhine, the Meuse and the Scheldt, defending them from the most violent storms and floods. This impressive project, also considered one of the seven wonders of the world, demonstrates the ability of the Dutch to dominate the immense power of water. The main element of the Delta Plan is the Oosterscheldekering dam, a unique 8-kilometer-long storm barrier that isolates the entire Eastern Scheldt in just 75 minutes; this ingenious system consists of 62 huge sliding gates that can close quickly protecting the Netherlands from flooding. Given that more than a third of the country is below sea level, the goal was very complex; to achieve the goal of hydraulic protection, the coastal dunes were raised more than 5 meters and the islands of Zeeland were connected by dams and other masterpieces of high engineering. Under normal circumstances, dutch water system works well. Problems such as safety, water shortages, flooding, waterlogging and salinisation usually only occur under extreme circumstances.

4 ROTTERDAM RESILIENT CITY: STRATEGIE AND ACTIONS FOR A WATERPROOF CITY

Rotterdam has been protecting itself from the threat of the water from the rivers and especially from the sea for centuries. The dams and dikes, belonging to primary and secondary defenses, have managed the risk of flooding and have helped the drainage of urban land. For this reason Rotterdam is considered one of the safest delta cities in the world altought Rotterdam iso ne of the most vulnerable city in the world (Meyer, 2003). Rotterdam is located in the delta of the rivers Rhine and Meuse; the city, for the resilience strategy, is divided in different zone but the main importance is to be in the inner city or in the outer-dike areas; The outer-dike areas of Rotterdam are not protected by dikes while the inner part is protected by dikes and is less vulnerable. Within the dikes, the inner-dike city of Rotterdam is mostly well below sea level, with the lowest point being as much as 6.67 metres below NAP[3]. The Rotterdam Programme on Sustainability and Climate Change (City of Rotterdam, 2014) focus on some priority, on some urban topic such as enhancing sustainability, producing a greener and more Energy saving environment, reducing CO2 emissions and working with polpe and communities to promote awareness for the best management of natural hazards and resources. Rotterdam is a delta city and in a period of heavy climate change is will experiment more extreme weather conditions, such as heavier rainstorms, longer periods of drought and more heat waves, as well as higher water levels in the river Meuse; so is important to know that it is a deep vulnerable city and need right strategies to overcome the problem and to be adapted to conseguences of climate change *Rotterdammer*[4] have been adapting their city to the ever-changing delta for centuries. Rotterdam has a strong relationship with water, the whole city is surrounded by water that comes from the sea, from the river, from precipitation and from groundwater.

[3] NAP, the National Amsterdam Level, is an agreed ordnance measurement that is almost equal to mean sea level.

[4] Rotterdam's citizens.

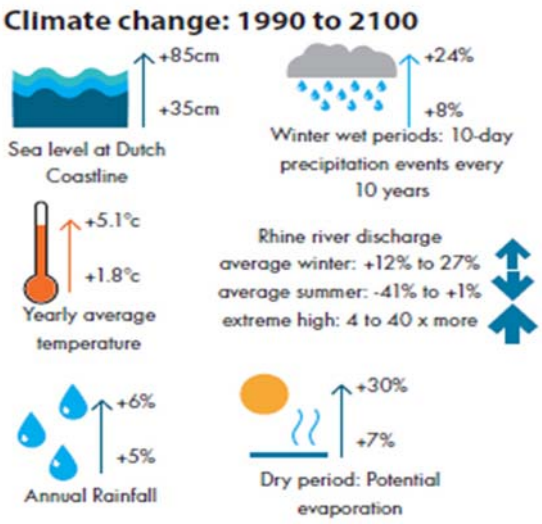

Fig. 2: Climate Change 1990-2100

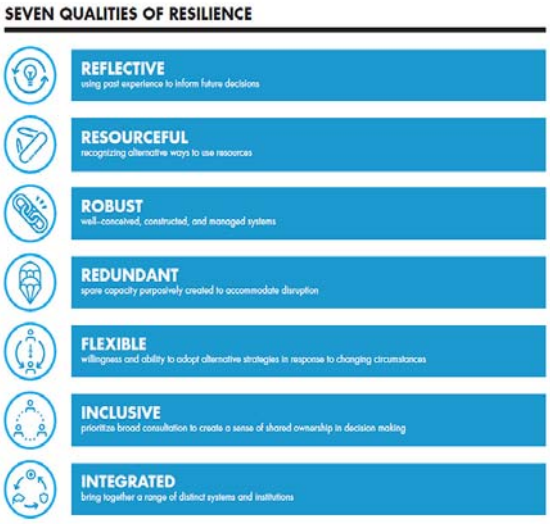

Fig. 3: Quality of resilience

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This is the main reason because the city is one of the more vulnerable to the consequences of climate change. The rise in sea levels and increase in water levels directly influence the city's flood risks. During periods of estreme rainfall, it is very difficult for the water to drain away. Drought manifests itself for example by low water tables and low river levels. Furthermore, the negative effects of a heat wave are more apparent in a highly populated, compact city such as Rotterdam than in the surrounding countryside.

Rotterdam is an example of resilience and adaptation to climate change; the theme of urban resilience has been under the attention of the municipality for about fifteen years and Legambiente has included the Dutch city as one of the examples to follow in the 2017 "Cities to the challenge of climate" dossier (Legambiente, 2016); moreover, in the central districts of Rotterdam, urban retrofitting actions are experimented through new technologies and new functions applied to existing structures, and in line with the climatic changes taking place. Rotterdam is also experimenting with some innovative building technologies; for example, is adopting architectural technology solutions that adapt to the fluctuation of water levels with the introduction of the obligation, by 2025, to create sustainable constructions with floating quarters, in areas outside the banks; the urban water system is also being resilient with the creation of tanks for the storage of excess rainwater. Through some programs, including the "Rotterdam Climate Initiative" (City of Rotterdam, 2013), Rotterdam is seeking, with the help of the government and organizations, research centers and citizens (van Oostrom, 2001), to reduce pollutant emissions by 50% by 2025, trying to adapt the city to climate change in progress and promoting five main initiatives focusing on the concept of resilience: 1) floating houses; 2) the water squares; 3) enhanced water collection systems; 4) green roofs; 5) the sustainable port. Rotterdam is the inspiring example to other delta cities around the world going through a sustainability approach; as a green city is an attractive and resilient city where people love to live, work and relax; sustainability is an integral part of all area development projects in Rotterdam; sustainable areas are future-proof areas with good living conditions. The Rotterdam City Council is committed to making Rotterdam a leader in sustainable urban living. The original core of Rotterdam was along the Rotte river (now largely reduced to an underground but navigable canal); in the expansion of 1626 the city assumed the shape of a triangle with the river Maas as a southern limit and limited by Goudsche Singel and Coolsingel and Schiedamsche Singel. Rotterdam is formed by some district: the *Oude Binnenstad*, the most ancient urban nucleus, almost entirely razed to the ground in 1940 by bombing and rebuilt with a new, extensive urban and functional structure; from the *buitenstad*, the predominantly commercial suburbs; from the *polderstad*, the most modern residential district, and finally, on the left of the river, from the *port* and *industrial quarters*, where economic

life is thriving and one third of the population. Refering to the city form, concerning climate change there is a clear distinction between the outer-dike and the inner-dike areas of Rotterdam; the outer-dike regions are not protected by dikes and are directly affected by the water levels of the river and by the tide so they are more likely to flood than the inner-dike areas. The outer-dike areas are protected by the Maeslant storm surge barrier. This barrier closes when water levels reach 3 metres above NAP; it is expected that by 2080 the barrier will have to close once a year on average, rather than the current average of once every twelve years. Inner-dike Rotterdam is extremely well-protected from flooding; prevention is the key factor in the flood protection of inner-dike Rotterdam. Outer-dike Rotterdam is the least vulnerable area. The 19th century urban districts are the most vulnerable areas. These are densely built-up, generally paved over, have relatively little open water and green. The inner-city centre of Rotterdam is especially vulnerable to extreme rainfall because it is densely built-up, the public areas are used intensively and there is very little vegetation The main difference between these six zones is if they are defended by the dykes (inner dyke) or if, on the contrary, they are lacking (outer dyke); in other areas the main difference is in the presence and availability of potential public spaces or, on the contrary, in the compactness of the fabric that precludes or limits the sustainable project of public space.

5 RESILIENT STRATEGY AND CLIMATE URBAN ADAPTATION

A definition of urban climate resilience is provided by the Environmental Protection Agency (United States Environmental Protection Agency, EPA, 2017): it is a city's ability to reduce exposure and sensitivity to, and recover and learn from, gradual climatic changes or extreme climate events. This ability comes from a city's risk reduction and response capacity, and includes retaining or improving physical, social, institutional, environmental, and governance structures within a city.

Resilience thinking has attracted attention since the Katrina disaster in 2005. Indeed, it is the ability to function, survive and thrive to any stress, according to the Disaster Risk Reduction Hyogo Protocol in 2005 (International Strategy for Disaster Reduction, 2007) and to the UN conference on Disaster Risk Reduction.

The European Commission has adopted the *European Adaptation Strategy* with the obligation for all the Member States to implement national plans to cope with the inevitable Climate Change impacts by 2017. Many EU members have already developed national strategies, among those: The Netherlands, Denmark, Finland, Spain and United Kingdom (Swart; Singh, 2013). Additionally, in 2012, the European Commission presented *The EU Approach to Resilience: Learning from food crises*, which provided policy principles for action to help vulnerable communities in areas facing crisis. Some countries, such as the UK, developed separate national resilience plans, whereas others, as The Netherlands and Denmark, included resilience in their national adaptation strategies. Rotterdam is considered one of the lowest-lying cities in Europe; a city safe and well protected but still vulnerable to flooding, in estreme weather conditions. For this reason, in the last yeas, a lot of urban and enviromental strategies were adepte to face climate change and environmental hazards; in 2014 the national Delta Programme was adepte and become part of the Rotterdam Adaptation Strategy (Ministry of Infrastructure and Environment, 2017).

The aim of the Rotterdam Adaptation Strategy (City of Rotterdam, 2016) is to maintain and optimise the existing strong defence system, to improve urban resilience through the implementation of some adaptive measures, to involve citizens and community, and to link this strategy to the whole urban governance of the city. The final aim is to take advantage of the opportunities that climate change adaptation provides making city more attractive and forming new multifunctional public space. This strategy also aims to contain storm water runoff in case of extreme rainfall, if possible in combination with measures to improve and enhance the green quality of open spaces in the city. It includes measures at neighbourhood, street and building level to minimise the consequences of extreme precipitation that will, at the same time, result in a more beautiful, green city for the people of Rotterdam. The strategy combines sustainability efforts with resilience and urban

transformations, making Rotterdam more able to clear the panorama of the different hazards that could interest it; and in this way the right action to face the situation could be undertaken, a smart and comprehensive solutions able to realize a waterproof and resilient city. Rotterdam has joined also the Resilient City programme for the best 100's city promoted by the Rockefeller Foundation (Rockefeller Foundation, 2015); this programme can provide very useful support for the other pillars and ambitions of the Rotterdam Programme on Sustainability and Climate Change, not least by linking the various themes and intelligently anticipating future trends (Kimmelmann, 2017). The Rotterdam Climate Change Adaptation Strategy indicates which measures can be implemented in the various parts of the city in order to face the effects of climate change. The main priority in outer dyke areas is based on prevention and adaptation; the main defense system based on the storm surge barrier will continue to be the first strong measure for flood protection but, according to this, the protection will be augmented with adaptive measures aimed at increasing resilience and evolving with climate change; for example with the creation of adaptive building, with the construction of floating buildings and the adaptive design of outdoor areas including roadways, utility infrastructure, wilderness areas and parks.

In the area within the dykes will be promoted urban design action able to reinforce the sponge function of this part of the city; will be implemented actions able to store rainwater and to delay drainage, will be realized green roofs and sustainable green infrastructure and will be promoted the permeability of private and public space. In the highly populate areas, with little open space, will be developed measures on existing buildings while, in those part of the city where there is more space, robust measures such as increasing the water storage capacity of canals and lakes and constructing green-blue corridors will significantly contribute to making the city climate proof. The activities promoted in the strategy, and that has to be achieved within 2018 regarding the planting of trees, plants and flowers in the district of Oude Noorden, Nieuwe Westen/Middelland, Tarwewijk, Bloemhof and Hillesluis, combining, where is possible, this with measures to contain storm water runoff in incidences of extreme rainfall; encouraging the residents to plant more flowers, shrubs and trees near their homes removing tiles from the garden enforcing the private space's permeability; encouraging the introduction of lush greenery and a healthy cover of vegetation along the river banks of the New Meuse River, along the New Waterway, the River Rotte and the River Schie, creating an attractive and pleasant green corridor; encouraging the addition of green alements to existing facilities, such as green car parking sites; stressing the importance to develop Wall gardens, or vertical gardens, not only brighten up the streets but also prevent the wall from warming up too much during extremely hot days. Making green roofs has a double meaning: enforcing urban beauty and absorb excess rainwater, they are necessary especially in this district dominated by brick, such as the city center and the old urban districts. Green roofs save energy (keeping homes cooler in summertime) and double the life of the roof. Furthermore, they enhance the city's biodiversity. The target is to install 40.000 sq of green roofs every year. Private initiatives include measures such as green roofs and façades and green inner courtyards and gardens. In public areas there are a wide range of potential measures, from incorporating more green in the streets and along the infrastructure (boulevards, quays, cycle and walking routes) to good management and extension of parks and greenbelts. The 'waterproof city' is robust and resilient (grey and green-blue) with a mix of paving and vegetation. The focus is on adaptive measures whereby the rainwater is captured and drainage is delayed. Public areas become a strategical space where store the rainwater; this could be realized along the infrastructures (through the street profile) and along the surface of the square, realizing multilevel public space that, in case of particular weather, could be used as a store for rainwater. Additional areas of water storage are included in the projects currently being implemented in Rotterdam, for example in Centraal Station or in Kruisplein and also in urban vision in 2030 or 2050 as "Rotterdam child friendly city" (City of Rotterdam, 2010) or "Wilderness school playgrounds" . The group of architects "De Urbanisten" has defined several projects (Bokern, 2014) concerning the management of urban water in Rotterdam and in neighboring polders, realizing many water squares. Is interesting, for example, the project for the

Benthemplein water square, a large multifunctional water square that combines rainwater collection with the creation of an outdoor public area; the project was defined after three preparatory workshops in which the natural elements and the form of public space were discussed. Green and blue roofs, removing paving and planting trees and bushes in the streets and open areas and waterproof design all contribute to increased resilience. The core of the strategy is to incorporate more flora in the city, especially in its paved, densely built-up areas. This is being done at all levels in the city, from pavements to city parks.

6 CONCLUSION

In the manuscript is underlined the Rotterdam strategy for the creation of a resilient city; the whole strategy is developed promoting an intensive cooperation between the water boards, urban developers, the City of Rotterdam and spatial administrators; other parties such as housing corporations, project developers and the inhabitants has an active role in trasforming the city.

Creating a waterproof city, as Rotterdam best practice shows, requires intensive cooperation, public awareness and citizens involvement; everyone is deeply involved in making the city waterproof.

The Rotterdam Adaptation Strategy (City of Rotterdam, 2013) charts the course by which Rotterdam plans to adapt to the consequences of climate change and shows how residents, businesses and the city can gain maximum benefit. This strategy offers the framework and the guiding principles for a future-proof development of Rotterdam and ensures that every future (spatial) development will include subjects such as flood management, accessibility and robustness of the city as basic principles from the very outset of the process. It is also important to link defense design with other spatial planning tools, to allow the better integration and implementation, a right cost reduction and an increased innovation.

These actions will not only contribute to making Rotterdam more resilient but will contribute to the creation of a more pleasant and attractive urban environment¸rotterdam's climate adaptation strategy provided opportunities for reinforcing its image as an attractive city; resilient urban design experimented in Rotterdam was well integrated and multifunctional, making space for water storage gave to the city the opportunity to create an high quality and pleasant public space. The main added value for the city is the creation of an attractive and green-blue environment with sustainable solutions for coping with rainwater. Experiments with 'water in the city' reinforce the Rotterdam's international image as a progressive, ambitious delta city. Rotterdam's water squares are exemplary.

Rotterdam, in its adaptation strategy, wants to anticipate climate change; the main innovations are that:

- the strategy encourages flood protection through the architectural and urban project;
- resilience theme are included in all levels of government and in all urban planning instruments and spatial and strategic development policies;
- additional areas of water storage are included in the projects currently being implemented in Rotterdam, for example in Centraal Station or in Kruisplein and also in urban vision 2030 or 2050 as "Rotterdam child friendly city" or "Wilderness school playgrounds";
- as *waterproof city*, Rotterdam has involved in its strategy, individual actions and cooperation between water boards, ministreries and municipalities, urban developers and private firms, the housing corporations and, over all, the citizens;
- the defense works become spaces for the city and new high quality public space because "blue and green" strategy which will also contribute to making the urban environment more attractive and enjoyable.

In Rotterdam, Architects and urban designers are finally responding to the threats of rising sea levels by "welcoming the water" into city, so the waterscape is becoming a new paradigm of spatial planning; Rotterdam is striving to become a climate proof city that will be safe and attractive to inhabitants, visitors

and businesses, and will remain so in the future. A healthy delta city in which it is pleasant to live, work and spend leisure time.

Fig. 4: Water squares in Rotterdam. (City of Rotterdam, 2013)

The approach devised in the Rotterdam water plan will be extended to all areas that are important in a climate proof city. The adaptation strategy provides the framework and basis for discussions. The aim is to arrive at shared ambitions for climate proof urban development and to make specific concrete agreements about this. The Rotterdam's experience shows that there is the need to implement a conscious and smart urban governance and to undertake urban awareness actions that aim at the awareness of the communities, which becomes an active part in promoting urban resilience policies and in creating the sustainable city. The involvement of private is also crucial, taking place in two ways: firstly, individuals are involved in the thematic awareness process and become aware of the environmental risks associated with climate change; secondly, precisely because of this mature awareness, they become an active part of the adaptation policy by implementing some strategic actions in the areas they own or by encouraging participation in the case of interventions in public areas through forms of associationism and smart communities. Spaces and resources are shared and the strategy becomes more implementable and successful (EU, 2011). In addition, the Dutch are deeply aware of the environmental problems, because at school, from an early age, training courses are provided that update them on the risks and the main techniques to preserve their nation, as for example, that of the polders. The education system, in this case, is one of the best in the world and aims to raise children's awareness so that they can refine their behavior with growth and be examples of best practices and smart communities. Furthermore, there is a strong convergence of interests between the central government and the individual municipalities, a union that is difficult to implement, but desirable, in countries such as Italy due to the excessive size and the normative and administrative organization. Rotterdam is becoming resilient not just by fortifying its defences to a changing climate and rising seas, but also by building a more cohesive and inclusive society. Resilience thinking is being incorporated in the policymaking and initiatives across all domains of city government, including across social, physical and economic programmes.

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IMAGE SOURCES

Fig. 1: Rijkswaterstaat (2011). Water Management in The Netherlands, Den Haag, February 2011. Available at https://staticresources.rijkswaterstaat.nl.

Fig. 2 - Fig. 3: City of Rotterdam (2016). Rotterdam resilient strategy. Ready for the 21st Century. Available at www.100resilientcities.org/wp.../strategy-resilient-rotterdam.pdf.

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GEOGRAFICH DETERMINISM VS URBAN RESILENCE: AN ITALIAN SCENARIO ANALYSIS

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ABSTRACT

It has been for many years that the analysis of the resilience concept has transversally enriched the scientific debate, both from the technical-scientific view to the socio-humanistic one.
In urban areas, particularly, scientific literature offers a consolidated panorama of theories and applications.
The present work is animated by the objective of complementing this background with a geographic approach in which the characteristics of urban resilience, synthesized by a wide review of scientific articles, are associated with determinants of geographic type (urban dimension, latitude, and prevalent urban attribute).
The proposed analysis introduces methodological elements of evaluation useful for this topic, as well as demonstrates, based on the stratification of real data regarding some main urban variables (Living, Environment, Mobility and Legality), the scenario of Italian cities characterized by high, medium and low resilience actions as a function of their geographical characteristics. It will try to make clearer the question regarding the geographic determinism paradigm respecting the urban frame, analyzing the eventual geographical influence on the processes of urban resilience

KEYWORDS:
Resilience; geography determinism

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地理决定论与城市复原力:

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摘要

多年来，对“复原力”概念的分析横向地丰富了从科学技术观点到社会人文主义科学观点的科学讨论。
特别是在城市地区，科学文献提供了理论和应用的综合概述。
本文从地理方法这一补充角度切入，通过对科学文献的广泛梳理和整合，研究城市复原力特征与地理类型决定因素（城市维度、纬度及城市普遍属性）的关联。
本文提出的分析引入了对这一主题有用的评估方法要素，并基于对一些主要城市变量（生活、环境、流动性和合法性）实际数据的分层，将意大利城市高、中、低复原力作为其地理特征的功能。本文将试图提出有关尊重城市框架的地理决定论范式问题，分析地理因素最终影响城市复原力的过程

关键词:
复原力、地理

1 CONCEPTUAL FRAMEWORK

The topic of geographical influence on anthropic, as well as other, processes finds remote origins, but its most scientific formulation can be traced back to the end of the 1800s with the geographer Ratzel who identified the territory and defined it as a tangible material item made up of elements connected to each other in a Cartesian vision in which it is possible to analyze causal relationships and their effects.

Therefore, by inserting itself into all those sciences founded upon the scientific rigor of the cause-effect relationship, scientific debate began to speak about geographic determinism: cause function for the territory, and the way of inhabiting and using the terrestrial surface for the relative effect.

According to an approach of this type, therefore, the specific ability to react from man, in the specific topic of urban areas, to phenomena of shock, for example the urban resilience, could change according to the territorial or more generally geographical features.

The objective of this study is to evaluate, through some real data on Italian cities, how this correlation could be true and possibly for which variables. For over fifty years scientific literature has suggested an interpretation of the city as a system; in the last twenty years, the evolution of the complexity paradigm has awarded a central role to a dynamic reading of urban systems (Batty, 2008), more and more widely interpreted as complex systems, non-linear, capable of self-organization, which constantly change themselves by the action of perturbing factors, owned to internal processes or owned to exogenous factors.

Climate change, resource scarcity, individual or concatenated risks, and environmental degradation are just some of the many and varied factors that threaten contemporary cities and are now the pressure factors capable of triggering processes and modifications of urban systems, altering or changing their status. These factors are characterized by different natures and impacts: some may induce long-term changes (lack of resources); others cause immediate shock (risks). Faced with the various factors mentioned above, cities seem to play a dual role: on the one hand, they constitute systems that are highly vulnerable to the potential impacts of such factors, while on the other hand, in many cases, the characteristics and evolution modes of urban systems are themselves able to generate or amplify these factors.

The complexity of the various pressure factors, their close interactions and the characteristics of the urban systems, seem to suggest the need to analyze and manage the response of urban systems to potential impacts of these factors through a systemic approach, able to grasp the complexity and interactions between factors and better understand the ways in which the various elements of the urban system react to each factor and react to their interactions, at different scales and in the course of time.

Unfortunately, despite an awareness that cities are complex systems to manage, and considering that connections come even before the individual parts (Kanter & Litow, 2009), the different pressure factors are almost always treated separately, both by researchers as well as technicians with the result of an increasing fragmentation, and subsequent ineffectiveness, of urban policies.

Against this, a growing number of researchers and international organizations seem to agree on the key-role relative to the concept of resilience, which it can play in order to increase the capacity of social and territorial systems in order to adapt or to change themselves as an effect of heterogeneous pressures (Folke, 2006; Bahadur et al. 2010). This concerns both slower ones, related to climate change, as well as those such as instant risks (De Falco, 2014, 2015a, b, c).

2 LITERATURE REVIEW OF RESILIENCE ATTRIBUTES

The concept of resilience is well known in a number of scientific fields, including physics (applied in engineering and construction, for instance) and ecological studies. Although there is not only one definition, in an intuitive way resilience is basically understood as the buffer capacity or the ability of an element (for example, a material or an ecosystem) to absorb perturbations (for example, by deforming elastically), or the magnitude of disturbance that can be absorbed before a radical change in its structure (for example before reaching

deformation, in the case of a material, or collapse, in the case of a building). In the last two decades, the idea of resilience has been translated into a number of human and social sciences, including psychology, organizational studies and network studies (Vanolo, 2015).

The centrality of the concept of resilience in the scientific debate of recent years in various fields requires a deeper analysis: it is, in fact, a controversial concept, characterized by many definitions and approaches, which risks becoming an empty shell, difficult to translate in operative terms (Rose, 2007; Grünewald & Warner 2012). The concept of resilience has deep roots and a complex evolutionary path. Born in physics to describe the resistance of the materials in presence of external disturbances, the concept of resilience has its main developments during the late sixties and early seventies in the field of ecology. Holling (1973) is one of the first to use the term to describe the behavior of natural systems in presence of external disturbances. And it was still Holling who proposed, in the mid-nineties, an interesting distinction between "engineering resilience" and "green resilience". The first one, strictly connected to the concept of stability, was based on characteristics such as efficiency, return to an earlier time condition and, and above all, on the uniqueness of the equilibrium state. The second one, was defined as "magnitude of the disturbance that can be absorbed before the system changes its structure (Holling, 1996), was based on the possible plurality of equilibrium states and allows for a dual possibility for a system to absorb adverse disturbances within a certain threshold, while maintaining its own characteristics and structure, or change, when the level of pressure exceeds this threshold, in a different system, not necessarily better than the previous one.

The interpretation from the ecological point of view concerning resilience is strengthened further when the concept began to be used in the study of socio-ecological systems characterized by the close interrelationship between anthropogenic components and natural components and their further correlations with studies on adaptive capabilities of complex systems, based on learning by experience, and the ability to adapt to changes (Holling, 2001; Walker, Holling et al. 2004; Bankoff et al. 2004). Analysis of ecosystems using the resilience model allows one to consider nature not only as a system that constantly seeks equilibrium, but also as a system able to evolve, depending on specific inner conditions and on the contest that surrounds it. There are four crucial aspects of resilience (Walker et al., 2004, 2-3). The transposition of the concept of resilience to complex adaptive systems is closely linked to the concept of "Panarchy", introduced by Gunderson and Holling (2001) to explain the evolutionary and dynamic nature, in time and in space, of such systems: the term describes the evolution of the systems according to evolutionary cycles as characterized by different phases. These cycles are developed in a domain of reality in three dimensions: the potential, i.e. the availability of accumulated resources (and for the socio-ecological systems which can be understood as natural capital and socially available); the connection, which is the system's ability to control its own destiny or, conversely, its vulnerability to unexpected changes that exceed the system's control capabilities; the resilience, that decreases when the system settles down in a stable condition and increases in reorganization phases and in growth, allowing the system to start a new cycle. The most recent developments of studies on resilience, strongly linked to the metaphor of panarchy, have further expanded the concept by proposing an interpretation as a result of three dynamically interacting components: persistence, adaptability, and transformability (Folke et al. 2010). Persistence, nearest to the concept of engineering resilience, expresses the ability of the system to resist impact, while preserving its own characteristics and structure, subject to a temporary removal from ordinary operating conditions. Adaptability expresses its capacity for social-ecological systems of learning, combining experience and knowledge, in order to regulate the response to internal or external disruptive pressures, changing the system in order to keep it within its domain of stability. Convertibility expresses the system's ability to modify its own characteristics and its own structure, entering a different stability domain. This interpretation of resilience, thereby inspired by an evolutionary vision (Davoudi, 2012), seems to be the one most responsive to the nature of urban systems considered as complex systems: finally overcoming resilience's idea as recovery of a previous equilibrium condition, it seems far more adapted to the dynamic nature of urban systems that constantly change themselves under the influence of endogenous and/or external

factors. As described above, in scientific literature there are different approaches to the concept of resilience applications on different systems (from the social to the economic and infrastructural). The main features of a resilient system are thus: persistence, adaptability and transformability as identified by Folke et al. in 2010. These traits are recurrent in scientific literature, although terms such as robustness or strength are often preferred to the term persistence. These terms, referring however to the ability of a system to face an event without undergoing alterations, can be easily interpreted as specifications of the persistence concept. Regarding sustainability, according to Folke et al. (2002), Chelleri (2012) and Colucci (2012), the target of sustainability can be achieved by enhancing urban resilience, especially "optimizing available resources, making a rational use of them, and contributing to increasing the amount of available resources" (Galderisi & Ferrara, 2012). Cities, in fact, are key players in energy and climate challenges, as they are responsible for the most energy consumption, and at the same time they are vulnerable to the effects of climate change (Gargiulo & Zucaro, 2015). Some capabilities are recurring regardless of the approaches and systems considered: diversity, for example, crucial in ecological systems, has been recognized as essential in the economic and social fields; learning ability, the feature of adaptive systems and the central purpose of their self-organization, interpreted as the capacity to learn from past events in order to confront the future. Table 1 provides a broad overview of scientific literature identifying the skills that, in different disciplines, are most used to describe a resilient system (Galderisi, 2016).

Field	Representative Author	Characteristics of Resilient Systems
Complex adaptive systems	Folke et al. (2002)	Diversity; redundancy; adaptability; self-organization; innovation; storage; experience; knowledge; learning ability; convertibility.
Systems thinking	Fiksel (2003); Bahadur et al. (2010).	Adaptability; cohesion; diversity; effectiveness and reliability of institutions; efficiency; control mechanisms; participation; knowledge; preparation; equity; networks; learning ability; multi-scale perspective.
Urban systems	Godshalk (2003); Ahern (2011); Desouza & Flanery (2013); Papa R., Gargiulo C. & Galderisi A., (2013).	Diversity; redundancy; resistance; adaptability/flexibility; collaboration; interdependence; autonomy; efficiency.
Communities	Bruneau et al. (2003); Chang & Shinozuka (2004); Davis (2005); Tierney & Bruneau (2007); Norris et al. (2008).	Redundancy; strength; availability of resources (resourcefulness); rapidity/capacity for mobilization.
Socio-ecological systems	Walker et al. (2004); Folke et al. (2010).	Resistance; latitude; precariousness; panarchy, persistence; adaptability; convertibility.
Ecosystems	Adger et al. (2005); Gargiulo C., Zucaro F. (2015); R. Papa, A. Galderisi, M. Vigo Majello, E. Saretta (2015); Colucci (2012).	Sustainability; diversity; redundancy; space organizations
Economic systems	Van der Veen et al. (2005); Briguglio et al. (2008).	Redundancy; sustainability; transferability; efficiency; rapidity; flexibility.
Urban communities	Chuvarajan et al. (2006).	Diversity; redundancy; self-organization; storage; networks; innovation; individual capacity; spatial interactions; temporal

		interactions; self-confidence; feedback.
Social systems	Maguire & Hagan (2007)	Resistance; resilience; creativity.
Social-ecological and economic systems	UNESCAP (2008)	Redundancy; strength; availability of resources.
Infrastructural systems	McDaniels et al. (2008)	Strength; rapidity.
Organizational theory	Gibson & Tarrant (2010)	Resistance; reliability; flexibility; redundancy.

Tab.1 Synthesis of literature for tge capacity of resilience

In table 2, after data sorting (figure 1), terms characterized by major occurrences in scientific literature can be deduced.

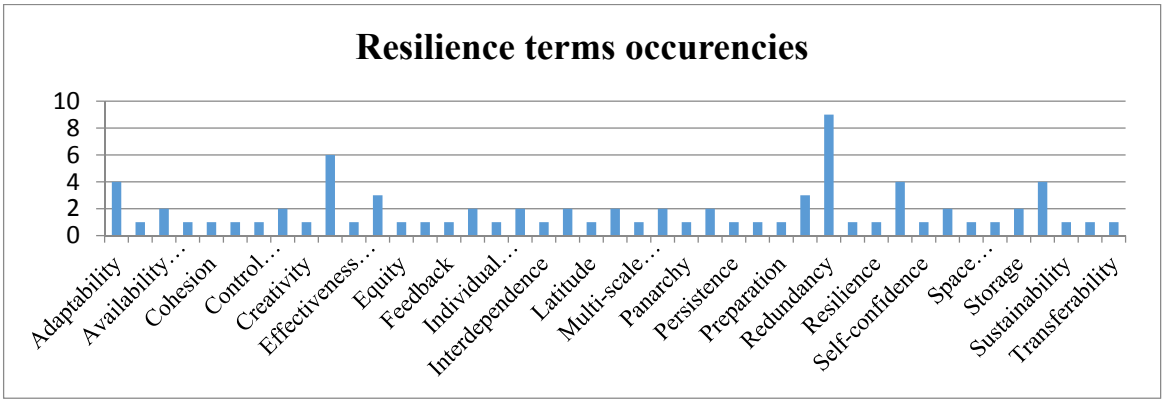

Fig. 1 Major resilience term occurrences in scientific literature

3 METHODOLOGY

The proposed methodological approach is based on some sequential phases. First of all, the resilience attributes, considered as prevalent inside the data set identified from literature review, have been defined starting from figure 1. The second step was the definition of the geographical features, in terms of the reference variables and relative levels of their respective variations, according to which stratify the data of the analysis to be conducted. In the present work, three urban geographical variables have been considered: size, latitude and type. Three levels of variability have been considered as well, as shown in table 2.

	Level 1	Level 2	Level 3
Size	Small	Medium	Metropolis
Latitude	South (S)	Middle (M)	North (N)
Type	University City (UC)	Cultural and Tourustic City (CC)	Industry City (IC)

Tab.2 Variables and level of geographical characterizations

Through appropriate filters related to the different levels of table 2, set in the processing software, the data were stratified according to their different geographical determinants.

In the following discussion, the main characteristics of the "type" characterizations of geographical determinants are chosen:

- *University City,* University cities are characterized by a young and lively context, innovative but with a long academic history. In fact, the element that unites the Italian university cities, similar to European ones, is represented by an almost oxymoronic union between rooted tradition and a propensity to the future. In the described context of these university cities, access to knowledge resources is potentially favored;

- *Cultural and Touristic City,* the touristic and cultural cities are those characterized by large tourist flows, as they are rich in monuments, churches, castles, museums, and historic houses. All preserve a historical, artistic, and architectural heritage that relate centuries of history. Often characterized by an urban fabric that preserves its original structure, whether it is a castrum or a medieval village, Italian cities of art represent vestiges of the times, frozen in their transformations. Marked by the activity of great artists and patrons, these cities are not only the container of relevant artistic expressions but are themselves works of art, characterized by festivals and theaters that combine traditions, culture, and entertainment;
- *Industry City,* Industrial cities are those cities polarized as an organizational and life model, mainly, to the presence of industries. Typical Italian industrial cities are Turin, a Fordist city par excellence thanks to FIAT, and Taranto which has the ILVA plant.

Next a correspondences matrix between resilience attributes and main urban characteristics is defined. These characteristics are Living, Environment, Mobility and Legality as shown in table 3, while sub-variables and metrics of these four variables are reported in the Appendix.

To assess the resilience of Italian cities with respect to these four identified urban variables, and for which data are available concerning both 2015 and 2016 through the source of the Icityrace report, two conditions have been considered in the analysis, in compliance with the pure definition of the concept of urban resilience:

- the first condition is the presence of low values of urban indicators;
- the second condition is the presence of a detected variation delta Δ for the variables of the first condition.

In this way, resilient cities can be characterized as those that, starting from a negative situation, reacted positively.

For those cases in which the data of the analysis will show a great intensity for this resilience action, the municipality policy and programmatic guidelines of those cities will be also analyzed to confirm the deterministic and non-random will of a municipality regarding the positive variation detected concerning these specific urban variables.

The results of the analysis shown in the next section will highlight, in the first case, a geographical dependence on urban variables and, in the second case, a possible relationship between some resilience attributes and geographical features, thus satisfying the objectives of the work.

4 DATA ANALYSIS

The analysis was conducted by considering the last 50 Italian cities from a total of 106, in the Icityrace 2015 ranking for each of the four urban variables: Living, Environment, Mobility, and Legality. These samples, each of them consisting of 50 units, represented cities with the worst values for the four variables considered. Then, for the same cities from each of the four samples, the respective values for the year 2016 were evaluated and the change, positive, null, or negative was used as a resilience metric.

Figures 2, 6, 10 and 14 show the variations of each city for each urban variable in decreasing order, while figures 3-5, 7-9, and 11-13 show the stratifications of data relative to figures 2, 6, 10 and 14 according to the three geographic variables chosen by size, type, and latitude, and according to their three variation levels (as shown in table 2).

	Urban Variables			
Resilience Attribute	*Living*	*Environment*	*Mobility*	*Legality*
Adaptability	▲	▲	▲	▲
Autonomy				
Availability of resources				
Capacity for mobilization			▲	
Cohesion	▲			▲
Collaboration			▲	▲
Control mechanisms		▲		
Convertibility	▲	▲		
Creativity	▲	▲		
Diversity				
Effectiveness and reliability of institutions				▲
Efficiency		▲	▲	
Equity				▲
Experience				▲
Feedback	▲	▲	▲	▲
Flexibility	▲			▲

Tab.3 Corresponding matrix

4.1 LIVING

The living dimension measures the livability of a city in terms of basic services and personal security as well as social cohesion, cultural offering and job opportunities. Therefore, in reality, the overall rating summarizes variables for which the distribution is extremely heterogeneous.

Global data shown in figure 2 reveals an almost univariate distribution more shifted towards positive variations rather than negative ones. The data stratifications in terms of geographical characterizations are reported in figures 3, 4 and 5.

From stratification data in figure 3 it emerges that the small and medium cities are characterized by better changes than the metropolis cities. Some sub-variables (see Appendix) such as school dropouts, infancy care, and elderly assistance have a very positive effect on the medium-sized size of cities, compared to other sub-variables such as amenities and entertainment, and the offer of cultural internationalization that are better for big cities. But the data clearly reveals a predominance of the medium-small size for the living variable.

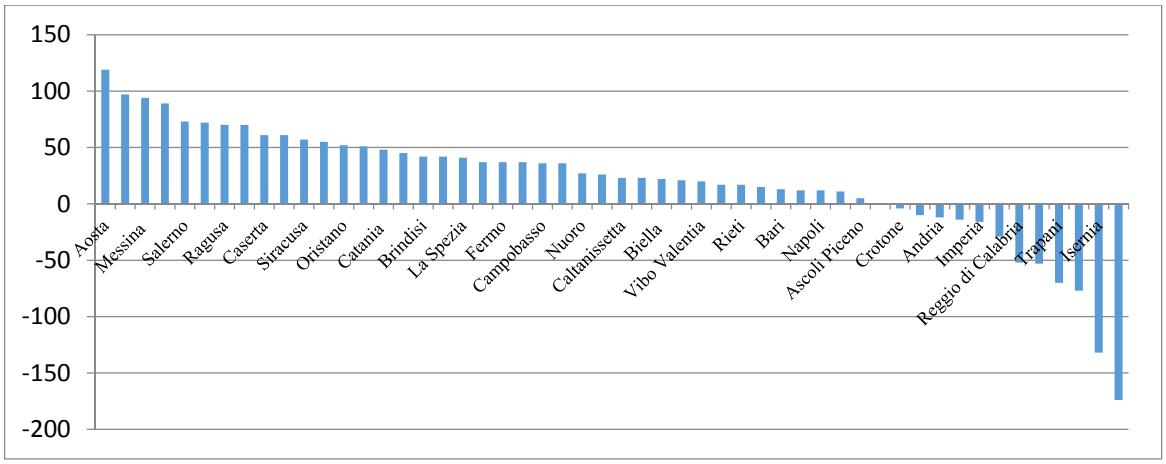

Fig. 2 Δ Living

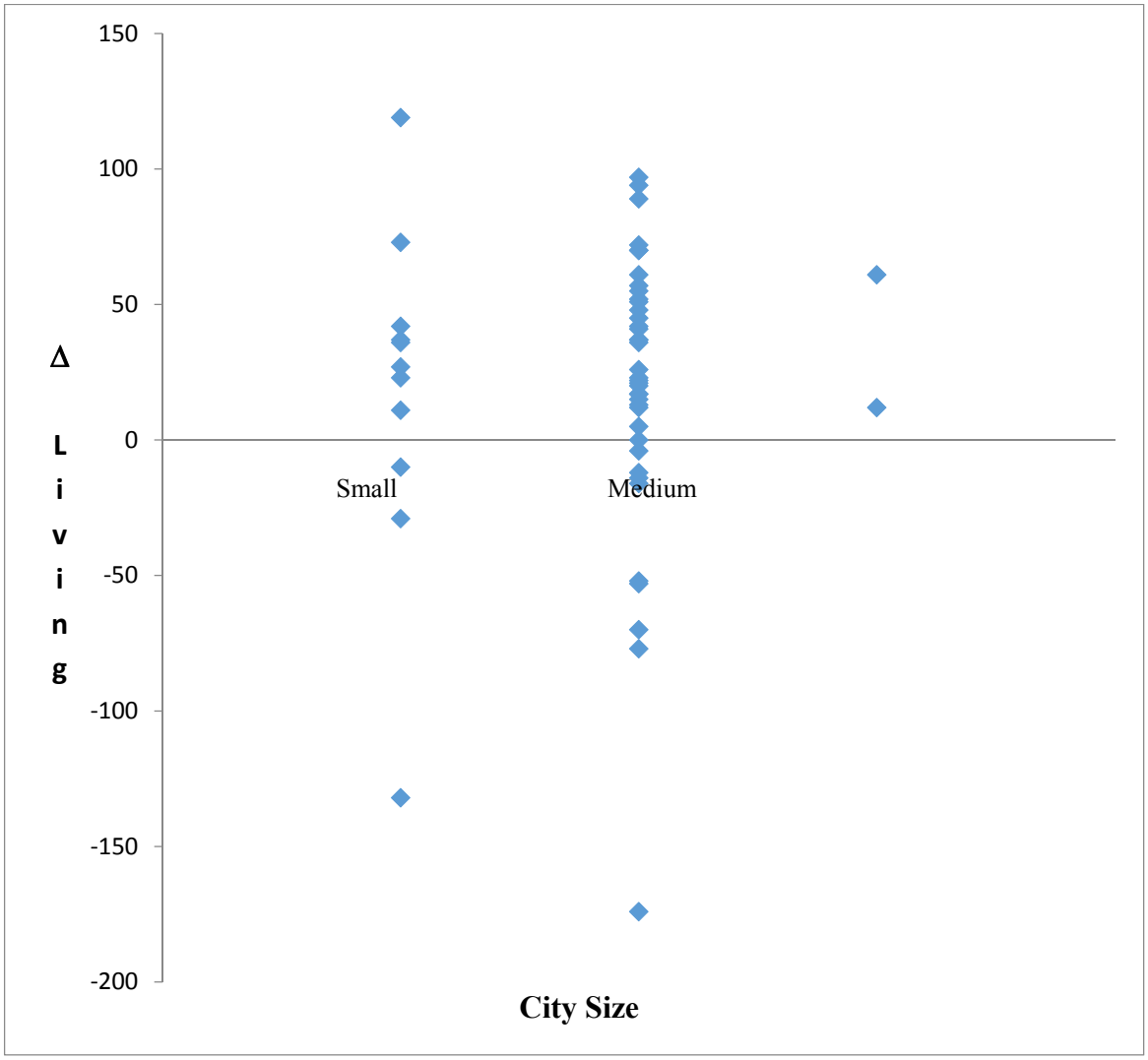

Fig. 3 Δ Living – size stratification

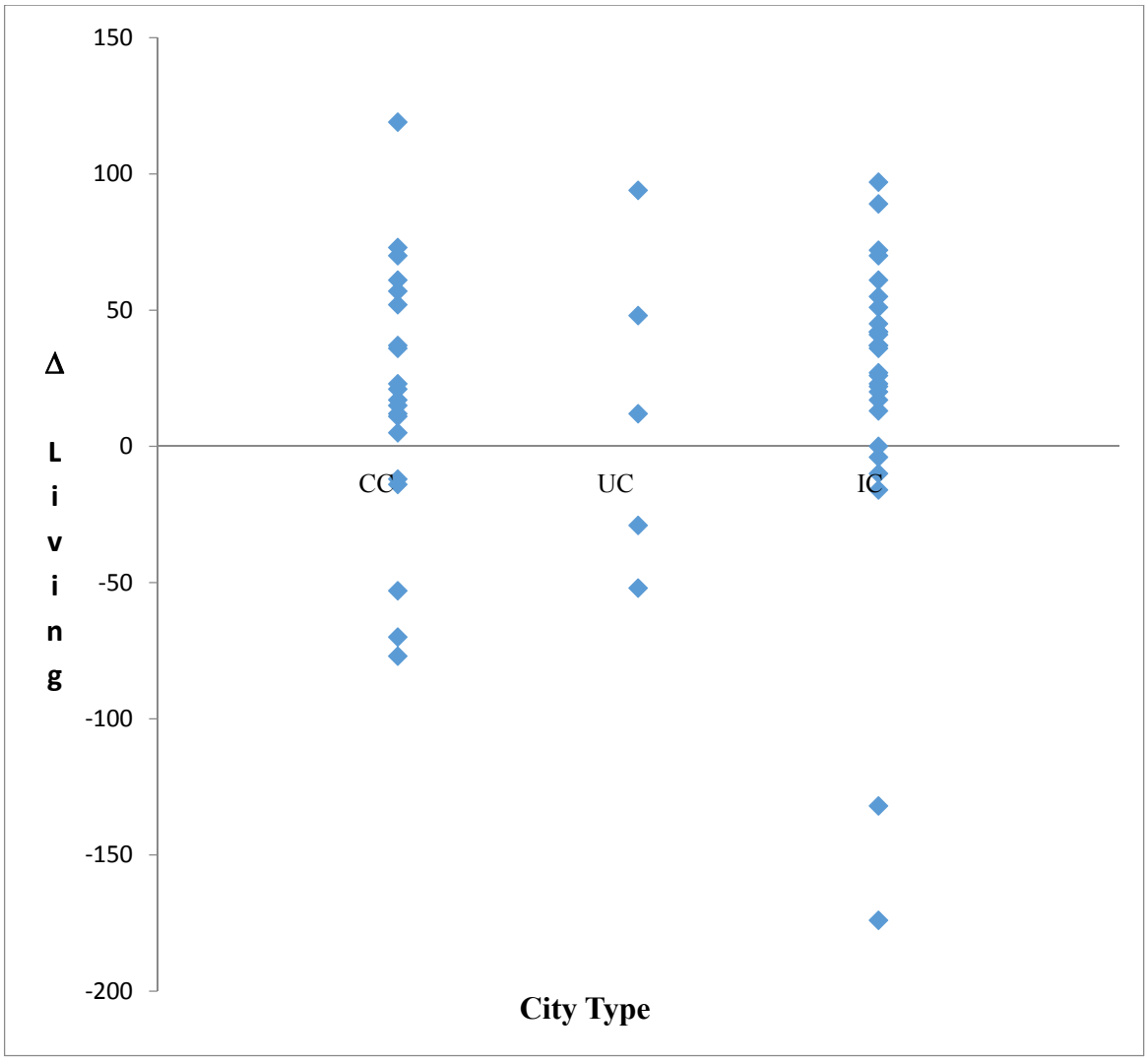

Fig. 4 Δ Living – type stratification

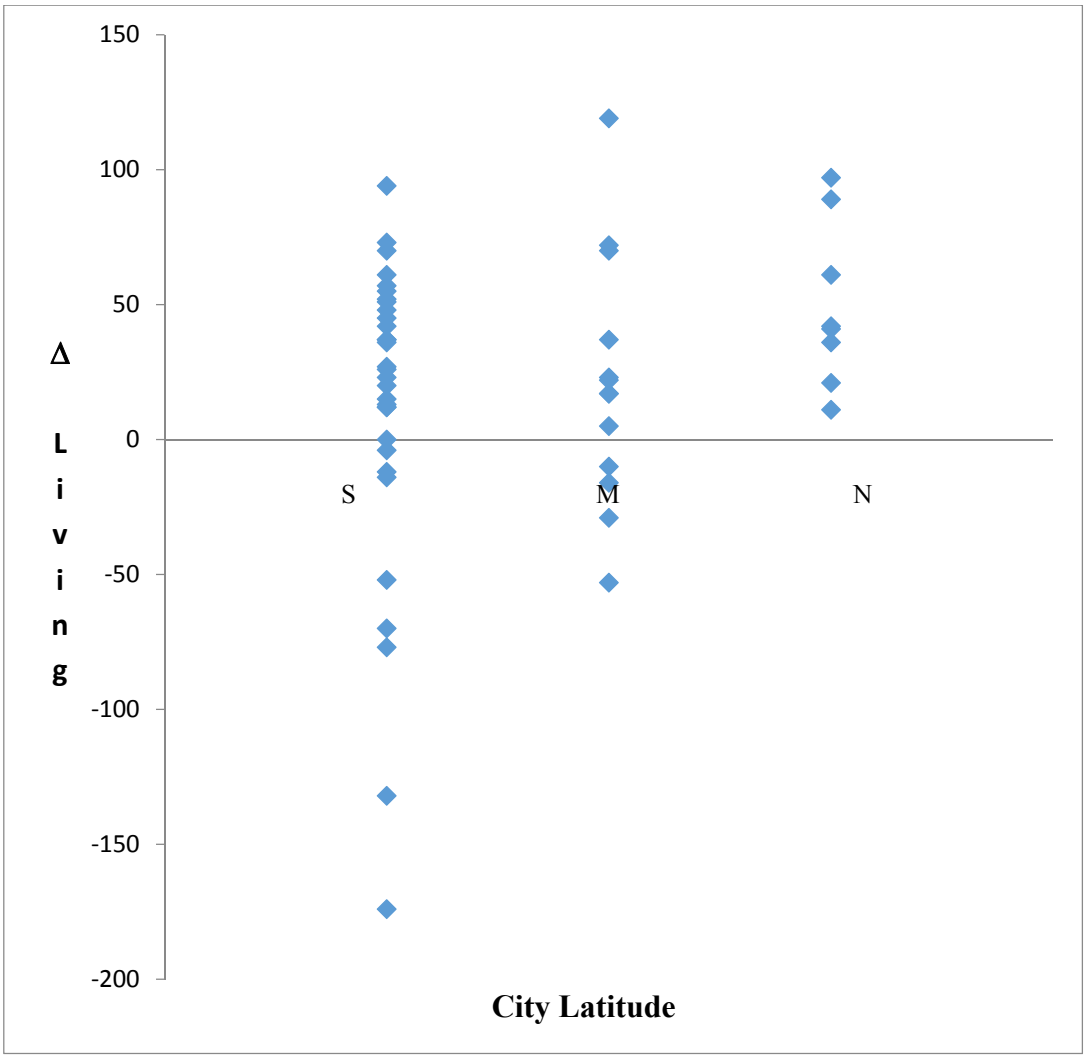

Fig. 5 Δ Living – latitude stratification

As shown in the graph stratification of figure 4, cities, regardless of their type, are in most cases prone to positive variations in regard to living. Thus the distribution of resilient actions can be considered uniform.
The stratification of data by latitude confirms an intense resilient action on urban livability in the cities of middle and northern Italy, while for the southern cities, even there is some positive data, it still shows many negative deviations, indicators of a degradation process that has not stopped.

4.2 ENVIRONMENT

The environment dimension describes the environmental sustainability of cities. The metrics, as shown in the Appendix, are oriented towards quality environmental protection measurement and public protection policies. Global data shown in figure 6 reveals a symmetric balanced bi-variate distribution. The data stratifications in terms of geographical characterizations are reported in figures 7, 8 and 9.

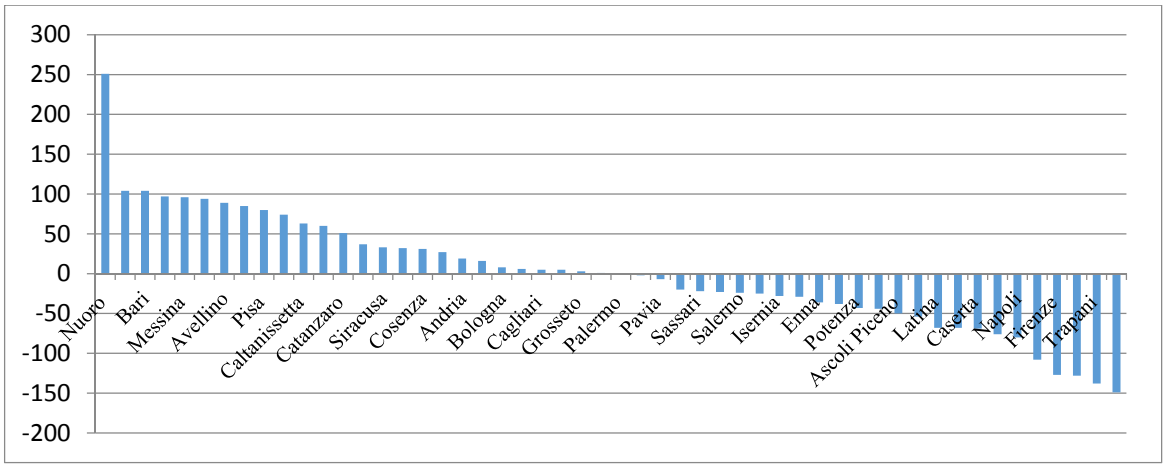

Fig. 6 Δ Environment

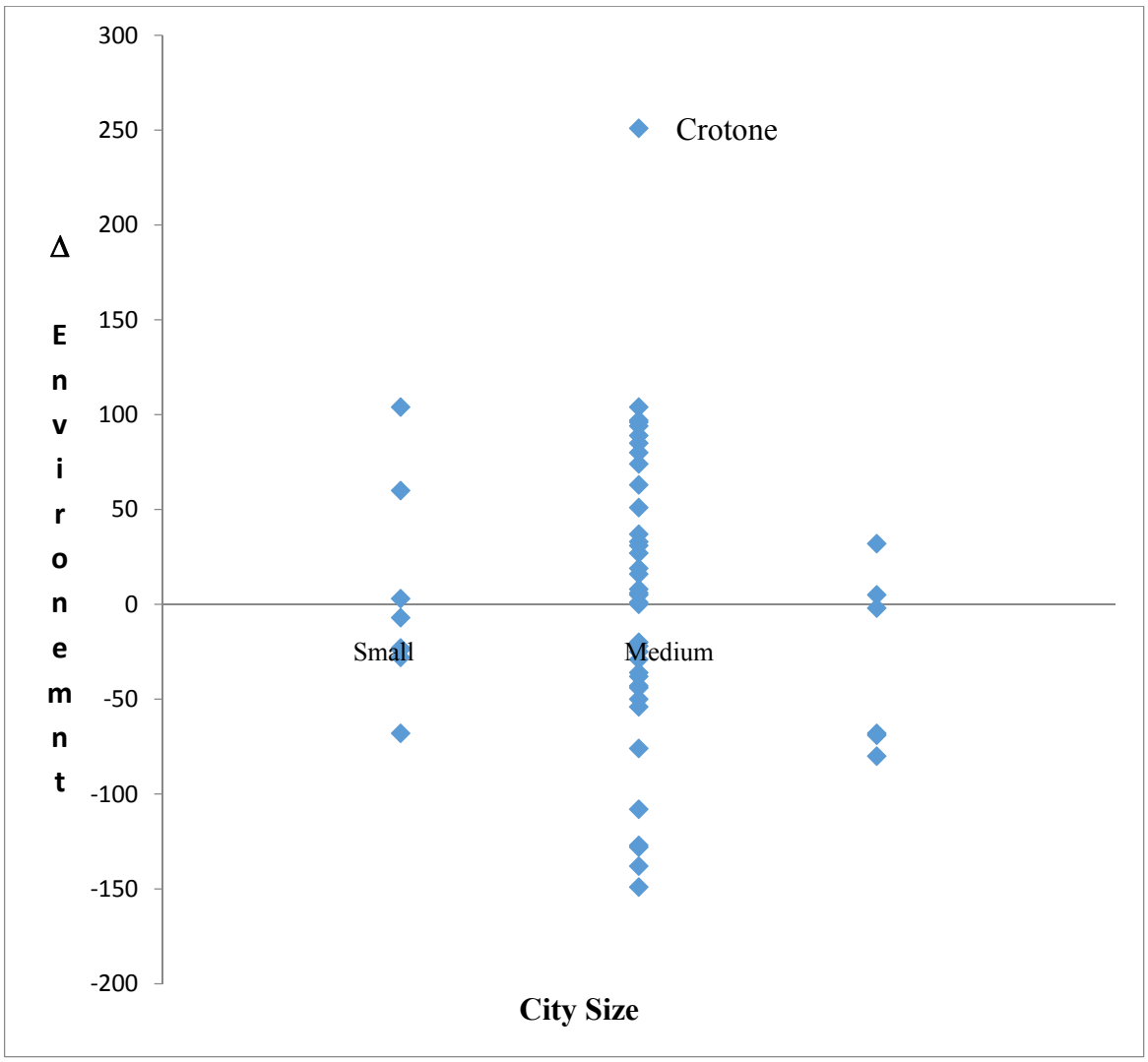

Fig. 7 Δ Environment – size stratification

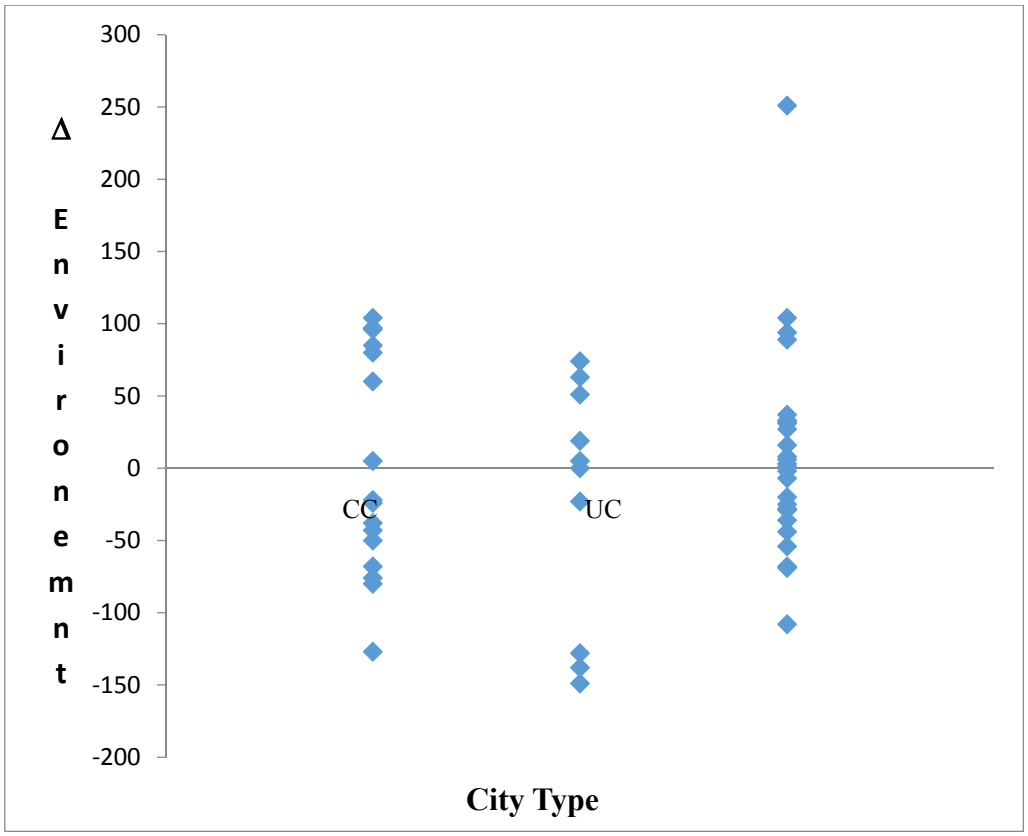

Fig. 8 Δ Environment – type stratification

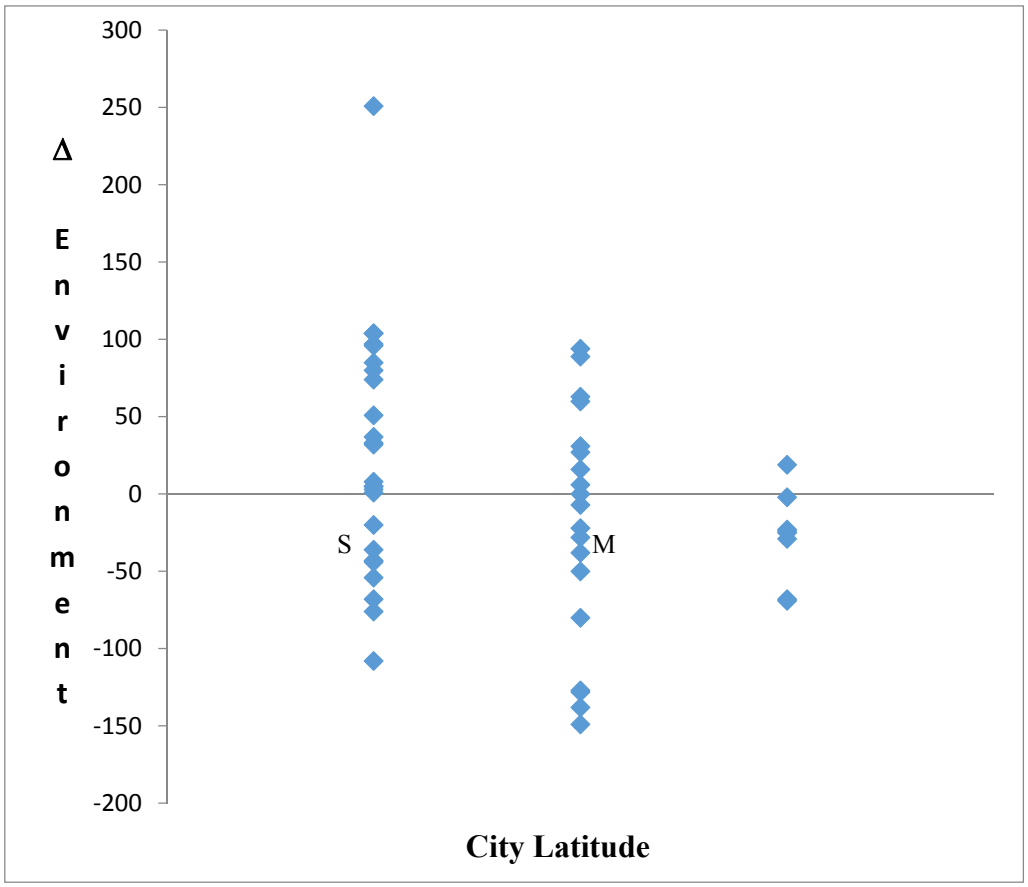

Fig. 9 Δ Environment – latitude stratification

In all cases, the stratifications both in urban size, type, and latitude as shown in figures 7,8 and 9, reveal an almost uniform bi-variate distribution, as global data profiles, representative of an Italian scenario in which both small and medium-sized cities are equally divided between those that have implemented the SEAP (Sustainability Environment Actions Plan) with innovative solutions for the use of renewable energy sources in their territories with the European objective of reducing carbon emissions by 20% by 2020, and those still unable to adopt solutions for the implementation of policies in the field of sustainable energy.
The geography of the resilience on the environment of Italian cities attenuates, at least partially, the ancient North-South difference.

4.3 MOBILITY

The mobility dimension measures the capacity of cities to promote models of sustainable mobility. The variables considered in the field of mobility synthesize the external accessibility and the internal fluidity of cities and their commitment to improvement.
Global data shown in figure 10 reveals an imbalanced bi-variate distribution almost shifted on the side of negative variations. In terms of geographical characterizations the data stratifications are reported in figures 11, 12 and 13.

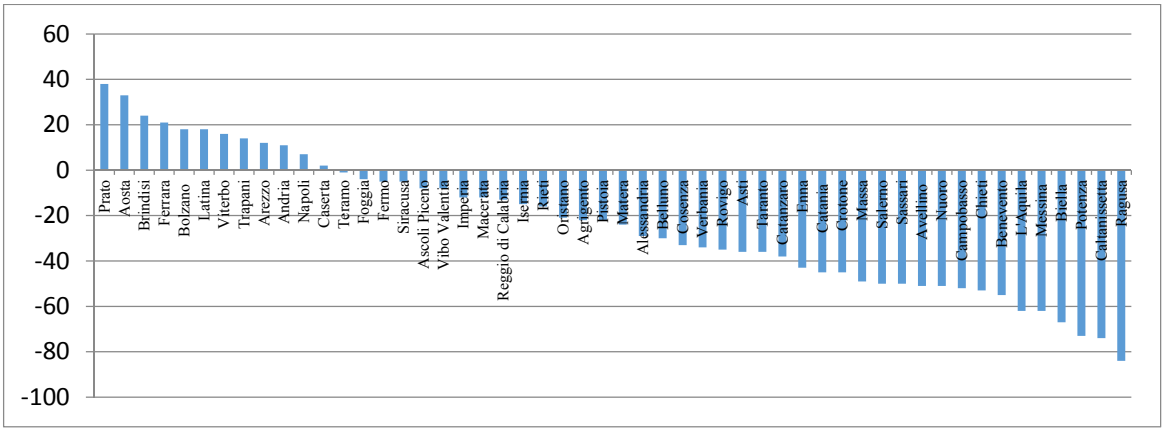

Fig. 10 Δ Mobility

With the exception of only two big cities that have shown an increase in the value of the variable compared to the low values from which they started the previous year, most cities, both small and medium, show signs of deterioration in mobility. Considering the indicators taken in analysis for mobility, shown in the appendix, the scenario highlighted by the stratifications is in compliance with a phenomenon, unfortunately, known for the Italian cities concerning distance compared to the target mobility parameters of European cities: cycle paths, shared transport, as well as green and efficient transport services.
The phenomenon of low resilience in the field of mobility does not show exception, even for the university cities, where it seems easy to imagine a relevant contribution of technologies to improve the efficiency of transport and, above all, to make them greener and sustainable.

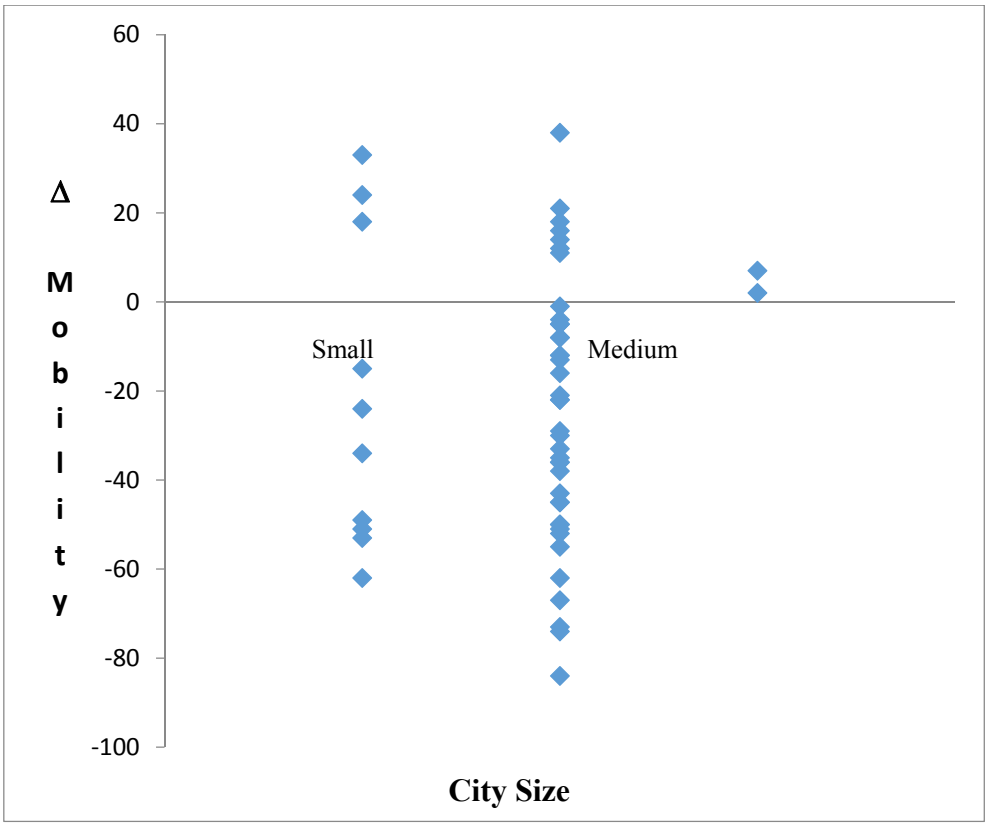

Fig. 11 Δ Mobility – size stratification

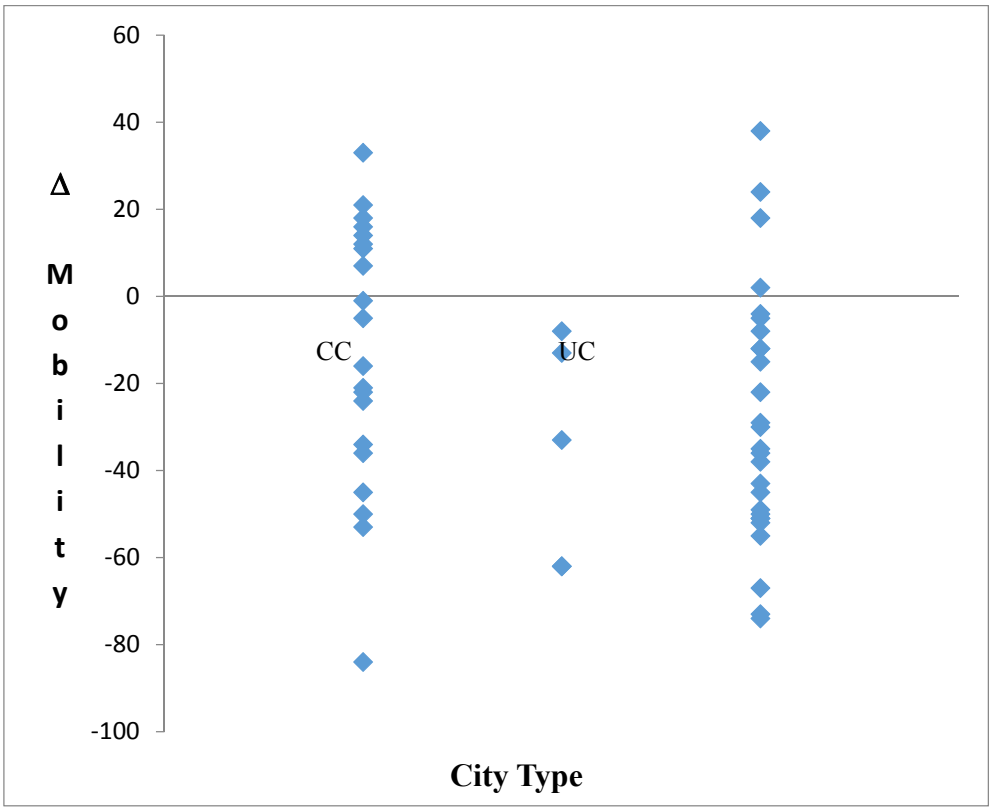

Fig. 11 Δ Mobility – tstratification

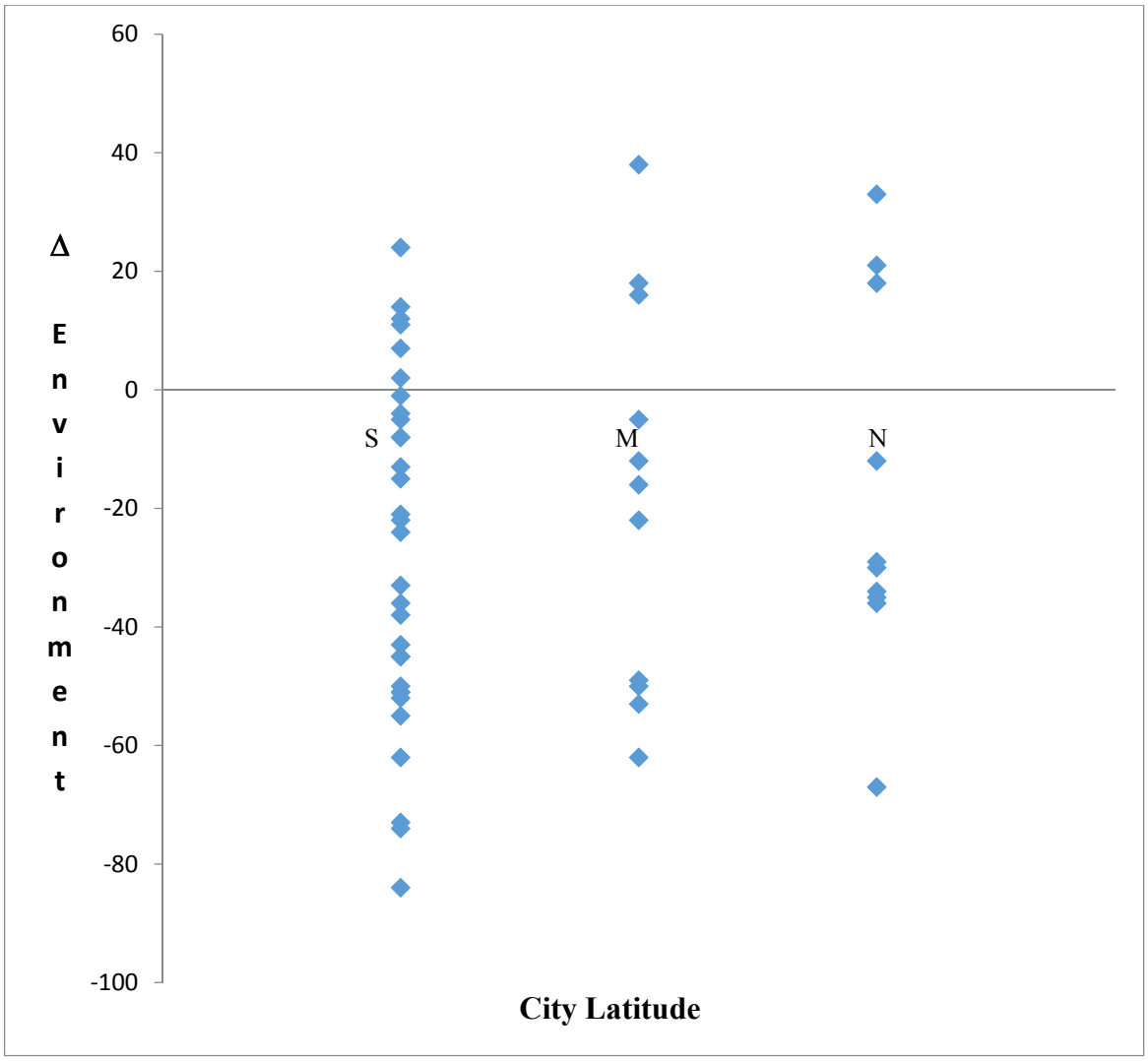

Fig. 13 Δ Mobility – latitude stratification

4.4 LEGALITY

The legality dimension describes the secure social network of cities and administration efficiency.

Global data shown in figure 14 reveals almost a positive (and very positive) distribution with only a few cities as outliers (Isernia, Latina, Catania, Nuoro and Naples), therefore also the data stratifications in terms of geographical characterizations as reported in figures 15, 16, and 17 show the same profile for each of the geographical determinants.

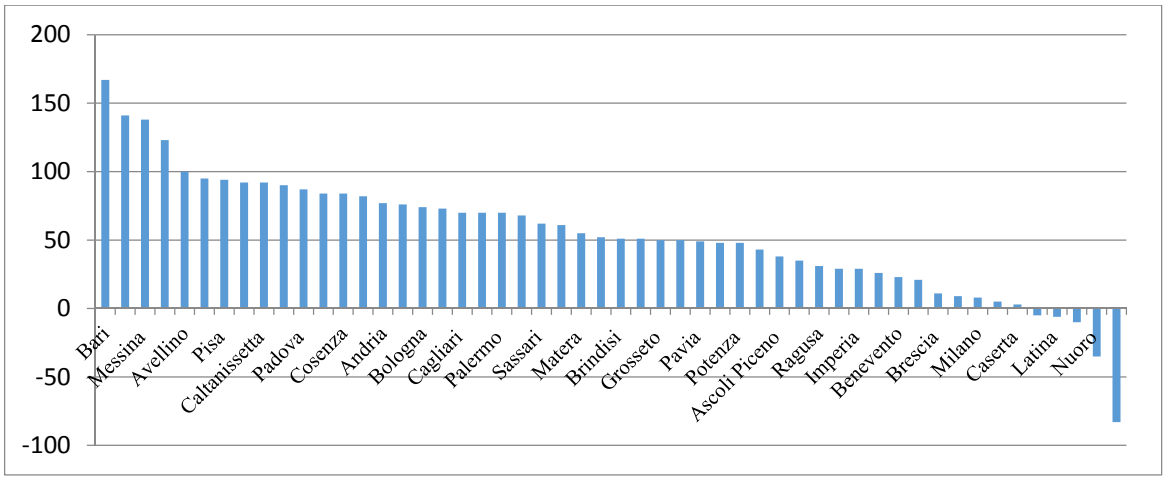

Fig. 14 Δ Legality

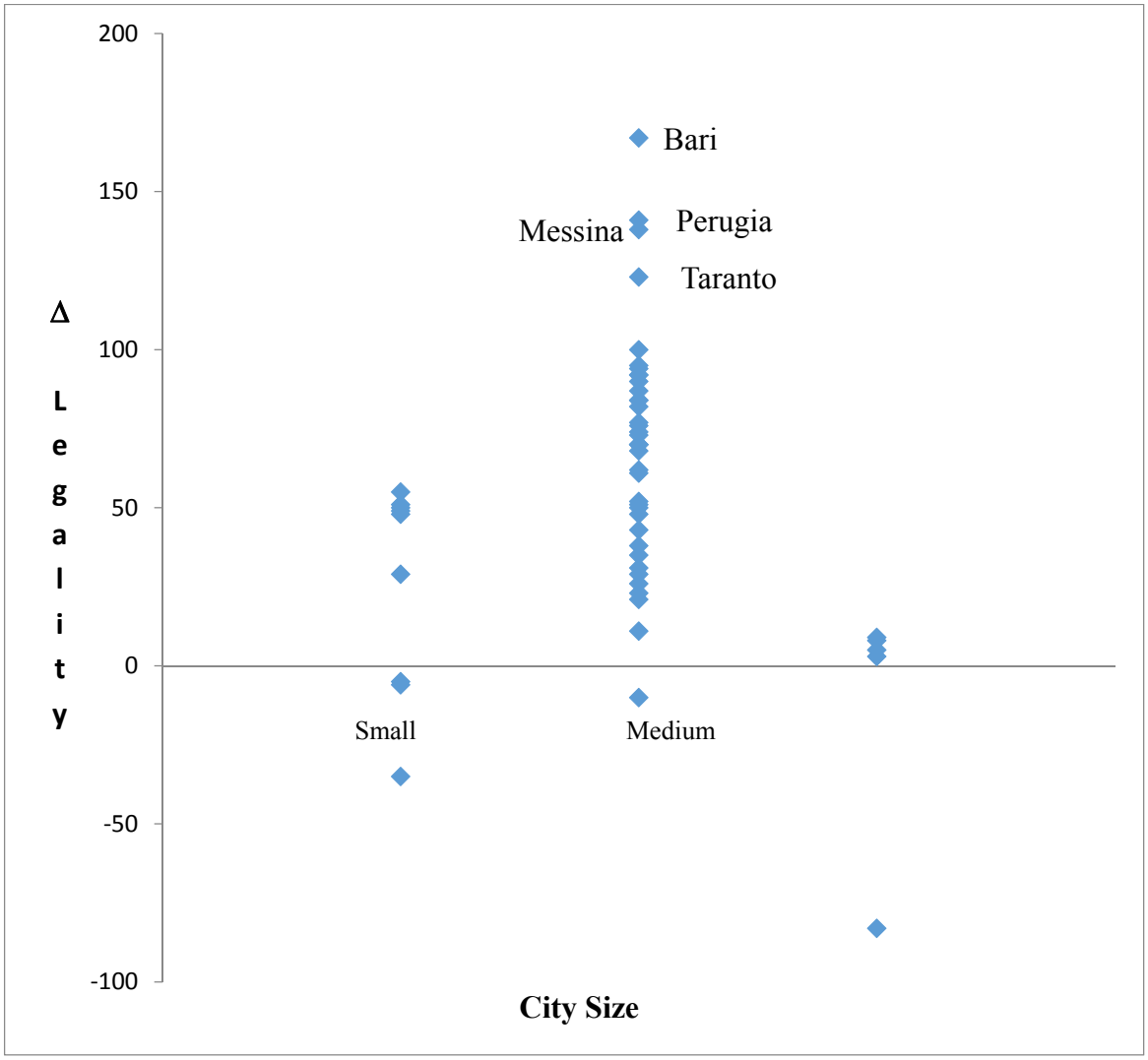

Fig. 15 Δ Legality – size stratification

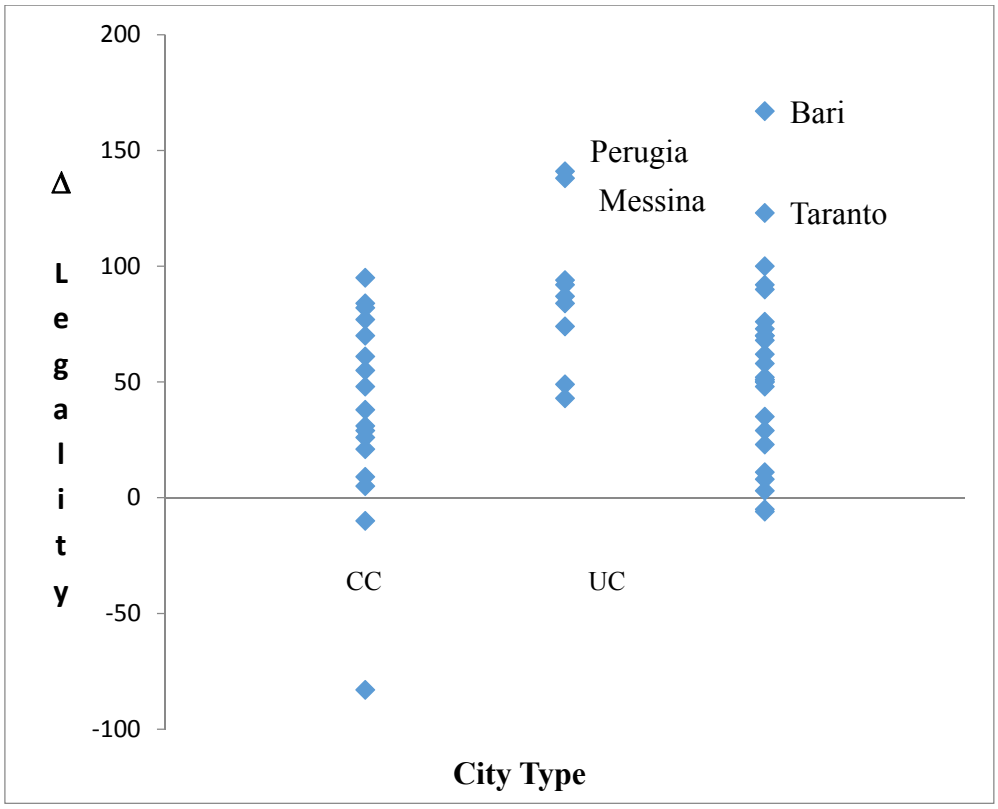

Fig. 16 Δ Legality – type stratification

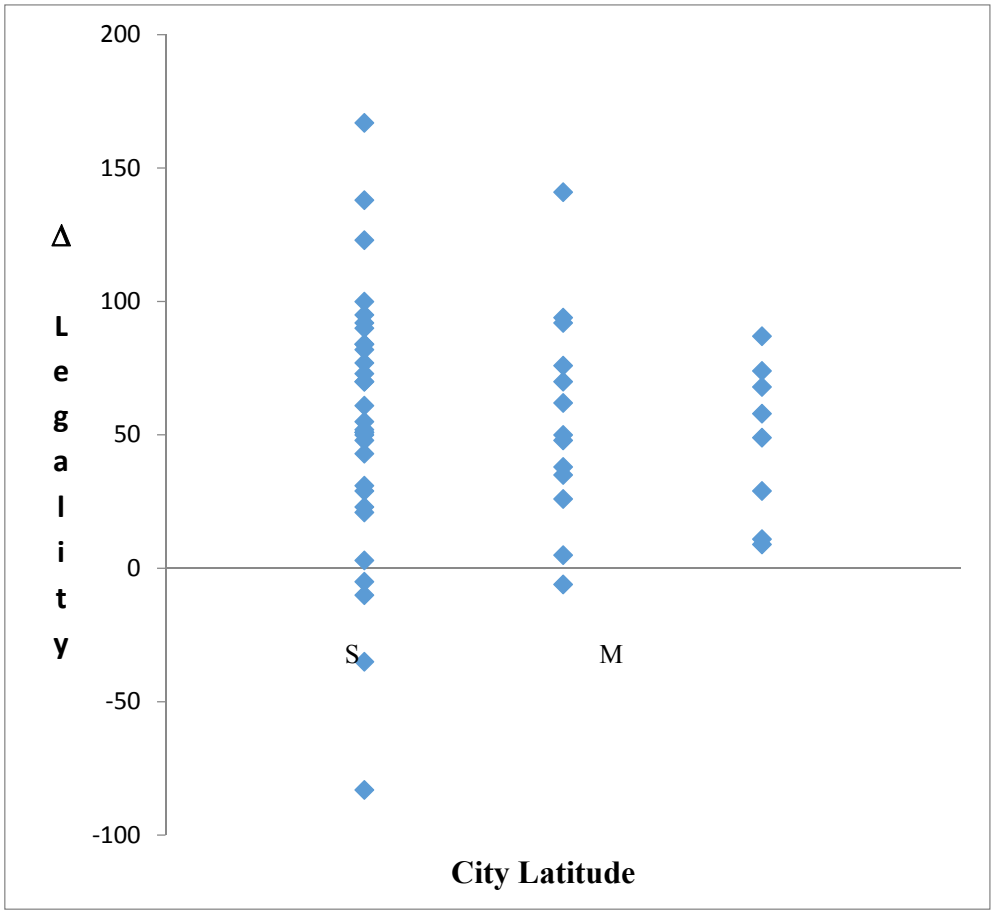

Fig. 17 Δ Legality – latitude stratification

5 CONCLUSIONS AND FINDINGS

The present work has proposed a geographic approach to the theme of urban resilience in order to verify the eventual relationship between some geographical and some urban variables involved in urban resilience actions. From the analysis carried out on data related to the scenario of Italian cities, the following paradigms emerged. Both the medium-sized cultural and industrial cities of the South are those characterized by a medium to high increase in the Living variable. Unlike the medium-sized cities, both small and large cities and northern cities have not been sensitive to the theme of the environment and there are no significant differences between cities of different types (as data are uniformly distributed). Only the medium and southern cities have proved sensitive to the issue of mobility and, as shown in figure 10, the deviations for this variable were generally quite negative. Finally, the southern medium-sized cultural and industrial cities are those characterized by a medium to high increase in the Legality variable.

Among the geographical variables, the one that seems to have the greatest influence on the processes of variation in urban variables is size; in fact, the middle cities have proved to be the most sensitive (both positive and negative) to the detected deviations. Understanding the phenomena of influences between geographical variables and urban variables can be a strategic element for all local stakeholders in terms of choosing appropriate assets, specific to that city or territory, through which to express the best resilience actions.

In fact, the principles and abilities related to the resilience approach can support a general framework and strategic visioning which is able to move and activate different interests and stakeholders (citizens, institutions, private sectors, professionals, academics and educators) towards integrated multi-issue projects. Existing trends and initiatives, and new polices and projects need to be integrated with a strategic vision (on a regional, metropolitan, or territorial scale, and at the local level), in order to be supported by technical and methodological innovative instruments that are able to orient the decision-making process and lead to the implementation of innovative governance solutions (Colucci, 2015).

Therefore, a geographic determinism can be considered in the phenomena of urban resilience and through the correspondence in table 3 it is possible to obtain a further correspondence between geographical characteristics and resilience's attributes as shown in table 4.

Geographical Characteristics	Resilence's Attributes
Medium-sized Cultural and Industrial Cities (E.g.: Aosta, Novara, Messina, Rovigo, Salerno, Cagliari, Ragusa, Sassari, Caserta, Pordenone, Siracusa, Benevento, Oristano, Enna)	Adaptability Cohesion Convertibility Creativity Feedback Flexibility
Medium-sized Cities of Middle and South (E.g.: Bari, Perugia, Messina, Taranto, Avellino, Lecce, Pisa, Siena, Caltanissetta, Catanzaro, Padova, Siracusa)	Adaptability Control mechanisms Convertibility Creativity Efficiency Feedback
Medium Southern Cities (E.g.: Brindisi, Caserta)	Adaptability Capacity for mobilization Collaboration Efficiency Feedback
Southern Medium-sized Cultural and Industrial Cities (E.g.: Bari, Messina, Taranto, Avellino, Crotone, Oristano, Lecce, Cosenza, Caltanissetta, Catanzaro, Siracusa, Agrigento)	Adaptability Cohesion Collaboration Effectiveness and reliability of institutions Equity

Tab. 4 Relationship between geographical characteristics and resilience's attributes

For those cases in which the data of the analysis showed a great intensity in those resilience actions, the municipality policy and programmatic guidelines of those cities, regarding 2015, have also been analyzed. This confirms the deterministic and non-random variables, and the declared will of the municipality regarding the positive variation detected about these specific urban variables as shown in table 5.

Urban Variable	City	Programmatic Policy Guidelines	Source
Living	Aosta	▲	Aosta Official Municipality Website
	Novara	▲	Novara Official Municipality Website
	Messina		Messina Official Municipality Website
	Rovigo		Rovigo Official Municipality Website
Environment	Bari		Bari Official Municipality Website
	Perugia	▲	Perugia Official Municipality Website
	Messina		Messina Official Municipality Website
	Taranto	▲	Taranto Official Municipality Website
Mobility	Prato	▲	Prato Official Municipality Website
	Aosta		Aosta Official Municipality Website
	Brindisi		Brindisi Official Municipality Website
	Ferrara	▲	Ferrara Official Municipality Website
Legality	Crotone	▲	Crotone Official Municipality Website
	Isernia		Isernia Official Municipality Website
	Oristano	▲	Oristano Official Municipality Website
	Catania	▲	Catania Official Municipality Website

Tab. 5 Random and determinism analysis of resilience trough municipality programmatic policy guidelines

In most cases, the result obtained from the data available from the official municipality website of each city demonstrates that the positive resilient action which emerged from the analysis of this work is explicitly provided in the programmatic policy actions, therefore demonstrating an evident cause-effect deterministic character of such actions and not a statistical error. The proposed work, also if somewhat based on an observatory window, showed that resilience is a possible cultural paradigm change for Italian cities and the ability to be resilient in terms of efficaciousness in urban strategy it is necessary to take the influence of geographic determinism in count.

Urban Variable	Sub – variables	Metrics
Living	Economic suffering	Declaration number less than 0 euro + number of declarations 0-10.000 euro/ Total number of declarations
	Coworking	Percentage of co-working services on the total recorded in Italy
	Urban attractivity	Index of the migratory balance 2015 (migratory balance 2015 / population 1 January 2015 x 1.
Environment	Nets for sustainability	Number of municipalities that have reached step 2 or 3 of the SEAP (Sustainability Environment Actions Plan) over total municipalities in the province
	Common Sspaces	Urban green area for urban gardens, equipped green areas, sports areas outdoors / per capita
Mobility	Railway utility	Share of stations gold, platinum, silver on the total
	Bikesharing	Availability of bicycles for 10 thousand inhabitants
Legality	Organized crime	Ranking of provinces for the presence of crimes related to organized crime (average 2010 - 2013; Italy index number = 100)
	Commercial illegality	Ranking of provinces due to the structural presence of commercial illegality, crimes reported per inhabitant (average 2010 - 2013, values normalized, Italy = 100
	Recycling	District ranking by the structural presence of money laundering crimes (average 2010 - 2013, Italy index number = 100)
	Voluntary homicides	Voluntary murders consumed per 100,000 inhabitants (number per thousand inhabitants)

Appendix. Source: Author's elaboration on Icityrace data

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IMAGE SOURCES

Fig. 1; 2; 3; 4: 5; 6; 7; 8; 9; 10; 11; 12; 13; 14; 15; 16; 17: Author's elaboration

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MONITORING USER-BASED ACCESSIBILITY ASSESSMENT IN URBAN ENVIRONMENTS AND IN PUBLIC BUILDINGS

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ABSTRACT
The research features analysis of user-experience-based accessibility assessment and progress monitoring of buildings and public spaces; this analysis is used as a tool for facilitating the development of humane, socially sustainable and an inclusive urban environment and architecture. A group of users representing people with different kinds of disabilities, the elderly and families with children was created to assess the quality of physical access to the buildings of different functions and locations across the cities of Vilnius, Lithuania and Singapore, Republic of Singapore. A school, two hospitals, a rehabilitation centre and two offices were selected for access monitoring in Vilnius City, while a hotel, a café and two metro stations with public squares were chosen for access assessment in Singapore (Fig. 11). The article draws a comparative analysis on accessibility of the selected buildings in Vilnius City and in Singapore where the same pre-tested method was applied to assess accessibility in 2000 – 2017. The results show a definite improvement of access quality over time and identify the critical aspects of urban spaces and buildings. The segment of plot planning represents the lowest quality of access for all assessed building types as compared to the building segment and the external–internal element segments. The paper also draws conclusions that access improvement is a continuous process of implementing advanced urban policy instruments, and city planners can contribute to it by constantly analysing and presenting to public the monitoring data about the progress in accessibility of buildings and urban spaces. Comparing the assessment results between Vilnius City and Singapore – cities that are located in different global regions and in different socio-economic environments – provides a practical tool for benchmarking, monitoring and prioritising this process.

KEYWORDS:
Accessibility; Architecture; Urban Planning; Regulation; Assessment.

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监控城市环境与公共建筑的基于用户的可达性评定

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摘要

本研究分析了建筑与公共场所的基于用户体验的可达性评定与进程监控；本分析被用作促进人文发展、社会可持续发展与包容性城市环境与建筑的工具。成立了一个代表各色人等：残疾人、老人、有子女的家庭的用户小组，以评估立陶宛维尔纽斯与新加坡等城市不同功能与位置的建筑物的实体可达性/出行（physical access）质量。在维尔纽斯选择了一所学校、两家医院、一家康复中心、两座办公楼用作可达性/出行监控，而在新加坡选择了一家酒店、一家咖啡厅、两个有公共广场的地铁站用作访可达性/出行评估（图 11）。本文对维尔纽斯与新加坡两市所选定的建筑的可达性进行了对比分析，而此相同的预测试方法也适用于 2000 – 2017 的可达性评定。结果表明，随着时间的推移，可达性质量有了一定的改善，并确定了城市空间和建筑的关键方面。与建筑部分和外部-内部要素（自然环境）部分相比，建筑用地规划部分代表了所有评估建筑类型的最低可达性/出行质量。本文还得出结论：改善出行条件是实施先进城市政策手段的一个持续过程，城市规划者可凭借不断分析和向公众展示建筑和城市空间可达性进展情况的监控数据来帮助这一点。对比位于不同的全球区域与社会经济环境中的维尔纽斯与新加坡城市之间的评估结果，为此过程的基准测试、监控与优先次序提供了一个实用工具。

关键词：
可达性；建筑物；城市规划；法规；评估

1 AIM OF RESEARCH

The research aims to analyse how the accessibility assessment method that was developed and pilot-tested by the author works in different urban settings and hopes to demonstrate its potentials for monitoring and improving the accessibility of publicly used buildings and urban spaces. The results of this research could be practically used for self-assessment initiatives by the assessed and many other institutions, urban planners, architects, property developers and users. The theoretical approach of the research rests on the methodology of reshaping urban environments by implementing advanced improvement programmes and assessing their results by evaluating, comparing and monitoring the consumer's perspective in local socio-economic environments (Bromley, Matthews, & Thomas, 2007). The research also aims to test the assessment tool for benchmarking the accessibility improvement process in different socio-economic and environmental contexts and therefore the author has selected the cities located in different geographical and cultural environments. It is expected that the compared and monitored assessment results can set the milestones for tracking and fine-tuning the accessibility progress in different environmental locations.

2 BACKGROUND

The researchers demonstrate a growing interest in the assessment of social processes. In the last two decades, the volume of papers in this field has increased immensely: in a Web of Science search on "assessment methods accessibility" (1996 – 6 items, 2017 – 196 items). Most of the papers had a background in the environmental, social and health sciences presenting the research in psychological, medical and bio-climatic aspects of person – environment interaction. The problems of better access to public environments and all kinds of services are frequently analysed as a policy instrument leading modern cities towards socially sustainable urbanism based on non-discrimination, justice and satisfaction for all city dwellers. Having integrated many additional user-friendly environment solutions, accessibility as a knowledge platform has advanced to the inclusive design with user-centred planning and design principles featuring a responsive, flexible, convenient and welcoming environment for all (Mulligan & Fletcher, 2006). In the current research, the accessibility assessment is extended beyond simple access to services and facilities – it also takes into account the qualities of safety, security and comfort in urban environments and in public buildings. This approach corresponds to a complex structure of socio-economic and environmental aspects of the built environment that most modern cities are implementing as their long-term strategy.

Politicians, practitioners and researchers look on urban access as a continuous process, with a clear goal of developing more inclusive and responsive urban communities. Therefore, those cities that have started the process earlier have achieved more by going further and could serve as a good case study for others. The process usually starts with setting a strategy, programming the process and planning adequate measures for accessibility improvement as land use plans for open spaces and buildings of the most diverse functions are drawn up (Stockholm, 2011). Recently, access assessment has focused on the elements of public mobility infrastructure, such as road crossings (Blecic et al., 2017), metro, bus and train stations. Multiple users' needs intersect in a limited space and existing obstacles not only increase the necessary connectivity time but also decrease the number of amenities and comfort for the users of this infrastructure (Sun, 2016). Specific aspects of a safe environment, such as outdoor lighting, are frequently analysed and outlined as having tremendous importance on movement safety and comfort of users in public areas (Johansson et al., 2011). Accessibility programmes currently are developed along with the general sustainability strategy, including life-cycle analysis of constructed buildings and economic, ecologic and cultural aspects of sustainability, and even deliver the platform of educational research for planning and design professionals as well as for city managers (Ahlberg et al., 2003). Creating eco-homes for eco-communities is based on a highest accessibility standards and practices, and the outcomes are assessed in all phases of development, from the concept to the built facility (Bhakta & Pickerill, 2016). Multiple external and internal space planning implications are resolved easily if one

looks at the issue from the perspective of the user, who is also a customer buying goods and services (Rosemary et al., 2007).

National and European standards regulate the accessibility features in design and construction, yet there are many specific cases that need individual solutions for providing users with a safer, easier and more pleasing access. The first comprehensive regulation in this field was launched in Lithuania in 1993, and upgraded in 2001 and 2010 (Statybos Techninių Reikalavimų Reglamentas STR 2.03.01:2001, 2001; Statybos Techninis Reglamentas STR 2.03.01:2001, 2010). Singapore, which is the next site of our interest, adopted the access legislation in 2007 (Accessibility Code, 2007), followed by the upgraded version in 2013 (Accessibility Code, 2013). In some countries – for example, in the United States, which has introduced the Americans with Disabilities Act (ADA) in 1990 and upgraded it in 2010 – building standards are accompanied by guidelines that present detailed comments, advice and examples for standard implementation (Americans, 1994; Guidance, 2010). There is research evidence showing that awareness of local authorities is higher than the knowledge needed for implementing the national accessible environment standards (Kamarudin, Hashim, Mahmood, Ariff, & Ismail, 2012). Indeed, accessibility requirements are horizontally integrated in regulation of urban planning, architecture, landscape, mobility, infrastructure and other sectors. Naturally, regulation reflects on national socio-economic and environmental priorities, and adjustments are made in time to meet these goals. Researchers often rely on the national regulation or global design standards if the national ones are vague or non-existent while shaping their evaluation tools (Meşhur, 2016).

Researchers globally apply different self-adapted or authority-recommended access assessment methods to measure and evaluate the quality of the built environment and different kinds of buildings. Accordingly, various assessment tools are developed. It is essential that these tools should correspond to the specific purpose, especially using the survey results: if the aim is to support the owners or managers of facilities to make them more accessible, then the assessment should be detailed enough to figure out the weak points of the said environment that need improvement (Calder & Mulligan, 2014, p. 28). Researchers focus their attention on accessibility at different scales, from public areas to buildings and to their interiors (Bromley et al., 2007) using the corresponding assessment tools. There are a number of assessment tools, such as checklists, questionnaires, interview forms, expert analysis etc., used to evaluate access quality. Calder and Mulligan recommend that researchers consider conducting psychometric assessments of the instruments to be used for an adequate sample size. In addition, easy-to-administer tools with clear scoring benchmarks have rendered more objective and reliable results (Calder & Mulligan, 2014). Still, the tools employing universal user experience for surveys that give the overall evaluation of internal and external qualities of buildings in the public arena are rare to find.

As accessibility is a universal urban paradigm and policy instrument that is implemented to last a long time, methods that allow for comparing and monitoring access progress are needed, and just few research attempts could be found in this area. As a result, benchmarking and comparative analysis are needed to measure and compare access qualities in different urban settings. Society is the major disabling force as it marginalises impaired people socially, economically and politically by allowing the creation of non-accessible spaces and buildings (Gabel & Peters, 2004; Shakespeare, 2006). Traditional city construction has often led to the emergence of inaccessible environments as it follows the sequence of using conventional solutions that turn into barriers for many citizens (Casas, 2007). As a result, impairment-affected individual disability to perform certain actions or functions confront the limiting factors of the environment, which lead to a person's handicap in private or public life and result in the person's isolation to various extents and prevent the person from participating in community and an active social life (Fig. 1). Multidimensional and inter-sectoral accessibility programmes have a goal to divert the process of person–environment interaction from the point of handicap to an accessible environment track (Fig. 2, top) by creating and implementing the complex accessibility approach. The results of these implementations preventing a person from falling into the trap of a handicap and are led back to a normal life track are analysed in this paper (Fig. 2, bottom).

Fig. 1 Traditional flow from personal impairment to disability

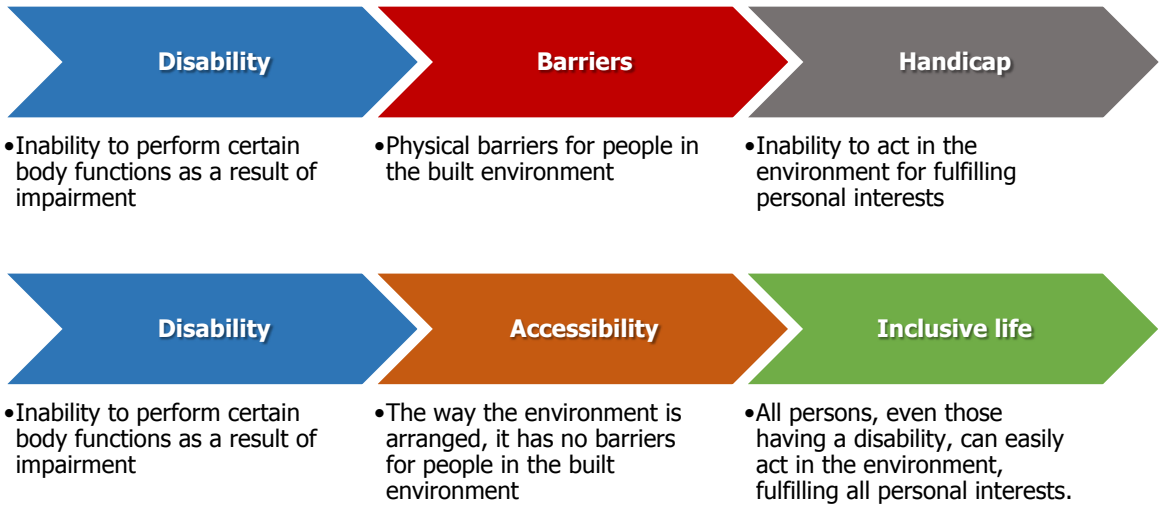

Fig. 2 The sequence of managing disability in barrier-full (top) and accessible barrier-free (bottom) environments

As it emerges from the background analysis, there is a need for a comprehensive, objective and easy-to-use system for access assessment and monitoring that fits different urban environments and diverse socio-economic conditions. The assessment tool should function over the variety of scales of urban environments from interior details, public and commercial buildings and to open spaces, mobility and infrastructure facilities. The assessment tool based on users' experience and clear scoring benchmarks could report on the access quality – both at the level of fundamental needs for safety and security, and the higher user's aspirations for comfort and satisfaction – as required by the universal design principles that emerged on the ground of accessibility philosophy and practice (Universal, 2007). Users' groups involved in assessment should cover a wide array of disabilities and could extend to the elderly and families with children.

Moreover, comparative analysis and monitoring of access quality progress is important in the fundamental and applied senses as it adds one more important quality segment to a highly complex planning and design agenda (Simon, 1962).

2 METHODOLOGY

A participatory access assessment method involving people with disabilities was created by the author and practically tested at several urban spaces and buildings in Vilnius City (Stauskis, 2017). The method features a comprehensive assessment matrix of 59 aspects for the assessors to report their on-site experience while testing by using the particular building's system or element. The same method, with some adjustments, was used to assess several public premises in Singapore in 2012 (Fig. 11) and in Vilnius in 2017. The paper draws an analysis based on the assessment results in Vilnius and Singapore, and discusses the trends that are specifics for these two cities.

At first glance, Vilnius and Singapore are two very different locations. However, there is an essential similarity in common for them and for many other urban centres. On the one hand, these cities are located in different geo-climatic and socio-economic regions: Vilnius – in North-East Europe, with a moderate cold continental climate, developing economy in an ethnically homogenous society; Singapore – in South-East Asia, with a hot tropical climate, ethnically heterogeneous society and world-leading economy. On the other hand, both cities are on the same path of improving accessibility of the urban environment and buildings by implementing different regulations in the context of regional traditions and economic potential.

Therefore, it is scientifically important, acceptable and practically adequate to evaluate accessibility in these two different places by using the same method and the same assessment tool. More, it is important to know how efficient is the assessment tool for monitoring accessibility of the same buildings over different time and to analyse the monitoring results.

The accessibility level of the selected facilities was assessed by a team of instructed evaluators according to the specially designed method that comprised a concise matrix of aspects covering different environment segments, structured over three levels: the site (i), the building (ii), and the details (iii). The assessment was carried out according to the original assessment methodology created and previously pilot-tested by the author in assessing several buildings in Vilnius City. The averages from the individual assessment scores were derived for each assessed accessibility aspect, for every environmental segment (i-ii-iii), and finally, for all facilities. As a result, the overall averages were derived for all assessed facilities of the assessment cycle for 2000, 2012 and 2017. The number of negative scores (0–4) granted by the assessors for all environmental aspects was accounted for in the same way. After accessibility was assessed for all aspects in the range of 1–10, the received results were normalised to a 0–1 range using formulas 1 and 2.

$$\mathbf{Z_i = X_i - X_{min} / X_{max} - X_{min}} \quad [1]$$

Z_i = i-th normalised value;

$X = x_1, x_2, \ldots x_i$;

X_{min} = minimal value of X;

X_{max} = maximal value of X;

The negative score numbers were normalised using the formula 2:

$$\mathbf{Z_{ni} = X_{ni} - X_{n-min} / X_{n-max} - X_{n-min}} \quad [2]$$

Z_{ni} – i-th negative normalised value;

X_{ni} – $x_{n1}, x_{n2}, \ldots x_{ni}$;

X_{n-min} – minimal negative value of X_n;

X_{n-max} – maximal negative value of X_n;

The original methodology was upgraded for the recent assessment cycle by including the evaluation the lowest assessment scores (0–4), which are an important indicator of the extremely low accessibility. As those elements of the environment that were given the lowest scores are principally non-accessible barriers that are critically limiting access to and usability of the whole facility and not just its part, the normalised non-accessible assessment scores were included in the final assessment as the diminishing criterion of the overall evaluation.

The final scores were obtained by subtracting the normalised negative scores from the normalised average assessment scores (formula 3). Formula 3 delivers the final assessment score:

$$Z_{i-fin} = X_{i-ass} - X_{i-neg} \quad [3]$$

Z_{i-fin} – final score of assessment of i-th facility;
X_{i-ass} – normalised average assessment score of i-th facility;
X_{i-neg} – normalised negative assessment score of i-th facility.

Assessments were carried out in reality by a team of seven assessors with varying physical conditions, different environmental needs and diverse capabilities (Fig. 4). The composition of the assessor's team and the social profile wasdesigned to cover the natural array of most vulnerable user groups with diverse needs representing the broad spectrum of modern society (Fig. 11). An elder person and a parent with a baby in a stroller to reflect the interests of the elderly and young families complimented the assessor's teams for Vilnius 2017 and Singapore 2012 tests (Fig. 11). The assessor's team featured a variety of occupations, ages and gender balance (Fig. 3). To increase the quality of the assessor's feedback about usability and performance of the assessed facilities the assessment was practically implemented by reporting an on-site user's experience of testing different environment elements. The individual assessment scores were filled in the summary matrix in decimal grades from 0 to 10 in an Excel spreadsheet.
The usability and performance of buildings and other built facilities in their environment could be assessed by different value levels starting from the basic safety qualities; once this was achieved, it could proceed to the higher level of comfort of use. In addition, if this was realised, assessment could rise to the top qualities that please and satisfy user's aspirations (Gehl, 2010). This structure of values (Fig. 3) suggests that comfort may be only addressed after the basic safety needs are ensured, and pleasure level is targeted on the ground of good performance in safety and comfort aspects. Therefore, the original assessment method was upgraded by grading the value levels of the assessed urban environment and the selected buildings, and the assessors were instructed to evaluate the aspects of: (1) safety, (2) comfort, and (3) pleasure of use (Fig. 3).

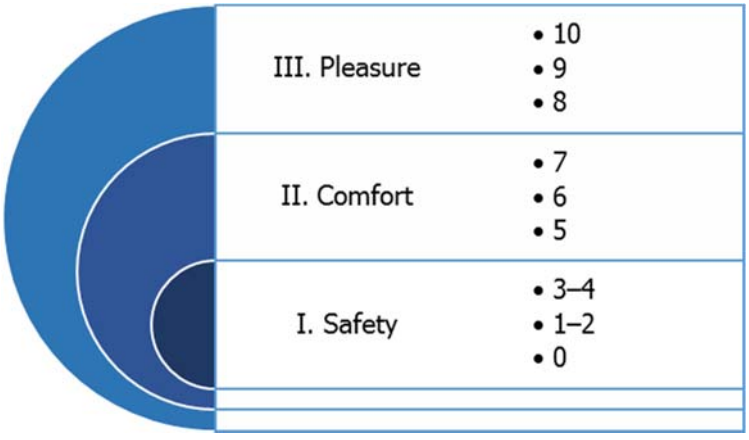

Fig. 3 The scores for assessed value levels of the environment elements and buildings

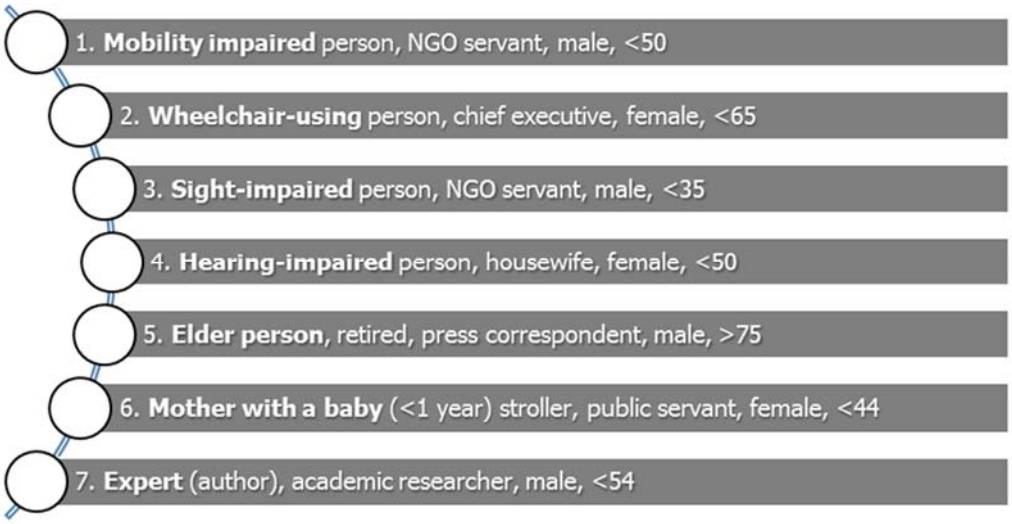

Fig. 4 Assessor's team composition represent the array of physical and social condition, gender, occupation and age

3 RESULTS

As each assessor had an opportunity to experience his own specific environmental needs by testing the use of given environment elements in urban space and in buildings, the overall assessment results reflect the needs of major physically sensitive user's groups.

The summary normalized results (Table 1) show the highest (object 9) and the lowest (object 1) *average assessment* scores, on the one hand. On the other hand, the table outlines the largest (object 4) and the smallest (object 2) numbers for *negative* scores given by the assessors, and these are different objects than those ranked by an average assessment score. According to the *total* assessment grade, the object 9 earns the highest score, object 4 – the lowest score. The highest assessment score was assigned to object 9, the same as for the assessment average, and the lowest – to objects 4 and 11, the same 4 that got most negative scores. In total, six objects received overall negative scores (Fig. 5).

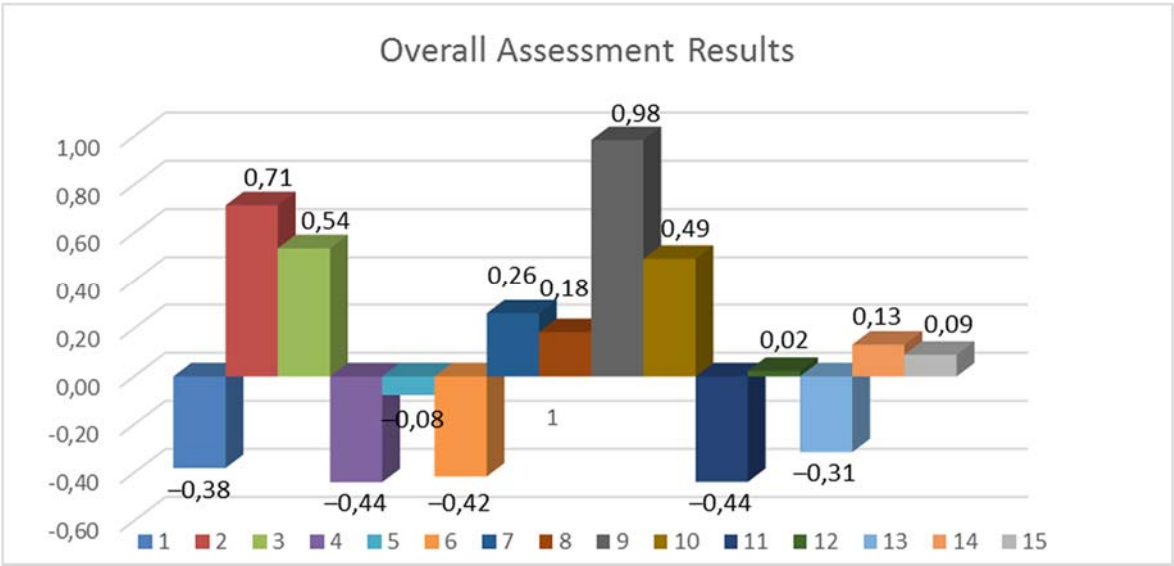

Fig. 5 Overall assessment results for all objects (1–14 Table 1)

No.	Year built or refurbished	Object, city, assessment year	Assessment average		Non-accessible elements assessment		Overall score
			Score	Normal	Number	Normal	
1	1989	Office LŽNS, Vilnius 2000	6,28	0,00	33	0,38	–0,38
2	1998	Office LŽNAPA, Vilnius 2000	8,18	0,71	**9**	**0,00**	0,71
3	2005	Office LŽNAPA, Vilnius 2017	8,17	0,71	20	0,17	0,54
4	1998	Social Affairs and Labour Ministry, Vilnius 2000	7,77	0,56	72	1,00	–**0,44**
5	2010	Social Affairs and Labour Ministry, Vilnius 2017	7,51	0,46	43	0,54	–0,08
6	1990	MM hospital, Vilnius 2000	6,65	0,14	44	0,56	–0,42
7	2011	MM hospital, Vilnius 2017	7,75	0,55	28	0,30	0,26
8	1998	Rehabilitation centre Baldžio Šilas, Vilnius 2000	7,36	0,41	23	0,22	0,18
9	2014	RVUL hospital, Vilnius 2017	8,94	**1,00**	10	0,02	**0,98**
10	2010	Versmė School, Vilnius 2017	8,18	0,71	23	0,22	0,49
11	2005	V-Hotel, Singapore 2012	6,38	0,04	39	0,48	–**0,44**
12	2010	Metro station Dhoby Ghaut, Singapore 2012	6,72	0,17	18	0,14	0,02
13	2010	Metro station Lavender, Singapore 2012	6,54	0,10	35	0,41	–0,31
14	2010	Starbucks cafe, Singapore 2012	6,8	0,20	13	0,06	0,13
15		**Average all objects**					**0,09**
16		Average Vilnius 2000 and 2017					0,19
17		Average Singapore 2012					–0,15
18		Difference Vilnius (2000–2017) and Singapore (2012)					**0,34**

Tab. 1 The summary of all assessment results Vilnius 2000, 2017, Singapore 2012

Comparing the assessment results, the averages of Vilnius's and Singapore's objects show that the combined scores for Vilnius 2000 and 2017 assessments are, by normalisation, 0.32 higher than for Singapore 2012 (Table 1). This may relate to earlier implementation of accessibilty-promoting building regulations, dynamic growth of public awareness after 1990 and some other factors in the respective countries.

The site segment delivered the lowest score (6.52) from all the assessed buildings in all environmental segments (Fig. 6, 11). The highest assessment score was given to the buildings segment (7.64). Comparing assessment averages from all objects, the lowest score (5.61) was assigned to the site segment in Vilnius in 2000 and the highest score (8.57) to the building segment in Vilnius in 2017. Average assessment of Vilnius's objects in 2017 got the highest score (8.18) while comparing all three assessment cycles (Fig. 7).

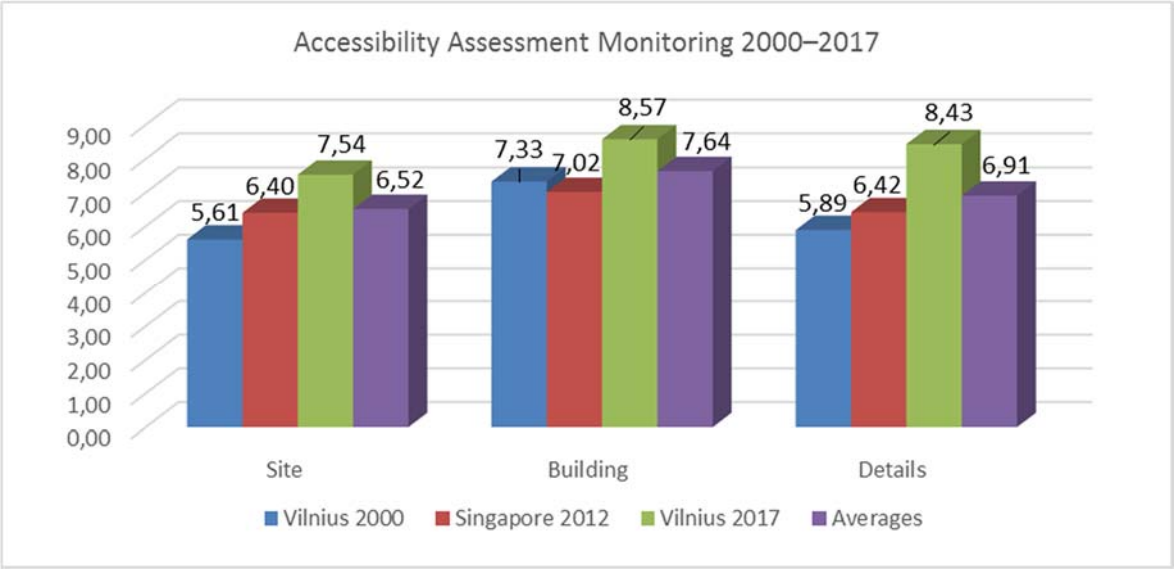

Fig. 6 Accessibility assessment monitoring 2000–2017

Comparing average assessment scores in Vilnius, we see a 30.2% improvement from 2000 to 2017 (Fig. 7). Some objects have increased their assessment grades from 2000 to 2017 (4–5 and 6–7, Table 1), but one has decreased its grade (2–3). All objects assessed in 2017 have earned overall positive grades (3, 5, 7, 9, 10). For Singapore, object 14 has rendered the highest positive score (0.13), which is one of the lowest compared to Vilnius City object's assessment scores.

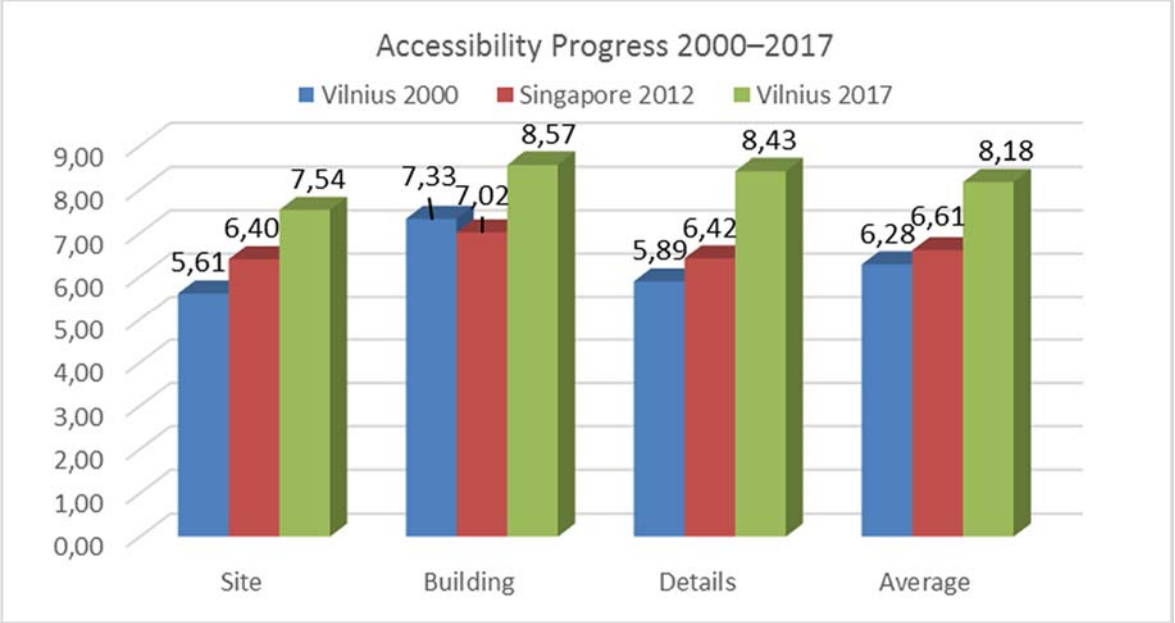

Fig. 7 Accessibility assessment for different environment segments

Finally, assessment results allow for monitoring the accessibility quality in the analysed urban sites and buildings at different times (Fig. 7). Accessibility level in all environment segments has increased in the period 2000–2017 by 30.2%. The elements of the ***site*** segment were graded the lowest scores through all assessment periods. The biggest progress through the analyzed period is observed in the segment of ***site and building details*** (43%) and the ***building's site*** (34.3%).

This shows the precise impact of the variety of accessibility promoting measures as more strict regulation and control, intensified professional upgrade, rising public awareness and others that urban planning and

architectural design practices take into account for improving the quality of both public and private environments and buildings. Analysing the assessment results according to the year of construction (or refurbishment) of the surveyed buildings in the interval of 1989–2014 reveals a definite increase in accessibility scores from –0.38 for facilities built in 1989 to 0.98 for those built or refurbished in 2014 (Fig. 8). This trend has become especially evident after 2005 and continues until recently, and the more strict control of the regulation requirements is one of the reasons along with the improved skills of city planners and architects

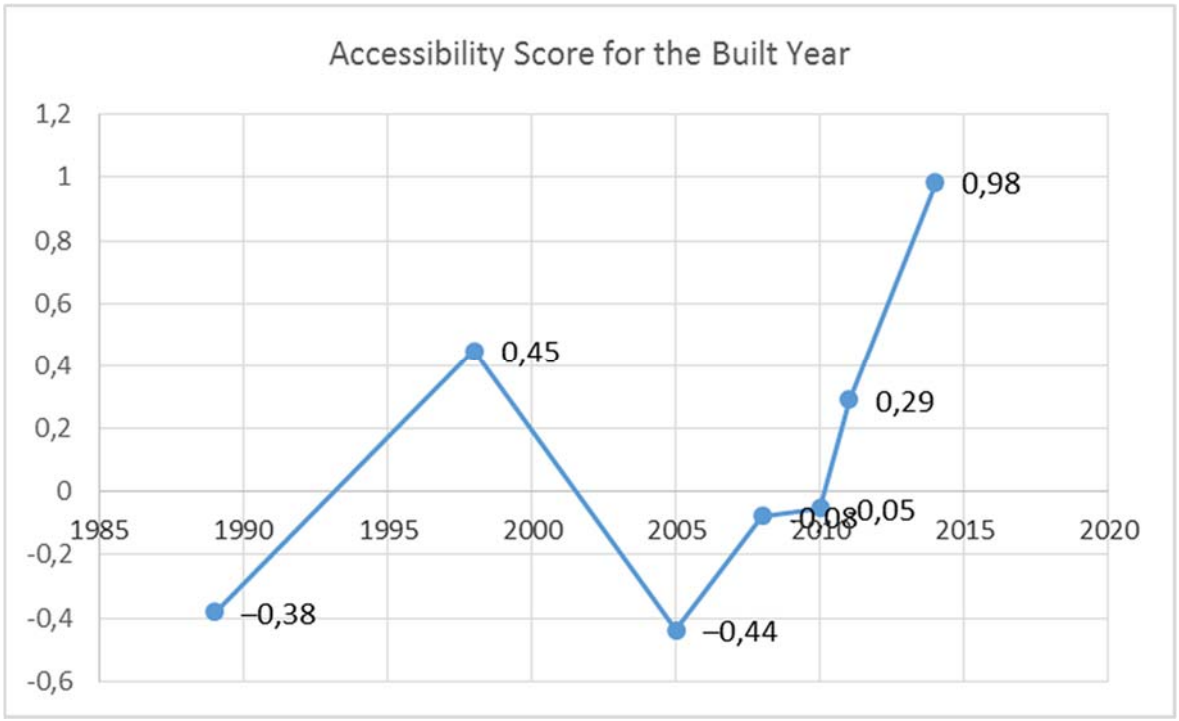

Fig. 8 Accessibility assessment scores for the year of construction of the object

As assessor's team was composed to represent a group of people with varying conditions, of different occupations, ages and experiences, the comparison of each assessor's average grades was also drawn up. The data analysis shows that the lowest assessment scores were delivered by the assessor with limited mobility, who was walking with additional support (the expert's scores are excluded). The hearing-impaired assessor delivered the highest average scores (Fig. 9). Consistency is another important aspect of the obtained accessibility assessment results. The scores assigned by different assessors present great variety for the different positions and environment segments. Examples in Figures 10, 11 show that the assessment averages for all aspects of two assessed objects differ from two to nine. It could be assumed that the grades lower than the average (6,5 – red line on Fig. 10) for the given object are below the lowest acceptable threshold and these assessed elements in buildings or in urban spaces need urgent improvement in order to continue using them. The rest of the assessed elements should be improved in the shortest possible time as decided by the authorities for urban spaces and the owners or the users of publicly used buildings and facilities.

As different assessors have different needs in the environment, their assessments reported different results even on the same environment element. E g the curb is a good guide for the sight-impaired person, but the same curb is a real obstacle for the wheelchair user. The question is how different assessments of the same element could be considered to make an impact on the overall design, which has to take into account different human needs, but make one planning or design decision. Analysis of the assessment matrix reveal that there are cases when assessors' scores coincide, but there are also cases when these scores differ greatly (Fig. 11).

Quality of parking, external ramps, main entrance, elevators and signage have all delivered radically different (4–10, 3–9) scores. However, many environment elements scored in the same high or low way (external rest places, warning surfaces, floor material and others).

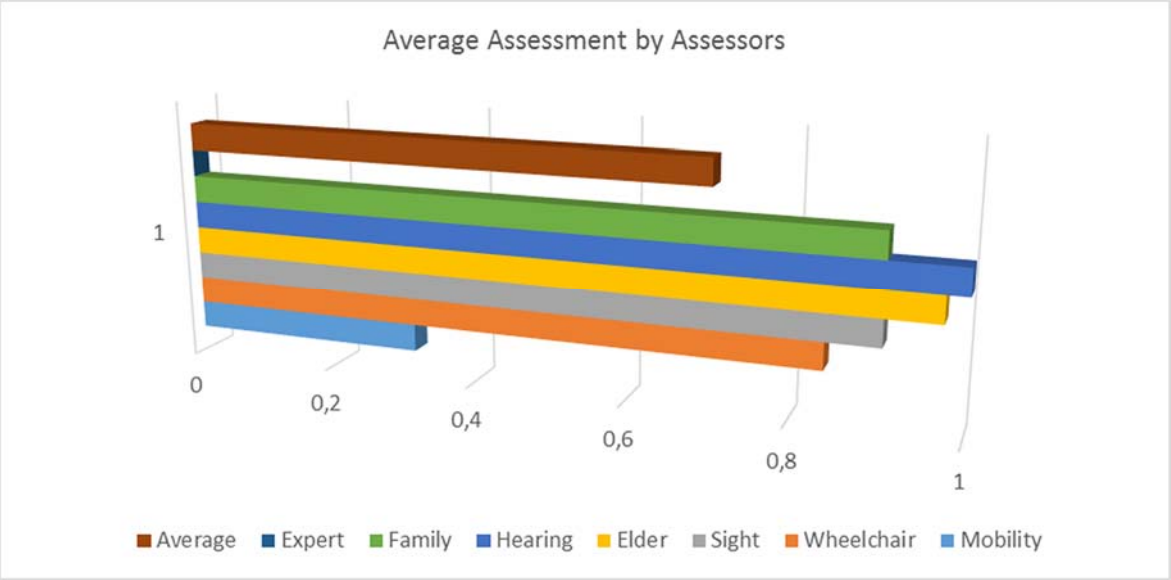

Fig. 9 Normalised average assessment by different assessors (0–1)

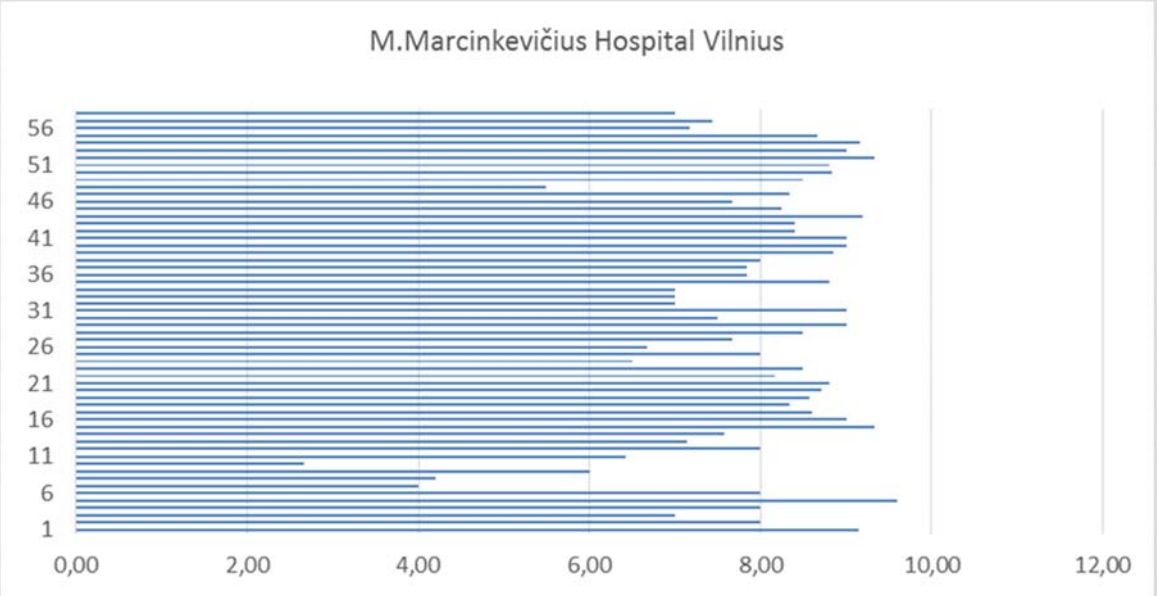

Fig. 10 Assessment averages for all aspects of 7 (MM Hospital in Vilnius City) and 12 (MRT Station in Singapore) objects

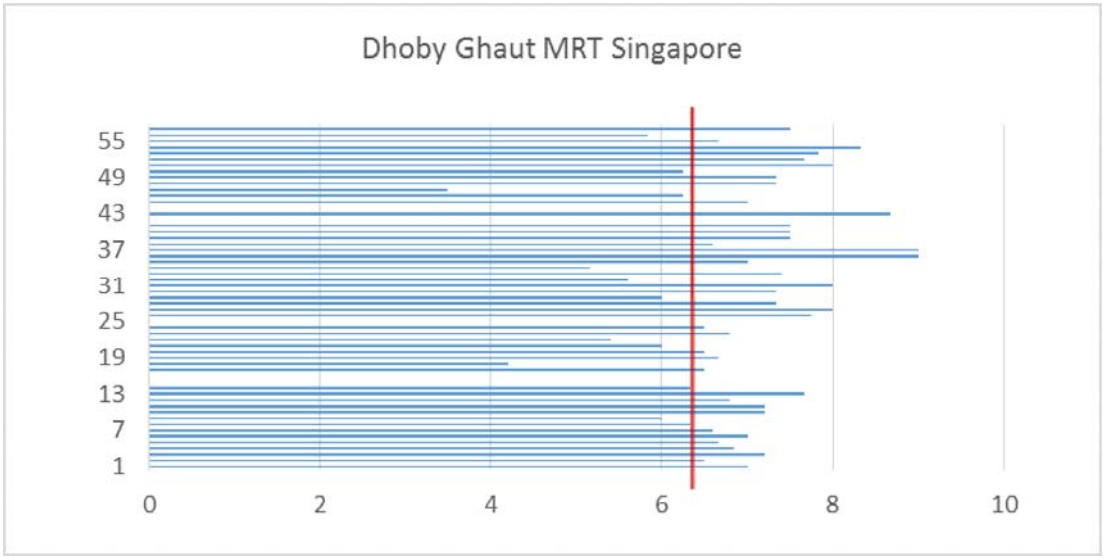

Fig. 10.a Assessment averages for all aspects of 12 (MRT Station in Singapore) objects

Building	Assessor	The Site												
		Assessment aspects												
		1	2	3	4	5	6	7	8	9	10	11	Sum	Aver
												Negative	7	
1. LŽNAPAoffice	1. Moving with supports	n	n	n	8	n	n	7	7	5	5	n	32	6,4
	2. Wheelchair user	10	n	n	10	10	10	10	10	10	5	n	75	9,375
	3. Blind person	5	n	n	7	n	n	n	n	8	n	n	20	6,667
	4. Elder person	9	n	9	n	10	n	8	9	9	n	n	54	9
	5. Mother with a baby	8	n	n	8	8	7	8	10	10	8	n	67	8,375
	6. Expert	9	n	n	8	4	n	8	9	5	3	n	46	6,571
	Average:	8,20		9,00	8,20	8,00	8,50	8,20	9,00	7,83	5,25		294	7,731
												Negative	14	
2. Social Affairs Ministry	1. Moving with supports	8	n	5	0	8	0	3	1	1	n	n	26	3,25
	2. Wheelchair user	7	n	7	7	n	9	4	4	0	4	n	42	5,25
	3. Blind person	8	n	n	7	n	9	9	9	n	n	6	48	8
	4. Elder person	6	n	n	6	10	6	6	6	8	n	n	48	6,857
	5. Mother with a baby	4	n	n	8	8	9	4	9	10	4	n	56	7
	6. Hearing impaired person	9	n	n	9	9	7	n	n	n	n	n	34	8,5
	7. Expert	6	n	n	7	8	n	6	9	4	2	n	42	6
	Average:	6,86		6,00	6,29	8,60	6,67	5,33	6,33	4,60	3,33	6,00	296	6,408
												Negative	7	
3. RVUL Hospital	1. Moving with supports	n	n	10	10	10	8	8	9	9	8	n	72	9
	2. Wheelchair user	10	n	n	10	10	10	10	10	10	4	n	74	9,25
	3. Blind person	5	n	n	7	n	7	n	n	10	n	n	29	7,25
	4. Elder person	9	n	10	n	10	10	9	10	10	n	n	68	9,714
	5. Mother with a baby	8	n	n	9	10	9	9	10	9	10	n	74	9,25
	6. Expert	8	n	n	7	9	5	5	5	5	4	n	48	6
	Average:	8,00		10,00	8,60	9,80	8,17	8,20	8,80	8,83	6,50		365	8,411
												Negative	8	
4. School Versme	1. Moving with supports	9	n	n	8	9	n	9	4	6	4	n	49	7
	2. Wheelchair user	8	n	7	7	8	n	10	10	4	4	n	58	7,25
	3. Blind person	n	n	n	7	n	n	n	8	n	n	7	22	7,333
	4. Elder person	n	n	n	8	7	8	8	8	6	6	n	51	7,286
	5. Hearing impaired person	10	n	n	10	9	9	n	n	9	7	n	54	9
	6. Mother with a baby	8	n	n	10	10	n	10	10	5	n	n	53	8,833
	7. Expert	6	n	n	6	7	n	4	4	4	4	n	35	5
	Average:	8,20		7,00	8,00	8,33	8,50	8,20	7,33	5,67	5,00	7,00	322	7,784
												Negative	9	
5. M. Marcinkevičiaus Hospital	1. Moving with supports	8	n	n	8	10	n	4	4	6	4	n	44	6,286
	2. Wheelchair user	6	n	6	7	10	n	0	0	n	0	n	29	4,143
	3. Blind person	10	n	n	7	n	n	n	n	n	n	n	17	8,5
	4. Elder person	9	8	8	n	n	n	n	n	6	n	n	31	7,75
	5. Hearing impaired person	10	n	n	9	9	n	6	6	n	n	n	40	8
	5. Mother with a baby	9	n	n	8	10	10	7	8	n	n	n	52	8,667
	6. Expert	8	n	n	6	9	6	3	3	6	4	n	45	5,625
	Average:	8,57	8,00	7,00	7,50	9,60	8,00	4,00	4,20	6,00	2,67	#DIV/0!	258	6,996
														7,466
	Good - very good	8 9 10												
	Low - very low	4 3 2 1 0												
	Total average:	7,97	8,00	7,80	7,72	8,87	7,97	6,79	7,13	6,59	4,55	#DIV/0!		7,47

Fig. 11 Assessment matrix, section The Site, Vilnius City 2017. Good – very good scores are in green highlight, low – very low scores are in red highlight

Fig. 12a Assessment of mobility system in Singapore 2012

Fig. 12b Assessment of urban open space in Singapore 2012

Fig. 12c Assessment of metro station in Singapore 2012

Fig. 12d Assessment of the cafe entrance in Singapore 2012

4 DISCUSSION

The results for all 14 assessed objects – open spaces and building (Table 1) show that eight objects have earned an overall positive assessment result and six have gained negative results (Fig. 5). The negative assessment results indicate that the urban space or the building is, in general, inaccessible and point out several critical obstacles that should be improved. The exact elements that need the improvement are listed in the assessment matrix and could guide the individually tuned accessibility programme and design for the given buildings in both cities (Fig. 11). This especially applies to the objects No. 1, 4, 6, 11 and 13 (Table 1). The used assessment method and the applied tool are suitable for accounting for and representing the low and high grades of accessibility that correspond to the low or high quality of accessibility to particular spaces and buildings. They can also serve as a proper comparing and monitoring tool that indicates the amount of progress or drawback in accessibility quality achieved over a certain period.

Assessment results, when grouped by the environment segment, identify the access level and its change in the outlined site, building and detail's segments. It is helpful for the building owner or facility manager to monitor access progress over time to figure out how efficient the taken measures are and to modify them according to the monitoring results, if needed. In this case, monitoring the assessment results shows that the site segment needs more attention from authorities, from academic institutions and professional associations to raise the competence of urban planners and architects for developing the best site planning and design solutions. Better legal regulation and support by guideline is needed for this segment as well. By evaluating the results from the point of the year of construction of the assessed spaces and buildings, one can see definite improvement in accessibility level – the new and the refurbished buildings are designed according to the valid

regulations and the best design and management practices. One could suppose that higher user expectations are also driving further improvement of professional architect and planner practices by increasing the pressure on professionals to provide for safer, more comfortable and more pleasing urban planning and architectural design solutions.

The variety of assessment results delivered by different assessors recommend keeping and even extending the wide spectrum of representatives of various user groups to cover more specific needs and interests. In spite of evident and fully understandable differences in assessing various aspects of the built environment, the wide array of the assessors is a pre-condition for obtaining universal and comprehensive access assessment results that are both up-to-date, reliable to analyze and practical to implement. Looking at the consistency of assessment results, it is evident that certain elements that scored low or very low exist for each assessed object. Even objects that have earned relatively high average scores have several critically unfit elements for urgent improvement. All elements that have a result lower than the average for the whole object or the average for the given environment segment should be taken as a non-accessible barriers limiting the overall usability of the object. There is a contradiction in the results from the point of assessment by different assessors. This is understandable and justifiable as different physical conditions lead to frequently very different environmental needs and consequently different assessor's attitudes. It is a challenge for city planners and architects to find the optimal solution that fits all space users most: this is a search more for a varying optimal compromise and not for the fixed ideal.

Monitoring the progress of accessibility over time is an evident additional merit of the employed methodology and city politicians, researchers, architects, the media and the public at large could widely exploit it. It helps to set the milestones for progress and demonstrate the reach of certain goals. The overall assessment shows quite an unequal spread of the results: the negative scores represent an accessibility level that is currently an unacceptable barrier for the users as they represent the elements that essentially limit the access and give very low functionality and no comfort. One facility in Vilnius City has dropped in its average accessibility level score from 2000 to 2017 (LZNAPA office), and two have improved their scores (MM Hospital and The Social Affairs and Labor Ministry). On the one hand, this shows that even newly built office buildings need constant supervision and proper maintenance of their essential features, and on the other, that constant implementation of a long-term access improvement program leads to an improved situation, even in very complicated cases at the earlier designed and constructed buildings and urban spaces.

The author of this research took part in the assessment of the presented buildings and spaces as well but these scores were excluded from the calculations. In future, also ordinary citizens could be included in the assessment group as to figure out their degree of satisfaction while using urban spaces and buildings. The assessor's role could be also useful for urban planning, architecture students and young professionals as to strengthen their practical understanding of academic accessibility knowledge and getting the design-related skills and feedback from real space users.

The possibility to shape the assessment tool according to the nature of the assessed objects is open as well: by doing that, the chances for comparing the assessment results of different buildings would be lost, but the results would reflect more the specifics of the particular building's typology.

5 CONCLUSION

It is important to underline that in each case, the assessment tool should be adjusted to the local socio-economic conditions and legal environment by fine-tuning the existing method. The used assessment method should correspond to the way we are going to use the survey results. In the case of the current survey, its result render the best outcomes when applied for analytic purposes, also for creating access improvement programs and monitoring implementation in a flexible, consistent and fluent way.

The user–experience-based assessment tool has demonstrated that it is appropriate for evaluating both the public and the private urban areas and buildings on different scales – from the site planning and functional layout to the design and instalment of interior elements. Involving the extended assessors' group into the assessment process, including people with different disabilities, the elderly and families makes the tool and the process more participatory and more inclusive, with more reliable and representative results. Therefore, we may suggest this easy-to-use and flexible tool for improving the quality of city management in Vilnius and in Singapore and in many other urban communities.

The wider question of what is a good access and what is an unacceptable one arises. Definitely, the objects that have several non-accessible assessment scores (0–4) and an overall negative result (<0) are seriously compromising their usability and comfort by multiple barriers and should urgently generate access improvement programs by using the particular scoring data from this research for replanning and redesign. However, monitoring access progress is an important task for the local authorities that take care of the quality of the public environment and of public buildings.

The used accessibility assessment method contributes to the wider attempts to improve the overall problems of urban environment quality (noise, pollution, climate, etc.). It also contributes to creating a higher value for the built urban spaces and buildings by addressing the issues of enhanced personal safety and security, satisfaction and pleasure for the users. All these measures improve the quality of public spaces and buildings, and by that, contribute to creating better livable cities.

Simultaneously with the recommendations for improving the urban environment and buildings, the question of legal regulation should be constantly looked at. It is evident from the results of research (see Fig. 7) that the urban planning segment needs more attentive regulation in the accessibility aspect from the national and European authorities. Besides the regulation, the professional guidebooks might also contribute to the continuous professional development of architects, city planners, landscape architects, building engineers and city managers.

The more general lessons learnt from this research show that even a single non-accessible element in urban space or in a building could critically prevent people from getting through the space or into the building. This means that every aspect assessed by using this methodology or alternatively the national regulation should be treated as an essential element of space planning or building design, construction and use including refurbishment and renovation. The aesthetical quality of accessible design that architects and designers apply is still problematic as it lacks intuitive logic and artistic quality. Frequently designed elements pop out of the whole project or building by that over-emphasize and exclude accessible space elements as ramps or handrail from the overall architectural style. Architects should more boldly take on the challenges of accessibility and turn them into the outstanding architectural projects. The methodology that we tested in this case for the monitoring efficiency allows adhering to the functional, ergonomic and use requirements that are universal and usual for all citizens.

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IMAGE SOURCES

Fig. cover: picture by the author. Vilnius. Lituania

Fig. 1: Traditional flow from personal impairment to disability. Own elaboration.

Fig. 2: The sequence of managing disability in barrier-full (top) and accessible barrier-free (bottom) environments. Own elaboration.

Fig. 3: The scores for assessed value levels of the environment elements and buildings. Own elaboration.

Fig. 4: Assessor's team composition represent the array of physical and social condition, gender, occupation and age. Own elaboration.

Fig. 5: Overall assessment results for all objects (1–14 Table 1). Own elaboration.

Fig. 6: Accessibility assessment monitoring 2000–2017. Own elaboration.

Fig. 7: Accessibility assessment for different environment segments. Own elaboration.

Fig. 8: Accessibility assessment scores for the year of construction of the object. Own elaboration.

Fig. 9: Normalised average assessment by different assessors (0–1). Own elaboration.

Fig. 10: Assessment averages for all aspects of 7 (MM Hospital in Vilnius City) and 12 (MRT Station in Singapore) objects. Own elaboration.

Fig. 11: Assessment matrix, section The Site, Vilnius City 2017. Good – very good scores are in green highlight, low – very low scores are in red highlight. Own elaboration.

Fig. 12: Assessment of mobility system (a), urban open space (b), metro station (c) and the cafe entrance (d) in Singapore 2012. Pictures by the author.

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Gintaras Stauskis – doctor of the Humanities in Architecture, is a professor with Vilnius Gediminas Technical University, conducting academic research at the Department of Urban Design. He is involved in European Union collaborative research programs. His current research fields are green architecture, sustainable urbanism, accessibility of environment, health care networks and urban recreation. The author has presented the research results in a number of national and international publications and conferences that could be seen on relevant databases (https://vgtu.academia.edu/GintarasStauskis).

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RE-SEWING THE URBAN PERIPHERY.

A GREEN STRATEGY FOR FONTIVEGGE DISTRICT IN PERUGIA

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ABSTRACT

The present study debates on the issue of urban regeneration in contemporary cities, adopting a strategic vision which includes the use of vegetation and green infrastructure to create a network of public spaces. Especially, urban periphery lacks of public spaces, meaning a public use of urban space for outdoor activities and social networks.
The extraordinary program for the Italian peripheries, addressed to all the metropolitan cities and provincial capitals in 2016, inspired to Renzo Piano idea of "re-sewing" urban fabrics, has been a good opportunity for testing new approaches to urban regeneration. The case study investigated in this study is the financed project for the city of Perugia, which provides different interventions aimed at improving (and developing new) public spaces through vegetation enhancement and a large area destined to vegetable social gardens as a strategy for urban infill. By recovering public spaces with social purpose and providing a comprehensive strategy for aesthetic improvement of the city, the case study provides a representative example, how greening the city may promote together biodiversity conservation and urban regeneration.

KEYWORDS:

Urban Regeneration; Urban Periphery; Urban Infill; Public Spaces; Green Infrastructure.

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重新部署城市周边。

佩鲁贾地区的绿色战略

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摘要

本研究就当代城市的再生问题进行了讨论，采用了包括利用植被和绿色基础设施建立公共空间网络的战略愿景。特别是城市周边缺乏公共空间，这意味着公众要利用城市空间进行户外活动和社交网络。

2016 年，Renzo Piano 构想了一项名为“重新部署”城市的非凡计划，针对意大利周边地区的大都会城市和省会城市。这对于检测城市再生的新方法而言是一个很好的机会。本研究调查的案例研究是佩鲁贾市的融资项目，该项目提供不同的干预措施，旨在通过增加植被并将大面积蔬菜园作为城市填充战略来改善（并开发新的）公共空间。 案例研究通过恢复具有社会目的的公共空间并提供优化城市美学的综合战略，提供了一个具有代表性的例子，即城市绿化如何能同时促进生物多样性保护和城市再生。

关键词：
城市再生、城市周边、城市填充、公共空间、绿色基础设施

1 INTRODUCTION

The "Extraordinary program for the requalification of urban peripheries", including a call for proposal addressed to all the metropolitan cities and provincial capitals, entitled *"Notice to present new proposals for the organisation of the Special Program for an intervention to requalify the urban area and the safety of the suburbs"* (DPCM no.127/2016) is a key opportunity to discuss about Italian urban suburbs and about the possible scenarios for a sustainable path of urban growth (Ahvenniemi & al., 2016). Funding of the extraordinary program was devoted to projects addressing problems in suburbs 'characterized by economic and social marginalization (Secchi, 2013), building degradation and shortage of services' (Petranzan, Neri & Purini, 2005).

The program found its cultural reasons in the concept proposed by senator Renzo Piano about 'urban mending', which undoubtedly goes beyond the theme of rebuilding urban fabrics, by including socioeconomic issues related to urban degradation. The "mending" notion proposed by Renzo Piano also recalls the strategy of urban infill (Iacovantuono & Marcoaldi, 2017) , i.e. densification of urban areas (Bettencourt & West, 2011) through the reuse of existing buildings, the construction of new buildings in empty lots, the creation of green areas and urban parks as green networking systems, the development of public services.

The theme of urban regeneration (de Franciscis, 1997) includes different issues related to the pedestrian use of public spaces (Musco, 2009), livability and urban vitality (Clemente, 2017). New projects for contemporary cities often include new constructions on greenfields, more rarely working to develop interstices of the urban fabric, with zero-scale interventions (Aymonino & Mosco, 2006), based essentially on projects of green areas and green infrastructures. Contemporary cities, after taking full advantage of the urban areas and consumed soil, are rewriting a new pact between architecture and nature, building natural landscapes and green infrastructure, called to mend the tears of the urban fabric, to rebalance ecological and environmental instability (Botzat & al., 2016), to regenerate neighbourhoods bogged down by spontaneous urbanization (Bryant, 2006), to define public spaces and places of life (Chon & al., 2009).

Green Infrastructure (GI), often supported by public funding (Regional, National or European), represent an opportunity for urban regeneration (Moffat & al., 2010). Projects born to rebalance urban metabolism, have shaped structural urban features in contemporary cities, sometimes with a great iconic and representative value. Examples are the New York highway, which has become a famous place frequented by residents and tourists; the system of parks and public spaces along the Madrid Rio, the Rose Fitzgerald Kennedy Greenway of Boston, the Buffalo Bayou Promenade. Planning and building urban gardens within inner cities, according to a reverse process that starts from the bottom, or by involvement of citizens in small local interventions, contributes to the creation of a green network that goes to graft and overlap to the primary network of green infrastructures. These projects have also fostered new social practices and new uses of urban open spaces.

When referring to GI within cities, zero-scale urban redevelopment interventions are essentially based on public investments (Ahern, 1995), contrary to what happened in the construction of modern and contemporary cities, which are primarily developed grounding on private investments to buildable land. With economic crisis negatively impacting local finance, agents have been increasingly required to look at the opportunities offered by European programs. Other possible sources of funding are represented by national or regional calls, which provide resources for local authorities to carry out interventions of urban regeneration.

In this paper, the proposal of the Municipality of Perugia to the "Extraordinary program of requalification of urban periphery" will be presented. The proposal, entering in a shortlist of financeable projects with a request of 16,388,790.60 euros, is foreseen to start in the next months. The proposal is a representative example of multi-target intervention incorporating and trying to solve a series of critical issues, typical of

urban suburbs, even if it addresses the requalification a central area of the city. In this regard, the proposal is grounded on the multifunctional value of GI and Urban Gardens as a strategy for peri-urban regeneration. By recovering public spaces with social purpose and providing a comprehensive strategy for aesthetic improvement of the city, Perugia case study provides evidence how greening the city may promote together biodiversity conservation and urban regeneration.

2. URBAN REGENERATION PROJECT FOR FONTIVEGGE DISTRICT, PERUGIA

The project elaborated for the metropolitan area of Perugia was drawn up by the Department of Civil and Environmental Engineering of Perugia University and the Municipality of Perugia and refers to the functional reconnection of the two districts of Fontivegge and Bellocchio separated by railways, and the downstream area of the Perugia train station with the rest of the city.

The project area is a central area of Perugia (the directional center and the Piazza del Bacio designed by Aldo Rossi), where, because of to the presence of the railway station, a progressive social disadvantage has been observed in recent times.

What is striking about this area is that the square designed by the famous architect of Italian rationalism, on which the Umbria Region palace stands, has become a place rarely visited by pedestrians, especially at night, and where the absence of attractive activities open to the public, favors phenomena of social degradation. The project is aimed at creating a public space to promote urban vitality of the entire district (Gehl, 2010), becoming an attractor for young people - which is considered a key factor to ensure urban security (Jacobs, 1961). Urban redesign proposed in the abovementioned project aims at promoting pedestrian accessibility, with a square that gradually descends towards the entrance of the underpass, placing pedestrian and cycle flows at the centre of the scene.

The proposal considers Piazza del Bacio and the large driveway in front of the station, which has the configuration of a large road junction, in an wider vision, that functionally relates the green area behind the upstream square and the district "Bellocchio" on the other side of the railway.

In details, the proposal consists of a series of strictly integrated and easily implemented punctual interventions to improve quality of public buildings (including a library, a new neighborhood center, and the progressive redevelopment of green spaces functioning as a link between the surrounding places), and a series of "widespread" interventions (video surveillance, public lighting, in addition to those of a social nature mainly intended for young people), aimed at improving the level of living in the area. Particularly, it is planned to replace a building currently hosting a commercial centre with a large gym building, and to build a skate park in the opposite area overlooking the square.

The most interesting aspect of the proposal is the theme of the "green infrastructure", which re-incorporate the neighboring green areas, with public spaces in front of the railway area and the natural areas beyond it. In addition to this green infrastructure, a large area dedicated to Urban Gardens has been planned. Developing this area, could give Perugia a primacy among Italian cities due to the high number of gardens (more than 400) and the central position in the city.

The intervention in the ecological parks gives more value to the area, promoting a coordinated process of improvement of user services and spaces. The main operational activities increase the existing vegetation, especially with the use of crops, and involve the construction of urban gardens for local communities with the aim to stimulate place re-appropriation and social wellbeing. Valorization of soft mobility will be implemented through the tarmac repainting of all the areas that are all divided and yet connected in a network model functional for the discover.

A specific color dominates the interventions of redevelopment, materializing in the printed tarmac according to specific surveys carried out with the support of construction/architectural engineering students.

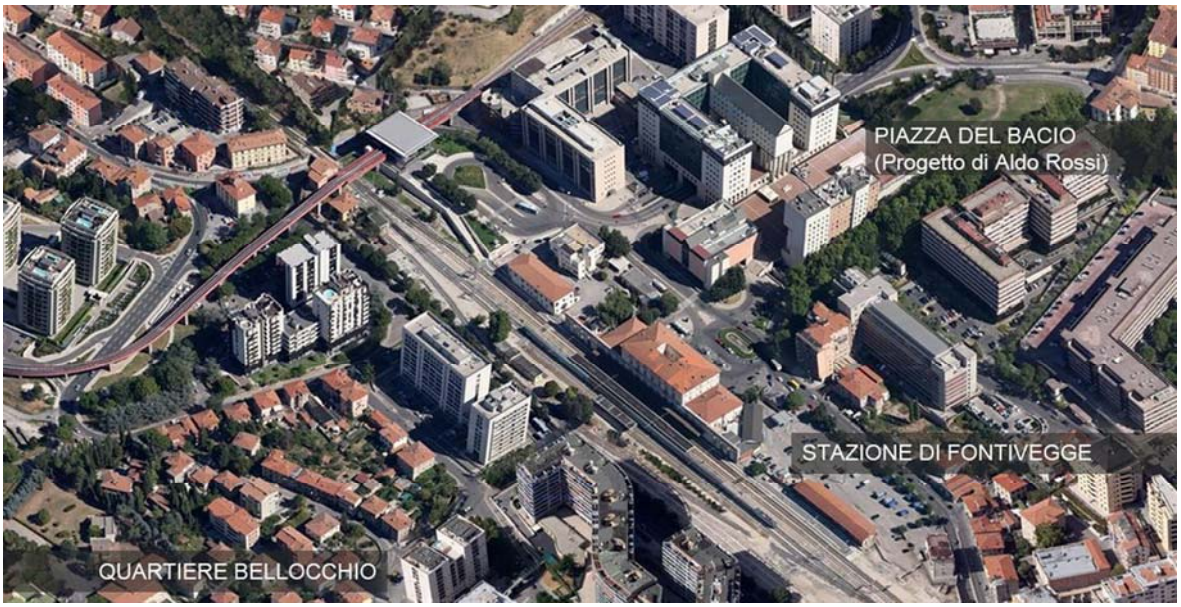

Fig. 1 View of the area project of Fontivegge Ditrict in Perugia

Paths will be enriched with naturalness chromatism to create a fundamental "edible landscape" and strengthen connective value of the ecological redesign. In this regard, the project encourages spontaneous naturalization processes, redefining relationships between vegetation and local communities. The pedestrian network now becomes functional to the green infrastructure system and the polarity of the parks, which at the same time are organically functional to the system for pedestrian and bicycle paths that unfold inside them.

The Green Infrastructure Project is treated as a multifunctional strategy (European Commission, 2012) that combines the idea of increasing habitat and connectivity to native flora and fauna, as well as cyclo-pedonal fruition of the area (Brown & al., 2005). The design of urban gardens has also been dealt with an innovative way of "Biodiverse" gardens, where human disturbance does not eradicate native wild species from the garden, but tries to manage the process of functional terms of ecosystem biodiversity. In particular, buffer zones with spontaneous herbaceous species and hedges (always native species, typical of native claddings) are planned, as well as the use of horticultural and officinal species for increasing pollinating insects. Such infrastructures, in their flowering and fruiting cycle, can take on an appealing centrality for the colors, flavors and smells that characterize them.

The project's hypothesis is that through the upgrade of green infrastructure if possible to recovery man-made spaces, bringing citizens at the centre of the interventions (European Environmental Agency, 2011).

3. DISCUSSION

The proposal developed for the area of Fontivegge in Perugia is essentially based on a project of public space and a green infrastructure, with the function of urban reconnection, including a large area destined to urban gardens. These interventions will reinforce the pedestrian flows towards the Piazza del Bacio and towards Piazza Vittorio Veneto in front of the station, creating a vibrant urban environment that can be experienced at all hours of the day.

The abovementioned strategy, that can be appealed to a "pervasion of the Green", aims to promote a re-appropriating of urban places stimulating identity. Identity-making become compliant characteristics to achieve innovative management solutions based on participatory planning, public engagement and social cohesion, in order to ensure long-term sustainability of interventions (Farina, 2000).

The project for the area of Fontivegge leads to more general reflections on the role of green infrastructures and urban gardens to regenerate urban space, opening up new possibilities for the recovery of urban suburbs. The following sections debates on the latent relationship between both interventions and urban regeneration.

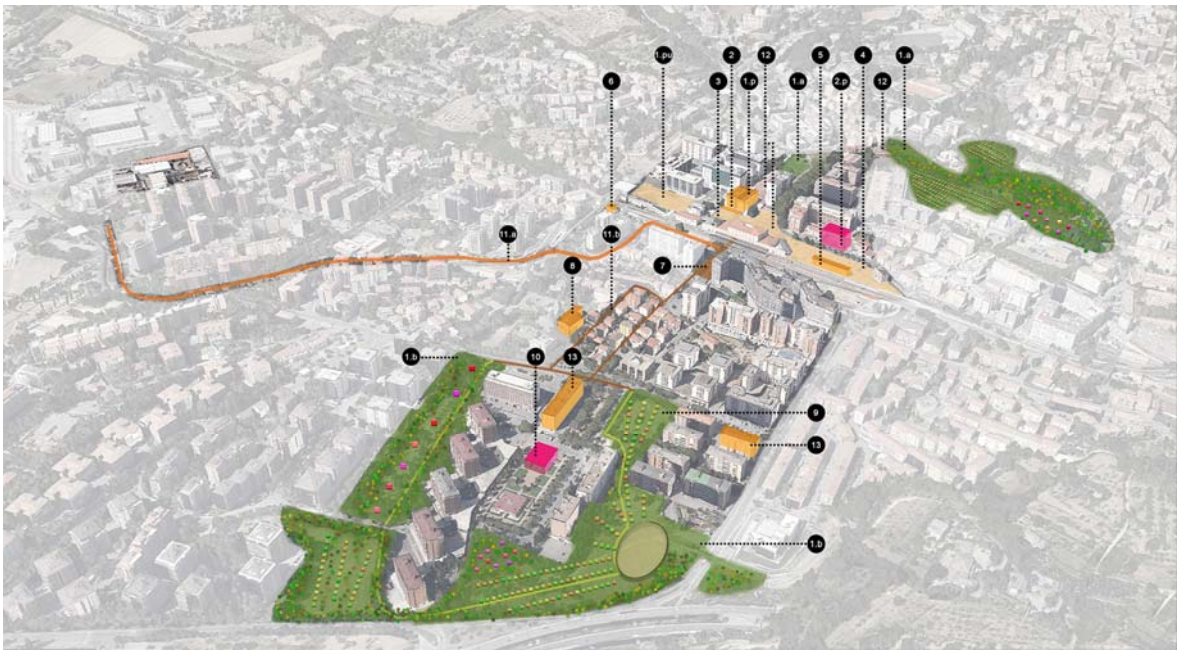

Fig. 2 Masterplan of the whole area, including Bellocchio District and Piazza del Bacio disconnected by the railway station. The drawing highlighs the public spaces and the green strategy.

3.1. THE RULE OF GREEN INFRASTRUCTURE IN THE CONTEMPORARY CITY

Green Infrastructure is defined as an ecosystem or a network of ecosystems with specific parts, needs, functions and services, "an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations" (Benedict & al., 2002).

Aspects related to ecological functionality and landscape connectivity play a role in ensuring the normal functioning of ecosystems, and this is essential for providing ecosystem services such as food air quality, carbon sequestration, flood management, water treatment, local climate conditions (Inostroza L., 2014), and soil erosion prevention (European Commission, 2010; Whitford & al., 2001). The European Union has issued directives supported by documents aimed at developing Green Infrastructures in Europe within the overall EU 2020 Biodiversity Strategy to achieve requalification of degraded ecosystems by 2020. Taken together, the main objectives of a GI include (i) promotion of ecosystem health and resilience, (ii) biodiversity conservation and maintenance of ecosystem services (Naumann & al., 2011) (iii) improvement of life quality (La Rocca, 2011), based on the multifunctional use of natural capital (European Commission, 2012).

The EU Working Group on GI strategy has proposed that GI also promotes integrated spatial planning identifying multi-functional zones and incorporating habitat restoration measures into land-use plans and policies (GI Working Group Task 1 Recommendations, 2011). Ultimately, GI contributes to a more sustainable economy based on healthy ecosystems delivering multiple benefits and functions.

At the local scale, GI may benefit from small green patches in urban and peri-urban areas, improving landscape connection. Urban greening include practices of urban forestry, agriculture, farming and gardening, together with the recovery of abandoned urban spaces and peri-urban voids.

Green infrastructure plays a significant action to mitigate the effects of climate change in the urban environment, promoting adaptation strategies of cities (Salata & Yiannakou, 2016). They can play an

important role for the reduction of emissions, prevention of hydro-geological collapse, soil protection, improvement of air quality and conservation of genetic resources potentially better suited to cope with extreme weather and socioeconomic conditions. The resilience to hostile climatic conditions, in fact, is closely linked to the level of biodiversity, and the preservation of traditional varieties.

As the Perugia project clearly suggests, an important role that green infrastructures play in the urban arena is supporting human activities in public spaces. Mitigation of climate change, biodiversity and environmental re-qualification provide justify the relevance of green infrastructures shaping new urban functions and new opportunities for enjoying public space in contact with nature. In their multifunctional dimension, new pedestrian pathways become attractive for private investors, local stakeholders, who can engage in the same recreational and commercial activities that contribute to making the urban environment vital and attractive.

Fig. 3 View of the park "Vittime della Foibe"

A combined action of top-level governance and active community participation, becomes a strategy for retrieving abandoned areas, refurbishing neighborhoods and revitalizing parts of degraded cities, involving planning authorities and policy makers with responsibilities ranging from the local to the European level (Bassoli & al., 2011).

The Green Infrastructure project assumes the value of urban regeneration (Giovinazzi & Giovinazzi, 2010), or a strategy for improving the quality of life of citizens in terms of "smart city". The bottom-up action of Urban Gardens project moves towards the same goal. They fit into urban voids or in public green areas without maintenance, becoming a strategy for retraining degraded or abandoned urban areas, improving the quality of life of local communities, in terms of "resilient city".

3.2. THE SOCIAL DIMENSION OF URBAN GARDENS

Urban gardens can be understood as tools to stimulate the persistence of citizens in the urban context, to support sociality and participation, to promote opportunities for meeting, cohesion (European Environmental Agency, 2011), and for the creation of informal exchange and help networks.

Fig. 4 View of the park including the urban gardens

Recovered urban voids converted into green areas can become real social spaces where they can meet people from different social and age groups. For aging people, they constitute an opportunity of aggregation and participation: they exchange ideas and opinions, rediscovering new forms of sociality and relationship among citizens (Kim & Kaplan, 2004).

There is also an increase in the number of gardens for educational activities into the schools, the vegetable gardens in prisons (for reintegration into the workplace of the prisoners); gardens with a rehabilitation function such as those for orthotherapy, gardening and horticulture activities to support rehabilitation programs for people with disabilities. The therapeutic function of horticulture correlates with the theory of taking care of a living organism as a plant, improves self-esteem and helps the patient regain an active role in society and promotes reintegration into a group.

In this regard, the Perugia project indicates how urban gardens may represent a great opportunity for Municipal Administrations to recover abandoned and degraded areas, making them ordered and productive, and fostering public participation in the activity of local government (Mabellis & Maksymiuk, 2009).

Implementing Urban Gardens has a positive effect on the state of local biodiversity, encouraging changes in social behaviour, toward more awareness to the central role of land management practices reducing/absorbing emissions through a network of urban green spaces.

Realizing vegetable social gardens in urban areas finally strengthens the sense of community and re-occupation of the site, strengthens ties through actions voluntarily supported by society and contributes to counteract exclusion and social isolation (Magnaghi, 2009).

By linking territories to local communities, environmental awareness of citizens may increase, preserving "common goods" through self-management processes of public spaces, to fulfill the increasing social demand for "landscape" (Recanatesi & al., 2016), contributing to sustainable urban form (Pili et al., 2017) and determining an overall aesthetic improvement of green cities and suburbs (Colantoni & al., 2015).

Fig. 5 Masterplan and view of "Parco della Pescaia"

4. CONCLUSIONS

Green infrastructure and Urban Gardens have been conceived in multi-level and innovative ways by new tools made available to administrators and citizens.

The Perugia project demonstrates that (re)designing green spaces and green infrastructure as a support system for human activities can revitalize public spaces, encouraging their use by citizens.

The project foresee to develop, test and verify a systemic approach connecting urban green spaces through a network of Biodiverse Urban Gardens suited to preserve biodiversity and native crops in urban environments. The proposal will act with a bottom-up approach with actions dedicated to the relationship between urban gardens and citizenships, considering different functions in an integrated way: the ecological function, the bio-ecological connection, the social dimension and the urban regeneration strategy.

Urban gardens finally represent an interesting model of collaboration between public and private spheres. Compared to the traditional notion of Green Infrastructure, which should be planned from above and implemented through public funding, urban gardens form a biodiversity network and have the same social effects through micro-interventions by involving citizens in the management and maintenance of green spaces, possibly saving public resources.

The design experiences analyzed here clearly outline the intimate differences between Green Infrastructure and Urban Gardens; in the first case, large-scale unit projects are foreseen, with major investments by public administrations; in the second case, small local projects can be realized with the involvement of small, networked communities, with restricted public investments. Green infrastructure units consider the city in terms of "smart city", while the most widespread and interstitial interventions of Urban Gardens seem to be a "resilient strategy", with even more significant social implications.

Using a strategy in line with the European Biodiversity Guidelines can implement and activate urban regeneration processes and enhancing local territories at the same time.

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IMAGE SOURCES

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AN ANALYTICAL TOOL TO SUPPORT THE PEDESTRIANISATION PROCESS

THE CASE OF VIA ROMA, CAGLIARI

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ABSTRACT

The article focuses on the case of the modification of an urban road network: the transformation of a portion of an important distributor road in the urban area of Cagliari into a pedestrian space. By means of this case study the article aims to point out how the conditions of hierarchy constitute a supporting tool for controlling and verifying the project of pedestrianisation. This analysis uses the fundamental conditions of hierarchy as a tool to assess to what extent the modification of the road network articulation has resulted in conditions of lesser inter-connectivity, legibility and functionality.
This analysis evidences that pedestrianisation interventions have not been completely defined within a theoretical system that clearly establishes modes and conditions of implementation. In this perspective the article proposes a system of criteria, founded on the principles of hierarchy, meant to be a theoretical support for processes of pedestrianisation.

KEYWORDS:
Hierarchy, arteriality, constitution, configuration, network.

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支持行人专用区进程的分析工具罗马

卡利亚里案例

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摘要

本文聚焦在城市道路网络改造的案例：将卡利亚里市区的重要干路的一部分改造为步行空间。通过对这一案例的研究，本文旨在指出层次结构条件是如何为控制与证实行人专用区项目构成一个支持工具。本分析使用了层次结构的基本条件作为一个工具来评估道路网连接的改造在多大程度上能够导致连接性、易可识别性与功能性降低的条件。
分析表明行人专用区干预在明确建立实施方式与条件的理论体系中未能被完全界定。从这个角度来看，本文提出了一个建立在层次结构原则之上的标准体系，旨在为行人专用区进程提供一个理论支持。

关键词：
层次结构，干路（干道），构造（章程），结构（布局网络

1 INTRODUCTION

Contemporaneity is denoted by the rediscovery of the porous character of territories, that urges the research of different modes of interpreting, conceptualising and organising mobility networks (Secchi, 2005). The isotropic structure of environmental networks, of cycling and pedestrian paths, open spaces and mass transport, is regarded as the foundation of a porous and permeable configuration of territories; this spatial organization is the condition for redistributing the spatial capital, increasing resilience of urbanised territories, restoring continuity between different ecological systems and increasing the plurality of modes of practicing spaces. (Alexander et al., 1977; La Cecla 2014; Jacobs, 1961; Gehl, 1987; Salingaros, 2005; Secchi, 2013). In this last instance, particularly, are encompassed the modification of the relationships with one's own body and space (Secchi, 2000), the transformation of leisure time (Donini, 2008; Magris, 2005), the rediscovery of the significance of usual local-scale practices as opportunities for encounters generative of original identities, codes, ideas (BenjaminElliott, 2011, Jacobs, 1961; Alexander et al., 1977; Gehl, 198791; Salingaros, 2005a;b; Tonucci, 2005; Secchi, 20142013; La Cecla, 20152014, Tiboni & Rossetti, 2012).

A question emerges, related to the discontinuities determined by the primary distribution networks – and by their constitutive discrete elements (Secchi 2005, 20142013, Bianchetti 2014). This question meets the criticism to some figures on which the network articulation is based and the search for alternative metaphors and paradigms (Ventura 1989, Magnani & Val 1989; Magnani, 2005, Viganò 2010). As a consequence, an instance of domestication of main transport infrastructures arises: it often results in transformation policies of large mobility spaces routes – or of portions of these – into multi-functional pedestrian spaces.

When these interventions modify the hierarchies on which road patterns and relations between different modes of movement are established, they lead to conditions of lesser functionality of transport networks: pedestrianisation strategies have not been fully defined within a coherent theoretical system meant to establish fundamental criteria, conditions and modalities of implementation.

This article presents and analyses the case study of the partial pedestrianization of an urban arterial road, in Cagliari. This analysis points out how hierarchy is a fundamental condition of some desired structural properties of transportation networks: coherence, legibility, inter-connectivity of road patterns, and safety and fluidity of circulation (Jiang, 2009; Marshall, 2005; 20142016; Salingaros, 2005; Xie & Levinson, 2007; Yerra & Levinson, 2005). Moreover, it infers, from the structural conditions of hierarchy, a qualitative method for control and appraisal of the project of pedestrianisation from the structural conditions of hierarchy.

The article consists of four sections; the first one introduces the case study and describes trans-scalar transformations induced on the mobility network by the partial pedestrianization of via Roma. These transformations are thus attributed to alterations in the hierarchical structure of interdependent and non-discursive (Hillier, 1996) relations between different routes. The second section, thus, defines the notion of hierarchy, related to transport networks, and identifies its fundamental conditions; the purpose is to show evidence that hierarchy is the condition of some desirable networks structure properties. The subsequent section identifies the cause of the discontinuity of minor networks; it proposes a hierarchy of modes of movement, based on speed bands, as a criterion for defining the relationships between different modes of interaction simultaneously present along a route. The fourth section describes a qualitative analytical method, based on the conditions of the hierarchy, and describes its application to the case study. The conclusions reflect on the findings of the previous sections and consider their potential as criteria for the definition and implementation of regeneration actions in road networks links.

2 HIERARCHY

As stated by Marshall (2005), in order to define hierarchy, a preliminary consideration concerning the distinction between the different dimensions of structures is required: *composition*, which refers to the metric

characteristics of a system; *configuration*, related to its topology; and *constitution*, which identifies distinct types of elements and determines their relations of interdependence. This distinction results in the definition of hierarchy as a structure of types (Marshall, 2005) and, more precisely, as a particular form of constitution, identified by four specific structural conditions: 1) differentiation of components; 2) ordered ranking of elements; 3), arteriality or necessary connections and 4) access constraint that restricts admissible connections only to those established between elements of the same type or complementary, i.e. whose rank diverges of just one position (or degree). Arteriality, in particular, is a fundamental feature of road networks: the contiguity of routes that constitute strategic itineraries at a specific level of scale. Thus, a network could be conceptualized as a structure of contiguous and complete sub-networks of different scales. Arteriality is the implicit fundament of any relevant functional classification of roads, since it is a category by which the specific function of each arc can be recognised in relation to the network, and referred to the dimension of the geographic realm served.

Some measurable properties have been identified to derive the function of each route from the analysis of the network configuration: *cardinality*, determined by observing the conditions of continuity and termination in the nodes of each route (Marshall, 2016), and *betweenness*, that measures the significance of each arc as a bridging element between distinct topological shorter paths (Jiang, 2009).

2.1 FAVOURABLE PROPERTIES OF A NETWORK

A road pattern that satisfies the structural conditions of hierarchy also possesses two fundamental desirable properties of networks (Marshall, 2005; Xie & Levinson, 2007): *legibility* and *inter-connectivity*. These properties are related to the user experience and determine individual behaviors and route choices, whose interaction defines the distribution of flows (Xie & Levinson 2007).

Legibility determines to what extent it is simple to gather the structure of a network. Arteriality and access constraint are fundamental features that allow users to determine their position within the network, according to the status of the route along which they proceed (Marshall, 2005). This condition thus implies the recognisability of the type, hence of the rank, of each route.

Inter-connectivity depends on the number, type and pattern of routes and intersections. Inter-connectivity can be measured as a function of the perceived continuity of movement across a network: this, in turn, is determined by measuring the number of transfers between roads of different classes (Xie & Levinson, 2007): as arteriality implies contiguity of strategic routes, it also ensures continuity of movement within the sub-network of primary distribution, thus resulting in an increased inter-connection of the entire system. However, this formulation of the continuity variable doesn't consider that the crossing of an intersection in case of vehicular mobility - even if between routes of the same class - results per se in an increased path discontinuity, due to the inconvenience associated with variations of speed and direction. Salingaros (2005) observes that, beyond a certain dimension, in an isotropic network of local-scale routes, the number of nodes traversed during a generic trip increases to the point of resulting in a perception of greater discontinuity and of decreased network connectivity. The introduction of larger scale elements and their configuration within a contiguous sub-network result in an increase of inter-connectivity and path continuity. Thus, the requirement of ensuring continuity implies the reduction in the number of accesses to the main routes and the spacing of consecutive intersections: it results in the configuration of arterial roads as discrete elements (Pisano, 2016, 2018) and, as far as vehicular mobility is concerned, in the requirement of ensuring conditions of access constraint.

Levinson and Yerra (2005) also demonstrate how hierarchy is an emerging property of complex systems: an isotropic network tends to modify and self-organize according to a hierarchical constitution. Jiang's analyses (2009) demonstrate the validity of this hypothesis by verifying the power laws informing the distribution of size and frequency of some fundamental variables related to the form or function of the routes in a network: for example, a rank order rule is recognized in the distribution of street length values and the cumulative

distribution of paths connectivity values and betweenness values resembles the 80/20 principle. Likewise, considering the distribution of flows within the road layout of the urban area of Gavle, Jiang concludes that the mobility function of a route descends from its morphology and its structural role within the configuration of the network.

2.2 A HIERARCHY OF MODES OF MOVEMENT

Having defined hierarchy as a specific type of *constitution*, indeed, as a structure of types, it can be concluded that the discontinuity of urbanized territories, pedestrian and cycling paths, and open spaces depends on specific functional and morphological features of types; thus, on parameters selected as a basis for route classification. The discontinuity of minor networks is implicit in conventional route typologies where the system function is derived from the mobility function, according to an imposed inverse relationship between the distribution function and the access function: thus an exclusionary relationship – hence a separation – is introduced between the transit function and any form of minute scale interaction that unfolds within the road space or between roads and buildings. Consequently, cycling and pedestrian surfaces occupy the last tier of the hierarchy and, consistently with the condition of arteriality, they constitute fragmented and discontinuous fabrics, dispersed among arterial routes exclusively designed for vehicular transit. Therefore, the restoration of continuity of territorial structures requires to overcome the inverse relationship between transit function and urban function and to interpret them as distinct but compatible dimensions of infrastructural spaces; this paradigm shift results in the possibility of conceptualizing strategic routes as multi-modal and multi-functional spaces; it is also consistent with the definition of route types in constitutional terms, according to the principle of arteriality.

The fundamental question arising from this first conclusion concerns the definition of the conditions within which different modes of movement can coexist in the same road section. This question can be expressed in terms of determination of admissible connections between elements of a hierarchy: the speed differential is considered as the most relevant criterion for determining the degree of separation between distinct modes of movement (Marshall, 2005). Thus, speed is identified as the parameter for a modal hierarchy; according to this, consistently with the principle of *access constraint*, the conditions of contiguity and separation between different modes of transport and their relative surfaces are determined. Moreover, these conditions are a criterion for establishing admissible connections between roads engaged by different modes of movement. Adherence to this criterion is a fundamental condition for ensuring fluidity and safety of circulation, as it implies a substantial reduction of conflicts among modes of movement characterized by significantly different speeds. In addition, since the categories of traffic admitted along a road depend on its function within the transport network, the degree of separation among surfaces intended for specific modes of movement constitutes a morphological parameter that determines the consistency between the typological definition of a route and its geometry. This coherence is implicit in the first principle of hierarchy: the distinction of components. The formalisation of these concepts as criteria of a tool for preliminary evaluation of transformation of the network structure constitutes the object of the research discussed here. In the following paragraphs authors present the methodology and the case study (the city of Cagliari).

3 METHODOLOGY

This section, based on findings summarised in previous sections, proposes a qualitative method founded on the structural conditions of hierarchy and explores its application as a tool for verifying whether the transformations of arterial routes into pedestrian spaces alter the functionality of mobility networks. This approach reflects the need of managing the road space at a network level (Jones, 2017). The analysis requiresfirst step is to reconstruct the configuration of the considered portion of the road layout: The Open Street Map database is selected as a fundamental, independent and available source of data (Almendros-

Jiménez et al. 2017; Jiang & Okabe, 2014) for reconstructing the configuration of the road layout. Then the road layout is represented as a route structure (Marshall, 2005, 2016). and a qualitative evaluation of its constitutional properties is developed. Moreover, in the OpenStreetMap database some types are defined according to several parameters and express the different dimensions of a road space: for example, the land uses along margins. These denominations specify the fundamental definition related to the significance of the route within the network. Nevertheless, these denominations have been rejected when implying an inverse relationship between distribution function and access function and, generally, between the transit status and the place status of a route.

Moreover, the proposed analytic method does not consider the principle of arteriality as an explicit criterion: the adherence of the network to this condition is implicit in the typological definition of each arc, classified according to the principle of arteriality, precisely because topologically contiguous within a complete and continuous sub-network that encompasses a specific geographic area. Consequently, only the conditions of *access constraint* and *differentiation of components* are individuated as pertinent parameters. The first condition is verified if non-complementary routes, attributable to types whose ranks differ of more than one position, do not connect contiguously. The second condition is verified if the morphological characters of an element are appropriate to its system function. The variable considered is the degree of separation between lanes and surfaces serving different uses or modes of movement, classified according to their speed values. Therefore, with reference to the categories identified in Table 1, three conditions are imposed: 1) modes of movement attributable to the same class can be accommodated by the same lane; 2) modes of movement of different ranks unfold along contiguous lanes if, among their coded types, there is a rank difference equal to or less than one integer value (S3 and S2); 3) if the difference between their relative coded types exceeds one integer value, the different modes of movement are segregated, each one within a confined surface, or within surfaces separated by lanes intended for intermediate-tier movement modes.

CATEGORY	SPEED BAND	MODES OF MOVEMENT
S5	Very high speed	Train, fast motor movement on motorway, busway, etc.
S4	High speed	The highest speed for a carriageway associated with a footway or urban street
S3.5	Medium-high speed	Medium-high speed motor transport movement
S3	Medium speed	Medium speed motor transport movement
S2.5	Medium-slow	Running; cycling; medium-slow motor movement
S2	Slow	Jogging; slow cycling or very slow motor movement
S1.5	Very slow	Walking pace; cycling or parking at walking pace
S1	Walking speed	Slow walking pace

Table 1. Stratification by speed; (Marshall, 2005)

4 CASE STUDY

This article is founded on the analysis of a concrete case of modification of an urban road network: the pedestrianisation of a portion of a main distributor in the urban area of Cagliari. Cagliari is the core of the metropolitan ciy of Cagliari constituted by 17 municipalities and its territory is defined by a polycentric structure, in which a complex pattern of relations of communication and social dependence are easily identifiable. Cagliari emerged as an optimal case study because of the concentration of conditions relevant to our studies: 1) the structure of the urbanised region, determined by processes of dispersion of residential and productive functions along main transportation corridors; 2) the concentration of metropolitan-scale services (educational, cultural, social) and of administrative functions in the compact city; 3) a transport system mainly

reliant on the road network; 4) a strong pressure on arterial distributors and on the network of urban sub-arterial and secondary distributors. Recent surveys measure 164.637 cars entering the urban area of Cagliari in an average week day and 130.336 cars leaving the urban centre (Comune di Cagliari, 2012), on a population of 156.538 residents (Comune di Cagliari, 2017); 5) presence of urban corridors relevant as distributors serving the metropolitan areas and as urban places (Via Roma, Viale Colombo): hence a competition for space arises among different uses and practices; vi) the strong commitment of the local authorities in policies able to foster sustainable modes of transport, including the introduction of a service of bicycle-sharing, sporting events (Cagliari respira – since 2008) and cultural initiatives (Museo in Transito – since 2015), experimentations and promotional campaigns (Zeus - Zero Emission Urban Bus System – Project, started in 2015) and the reorganisation of public open spaces. This last action is articulated in the following interventions: (i) the network extension of lanes reserved for public transport means and of cycling paths; (ii) the pedestrianisation of different areas of Cagliari (such as the Villanova and Marina districts) and of roads (such as the Corso Vittorio Emanuele, starting from 2016), and finally, (iii) the restoration of significant outdoor urban places (such as via Manno, starting from 2017, via Garibaldi, starting from 2015, piazza Garibaldi and piazza San Michele, starting from 2017). These factors result in a particular sensitivity of the context to the implementation of policies not grounded on a solid theoretical framework.

As a result, our research aims at proposing a preliminary analytical tool for the evaluation of hypothesis of modification of the structure of road network, based on the recognition of the relevance of the figure of hierarchy and, thus, on the utilisation of its structural condition as pertinent criteria.

4.1 THE PEDESTRIANISATION PROCESS

Opened in 1883, Via Roma consists of two carriageways – "*Lato Portici*" towards the city and "*Lato Porto*" towards the sea – separated by a central tree-lined promenade and it is delimited by a sequence of buildings opening towards the road space through a passageway. It is one of the main arteries crossing the center of Cagliari: some of the major buildings of the political power, such as the Civic Palace and the Regional Council, aligned along its margins. After the Second World War, via Roma assumed the role of fundamental urban distributor, intensely frequented by pedestrians and engaged by large flows of private vehicles, trolleybuses and buses. Therefore, it emerges the significance of via Roma within the urban structure.

In particular it emerges that Via Roma constitutes a multi-modal and multi-functional space, since it is part of contiguous circuits of strategic itineraries both at the metropolitan and at the district scale**.** Moreover, it is a fundamental arc within the public transport network. This condition is pointed out by the road classification derived from the Open Street Map database; this defines Via Roma *Lato Porto* as a primary road and Via Roma *Lato Portici* as a tertiary route. In recent years, a series of urban policies, in line with European trends, have led to a global requalification of the historic districts of Cagliari as restricted traffic zones and to the pedestrianization of main commercial streets.

The resulting configuration is connoted by the segregation between portions of the urban fabric – contiguous to the core of the compact historic city – connected by two links only: via Roma to the south and Porta Cristina to the northern extremity of the hill of Castello. This partial fracture and the consequent concentration of different flows along Via Roma have led to several proposals for the re-arrangement of the road surface: the re-configurations of the road sections, the concentration of public transport lines within a dedicated carriageway and the transformation of the central promenade into a reserved parking area for the residents of Marina district; these interventions add to the radical hypothesis of removal and confinement of vehicle lanes within entrenchments or tunnels, in order to release Via Roma from urban and metropolitan scale traffic flows. In this context lies the decision taken by the City Council to undertake the temporary pedestrianisation of Via Roma Lato Portici from August, 11 to September, 17, 2017. This experimentation, never conducted

before for such a prolonged period, resulted in numerous variations in traffic circulation and, in particular, in a significant modification of the network configuration.

Fig. 1. Separation between parts of the urban fabric

4.2 ANALYSIS

The transformation of Via Roma *Lato Portici* in a pedestrian space introduces a modification of the road pattern that invests different levels of scale: it determines the overlapping – along the strategic itinerary composed of Via Roma Lato Porto, Viale La Playa and Via Riva di Ponente – between the inter-district/local sub-network and the primary network; moreover routes such as Via Sassari, identifiable as links between the primary and the inter-district subnetworks, evolve into strategic routes within the inter-district sub-network, canalising movement of secondary distribution and penetration towards the primary distributors. As a consequence, Via

Roma *Lato Porto*, Via Riva di Ponente and Viale La Playa – in addition to a function of primary distribution – perform functions of penetration and secondary distribution. Moreover, it is observed, along certain routes, a situation of interference between different modes of movement. For instance, along the first segment of Via Sassari, promiscuity arises between distribution and access of private vehicles, public transport bus access,

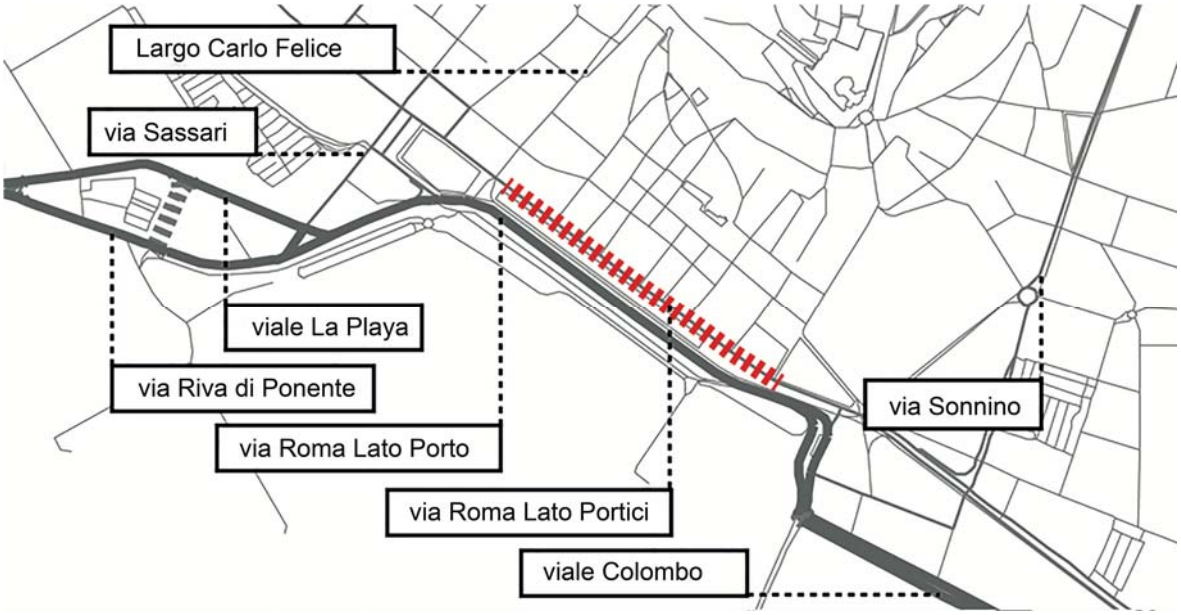

Fig. 2. The pedestrianized arc of via Roma Lato Portici.

parking, and walking. These criticalities, partially pre-existing, are exasperated, in consequence of the pedestrianization intervention, by the concentration, along adjacent routes, of functions of secondary distribution and penetration previously served by via Roma *Lato Portici*. The intervention of pedestrianisation *thus modifies* the link status of adjacent routes (Marshall, 2004; Annunziata & Annunziata, 2015): it increases their significance as bridging elements between two portions of the network strongly connected internally but weakly connected to each other.

Therefore it can be concluded that the transformation of Via Roma affects the fluidity of the circulation, and the legibility of the system. These considerations arise from the situations of congestion observed during the period of the experimentation, at the extremities of Via Roma, particularly in via Sassari, Viale la Playa and Traversa prima La Playa, and admitted by the Municipal Administration (Ansa 2017; Unione Sarda 2017).

As a consequence, it can be observed that the transformation of a single route determines a modification of the structure of the network. Nonetheless, these modifications do not seem to have been adequately considered in the implementation of the intervention of the pedestrianization. In a more general sense, it can be observed that the projects and strategies of transformation of infrastructural spaces – and particularly those regarding the conversion of spaces of mobility in multi-functional pedestrian spaces – lack of adequate predictive tools, meant to support the control and evaluation of trans-scalar effects produced by localized interventions. As a result, an analytic tool is required: this should be founded on a broad comprehension of the network properties engaged by the radical transformation of a road, as in the case of its conversion in a pedestrian space. It can be observed that the intervention proposed for Via Roma Lato Portici seems to engage a complex of interdependent relations constituting the implicit, non-discursive, structure of the network (Hillier, 1996; Cutini, 2017). These relations, as observed by Marshall (2005), constitute the most pertinent basis for a functional classification of roads: "the classification of an individual section of road refers to its relationship with the rest of the network. In other words, this is designation by relation" (Marshall, 2005, p.60): in this perspective, thus, function is intended as network function and not as traffic function; moreover, a classification system founded on the network-function of each road section, constitutes an ordered system

that underlines the relative importance and the significance of each element with respect to the network: thus, it defines a hierarchy of roads.
As a consequence, it can be argued that the modification of the status of a road determines the modification of a pattern of relations associated and profoundly connected to the hierarchical organisation of the network; thus, it is by understanding the fundamental properties of hierarchy that a consistent analytic tool can be defined. In the sequent section the authors discuss the application of the proposed qualitative analytic method to the case study.

4.3 CONSIDERATIONS ON THE CASE STUDY

The proposed qualitative method can be regarded as an analytic tool, by means of which to reconstruct alterations in the structure of the road pattern produced by the pedestrianization of via Roma Lato Portici.
The analysis requires to reconstruct the configurational and constitutional properties of the road layout: the network function of each element, hence its type and rank, is derived from the *Open Street Map* database.
The analysis of the road network reveals the existence of three circuits, or rings, that constitute contiguous subsystems of strategic itineraries. Hence, a metropolitan arterial sub-network is identified, consisting of trunk roads and primary distributors and an inner sub-network, contiguous at the scale of the compact urban settlement; these two circuits include the strategic itinerary unfolding along Via Roma (Lato Porto), Via Riva di Ponente and Viale La Playa.

Fig.3. Configuration of the road network and classification of its routes

Then, a contiguous sub-network of secondary and tertiary distributors is identified; this inter-district circuit encompasses Via Roma Lato Portici. This route carries out a local distribution function towards Marina district and it connects to the finest scale district network composed of local streets and pedestrian routes. Applying the proposed analytic method, it can be observed that trans-scalar effects of this intervention, are interpretable as consequences of the modification of the network constitutional properties, that is, of constitutional relations between routes. The partial overlapping between the inter-district network and the metropolitan network – determining the direct conjunction of a tertiary road and of a local road with a primary distributor – implies,

in fact, a pattern of connections between routes attributable to different types that does not verify the access constraint condition. Likewise, situations of conflict and interference between different modes of movement and different practices can be interpreted as a pattern of relations between different functions not consistent with the access constraint condition, referred to the proposed modal hierarchy based on speed values.

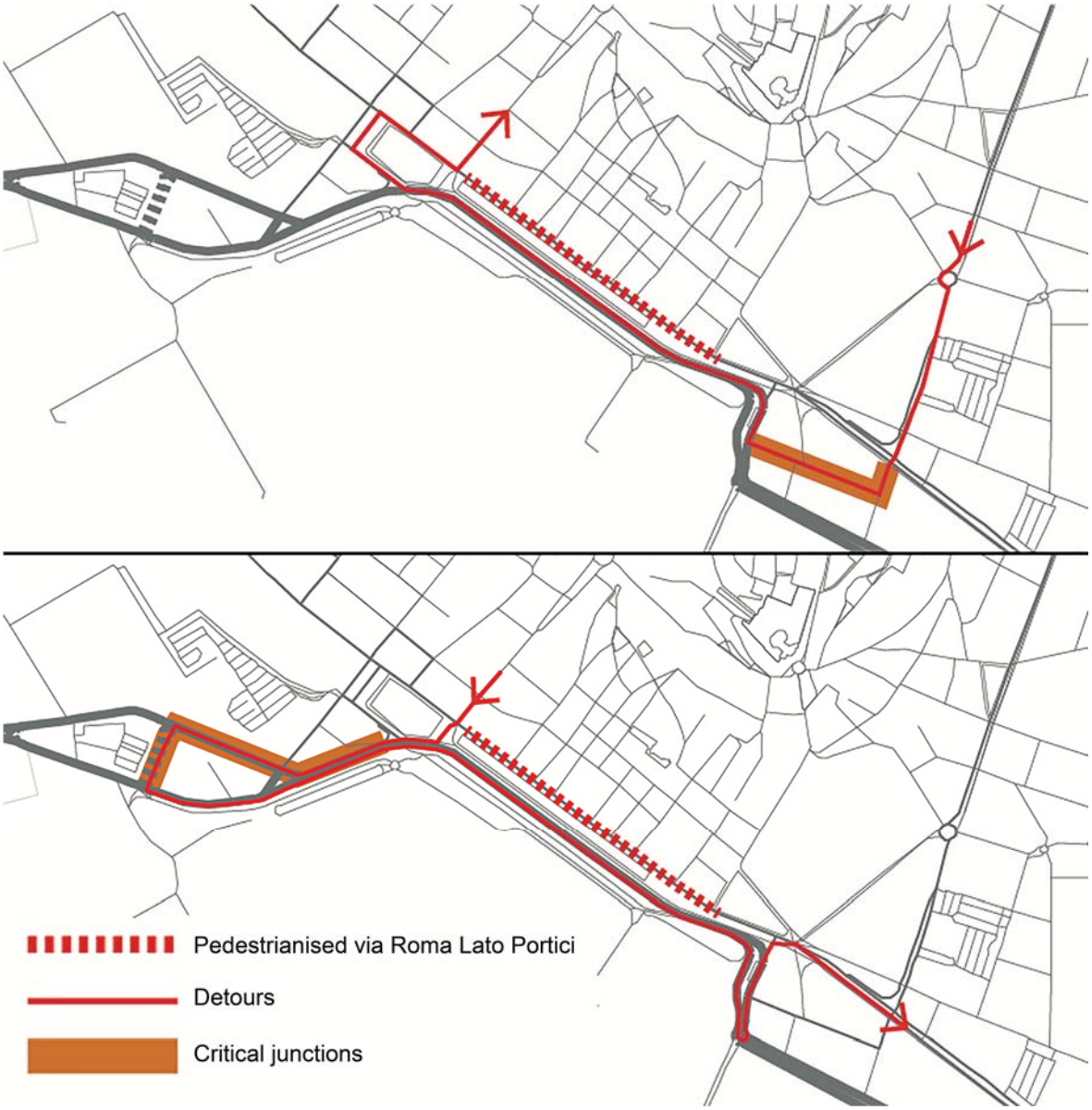

Fig. 4. The Effects of the overlapping between the primary and the inter-districts sub network.

Therefore, the interference, observed along Via Sassari and Viale La Playa, between distribution of vehicular traffic, access function, parking and pedestrian mobility, can be interpreted and described as a condition of contiguity between medium-high speed motor movement (S3) parking at walking pace (S1.5) and slow walking pace (S1), thus as a pattern of direct connections between modes of movement attributable – according to their specific speed bands – to types whose ranks differ of more than one integer. This particular condition results in decreased safety and fluidity of circulation. Moreover, this situation implies the loss of a clear relation between the typological definition of roads, related to their specific function, and the pattern of separation and contiguity relations among surfaces dedicated to different modes of movement: this aspect represents a fundamental morphologic feature of the road space; Therefore, the first principle of hierarchy, the distinction of components, is not satisfied: this results in a lesser recognizability of road types and in a decreased legibility

of the network structure. As a consequence, the situations of congestion and the decreased functionality, legibility and coherence of the network, observed during the experimentation period, appear to be interpretable as a consequence of the rupture of the hierarchical properties of the road pattern.

5 CONCLUSIONS

Hierarchy is a fundamental figure for both the analysis and the organization of mobility systems; nonetheless, as it is often interpreted as a generic form of order and identified with particular configurations, it is increasingly invested by a radical critique that prefigures its overcoming (Astolfo & Boano, 2014; Marshall, 2005; Secchi 1989; 2000; Viganò, 2010). Reaffirming the conclusions from previous studies, this article pointed out the distinction between *constitution*, *configuration* and *composition* as different aspects of the same structure, and defined the hierarchy as a specific type of constitution, by investigating its fundamental conditions, referred to road patterns: *distinction of types, rank determination, arteriality* and *access constraint*.

It was then observed how these principles are the condition of certain desirable properties of a transport network, such as *legibility* and *inter-connectivity*. Subsequently, it was noted that the discontinuity of minor networks depends on specific *configurational* and *compositional* features of networks and of infrastructures that constitute the main routes; these aspects are determined by an imposed inverse relationship between the distribution function and the access function. Conversely, the reference to *arteriality* as the most pertinent basis for the functional definition of routes, allows the overcoming of the opposition between mobility and urban place status and the configuration of roads as multi-modal and multi-functional spaces.

Likewise, the condition of *access constraint*, referred to a modal hierarchy based on speed classes, permits to coherently articulate the relationships between various functions along a road. In this way, the fluidity of circulation and the consistency between the typological definition of a route according to its system function and its morphology are guaranteed. From these considerations it emerges the significance of hierarchy as the fundamental condition of a transport network. This case study analysis, conducted by applying a qualitative method based on the conditions of *access constraint* and *distinction of types*, confirms that modifying hierarchical relationships between routes and modes of movement could result in a decrease in functionality of a road network. From these conclusions two alternative strategies emerge:

– the first one, that we could denominate the *recycle strategy*, entails the the modification of the network function of a route and its adjustment or radical transformation, for instance, through its complete pedestrianization. Nonetheless, this strategy requires to verify that the resulting *constitution* of the network still satisfies the conditions of hierarchy, in particular with respect to the principles of *access constraint* and *distinction of types*;

– the second one, referred to as the *healing strategy*, involves the centrality of the *composition* of roads, as the specific aspect to be addressed by interventions of *domestication* of infrastructural elements aimed at restoring the continuity of the territory, increasing its porosity and permeability, and reconstructing and expanding the minute systems of open spaces and of pedestrian and cycling paths.

In this perspective, numerous examples demonstrate the potential of this second strategy as a comprehensive research spacing from corrections of the infrastructure layout to the re-configurations of its transverse and longitudinal sections, from the connection to the soil to the design and organization of margins and residual spaces. Among these examples are La Gran Via de Les Cortes Catalanes designed by Carmen Fiol and Andreu Arriola, Jordi Henrich's Ronda del Mig, the Moll de la Fusta, by Manuel Solà-Morales, in Barcelona; the Atlantic Passeo in Porto, also designed by Manuel de Sola-Morales, and the rest area in Nîmes - Caissargues, designed by Bernard Lassus. It therefore emerges the necessity of the project as a device for investigating strategies that do not alter the function of a route within the mobility system – hence its constitutional and configurational properties – but pursue the integration of different movement functions and practices in the space of the infrastructure, by modifying its compositional features.

6 NOTES

This article is the result of the joint research developed by the two authors on the relationship between network, infrastructure, urbanization and landscape (see Annunziata, Pisano, Annunziata, 2015). In particular, the research on the network properties is mainly attributable to Annunziata, the analysis of the relationship between the network and the urbanized physical space is mainly attributable to Pisano, the methodological construction was jointly developed by Annunziata and Pisano.

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EXPECTATION MANAGEMENT AT THE LOCAL SCALE

LEGAL FAILURE OF PUBLIC PARTICIPATION FOR LARGE URBAN PLANNING PROJECTS

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ABSTRACT

The complex nature of large urban planning projects often results in delays or budget overruns. One of the causes is conflicts of interests between stakeholders. Recent planning failures in projects, due to limited public participation, sparked debates to increase citizen participation in formal planning procedures. This paper investigates how planning law supports public participation in large planning projects that cross municipal borders. The juridical analysis of German and Dutch codified law is based on four elements: literal content, institutional positioning, historical context, and teleological meaning of a legal text. The paper furthermore distinguishes four rationales for participation in planning: support, legitimization, improving plan quality, and education. The analysis shows that these rationales cannot be comprehensively regulated by codified law. Law can enhance the legitimate character of participation, but currently lacks the ability to organize support, improvement of planning, and education at the regional planning level.

KEYWORDS:
Participation; planning law; regional planning; Germany; the Netherlands

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本地范围的期望管理

关于大型城市规划项目之公众参与的法律失败

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摘要

大型城市规划项目的复杂性质往往导致项目延迟或预算超支。原因之一就是利益相关者之间的利益冲突。由于公众参与有限，因此，近期的规划项目失败引发了提高公民参与进正式规划程序的辩论。本文探讨了规划法是如何支持公众参与跨市界的大型规划项目。德国与丹麦成文法律的法理分析是基于四个要素：字面内容（文字内容）、机构职能（制度定位）、历史背景、法律文本的目的意义。本文就参与规划进一步区分为四个理论：支持/资助、合法化、提高规划质量与教育。分析表明，这些理论不能通过成文法律进行全面的规范。法律可以加强参与的合法性，但目前缺乏在区域规划阶段中组织支持/资助、改进规划与教育的能力。

关键词：
参与；规划法；区域规划；德国；荷兰

1 INTRODUCTION

"We planned, it worked" – with this special signboard, the City of Portland proudly announced a successful spatial planning project, which included a downtown plan for retail, parks, transit improvements, and housing efforts. This is worth mentioning, as planning projects often fail to keep within the foreseen time and budget. In particular, large spatial planning projects, such as the renewal of a station area in city centres (Spit & Bertolini, 1998) or the construction of new large infrastructure (e.g. for rail or energy) tend to struggle with time and budget. Moreover, when large urban planning projects reach beyond municipal boundaries in terms of impact and dimension, planning processes are long and dynamic (Dziomba & Matuschewski, 2007; Ibert, 2007). Municipalities have difficulty coping with the complex nature of these projects (Needham, te Raa, Spit, & Zwanikken, 2000). One of the issues that delays projects is conflicts of interests between invested stakeholders. Examples for such planning disasters are the renewal of the main station in Stuttgart, Germany, which raised furious and unexpected protests (Selle, 2011) or the station area in Utrecht, the Netherlands, where public appeals by citizens delayed train and tram facilities for several years. In recent years, there have been claims to include the need for better formal participation procedures in urban planning (Durner, 2011). Public participation in large urban planning projects is criticized as too vague because citizens' actual influence is regarded as limited (Dziomba & Matuschewski, 2007; Enserink & Monnikhof, 2003). This raises discussion on participation and its regulation (Durner, 2011).

Citizen participation is an important element of the spatial planning process (Irvin & Stansbury, 2004, p. 56). Coined as participative planning (Innes & Booher, 2000), the communicative turn in planning (Healey, 1996; Huxley, 2000), or collaborative planning (Innes & Booher 2010) in recent decades, this has become a trend towards more participation and stakeholder involvement in spatial planning (Wegener, 2012). Planning theorists tend to support the idea of more citizen involvement in planning processes (Edelenbos, 2000; Ritter, 2005)—a claim often related to the "ladder of citizen participation" by Arnstein (Arnstein, 1969). It is assumed in the academic debate that as citizen participation increases, the democratic legitimacy of planning increases as well. It is also assumed that it increases the quality of the outcome of planning, or that it creates support for a certain planning process (Hartmann, 2012). Citizen participation is sometimes celebrated as a goal itself in spatial planning (Brownill & Carpenter, 2007b; Dreijerink, Kruize, & van Kamp, 2008; Fagence, 1977; Silver, Scott, & Kazepov, 2010). In planning practice, however, participation often merely becomes "ritual dances" and "window dressing" (Edelenbos, 2000; Wolsink, 2003), where motives and purposes of participation often remain unclear (Hartmann, 2012; Leino & Laine, 2011), and the role and the power of citizens in participatory processes are vague (Donders, Hartmann, & Kokx, 2014). So there is a tension between planning theory on participatory planning and citizen participation in practice. Modes of participatory and collaborative governance that are favoured by planning theory seem not to fit in real world situations, which becomes obvious in large urban projects where citizen participation—or the lack thereof—regularly delays and hinders process and projects.

Planning law formally determines the boundaries and frontiers of urban planning (Stierand, 1993; Yang & Pandey, 2011). Participative governance is often regarded as a realm outside of land use regulations (Dziomba & Matuschewski, 2007; Hartmann & Needham, 2012; Ibert, 2007). Planners tend to pursue different planning objectives when it comes to participation (Albrechts, 2004; Campbell, 1996; Healey, 2002; Needham, 2006; van Straalen, Janssen-Jansen, & van den Brink, 2014). The impact of law on participatory and collaborative governance has often been marginalized or neglected in planning theory (Hartmann & Spit, 2015; Healey, 2003), but the legal perspective provides an understanding of how spatial planning processes function and are embedded in a certain legal context. The general assumption in this paper is that the law is a key systemic variable for the functioning and robustness of participative governance (Hartmann & Needham, 2012). Applying the method of the juridical analysis, this contribution compares two planning laws—the German and the Dutch—and their respective citizen participation, to trace the rationale of

participation in planning law. The central question is: to what extent does planning law support public participation beyond municipal boundaries?

In both countries, Germany and the Netherlands, participation is deeply embedded in planning legislation. A commentary on German participation regulations mentions that participation is an instrument for increasing democratic quality by citizen involvement in public decisions. It can also be seen as a process of legitimizing state activity, and serves as a tool to increase information (Battis, 2007). In 2011, the Dutch parliament proclaimed that public participation in spatial planning is of national interest for three reasons: it leads to broader public support, to a better quality of decisions, and to a more democratic process (Tweede Kamer der Staten-Generaal, 2011). The emphasis on participation during large projects in the new Dutch Environment and Spatial Planning Act (*'Omgevingswet'*)—to be enacted in 2021—highlights this proclamation by the Dutch parliament. Furthermore, the European Union wants its members to stimulate participation (Directive 2003/35/EC: providing for public participation for the drawing up of certain plans and programmes relating to the environment, 2003). We assume that the general arguments in this paper might be applicable to other countries with codified law as well as to the wider international debate on the relation between participation and regulation.

2 METHODOLOGICAL APPROACH: JURIDICAL ANALYSIS OF PARTICIPATION REGULATIONS

In this paper, codified law in Germany and the Netherlands are taken as starting points to analyse the relation between participation and planning law. In principle, there are two viewpoints when analysing legal texts. The first presumes a legal text to be an imperative itself, inducing a normative impact on the regulated subject through its wording. The second viewpoint perceives a legal text merely as "raw material for the communicative process" (Engberg, 2002), which needs to be contextualized by interpretation in concrete situations. Germany and the Netherlands are examples of the first legal tradition (the latter would be the Anglo-American interpretation). As such, our analysis of codified law aims to reconstruct the intention of a legislator (Stelmach & Brożek, 2011). Von Savigny developed a method of juridical analysis of codified law (Ifsen, 2004) using four elements: literal content, institutional positioning, historical context, and teleological meaning of a legal text (Stelmach & Brożek, 2011). This methodological approach is applied in this paper to German and Dutch planning law concerning citizen participation.

Our analysis is based on land use regulation, the German Federal Building Code (*Baugesetzbuch, BauGB*) and the Dutch Spatial Planning Act (*Wet Ruimtelijke Ordening*, Wro). It is important to note that German and Dutch planning laws only determine procedural aspects of participation. The *BauGB* and the *Wro* both emphasize early-stage participation and a display of the formal plan at the municipal level. The regulations are quite elaborate and sophisticated for the display of land-use plans, but both leave some scope for the specific realization of early-stage participation. We have analysed the legal texts and the official parliamentary explanations (German *Drucksache* and Dutch *nota van toelichting*, and its commentaries of both the *BauGB* and *Wro*). Furthermore, we have studied related and constitutional law of both countries (German constitutional law: *Grundgesetz,* German Regional Planning Act: *Raumordnungsgesetz (ROG),* Dutch General law on administration: *Algemene Wet Bestuursrecht,* and Dutch decree on regional planning: *Besluit Ruimtelijke Ordening*). This analysis is complemented by secondary data from other studies and an extensive literature review.

3 JURIDICAL ANALYSIS: PARTICIPATION IN GERMAN AND DUTCH PLANNING LAW

The juridical analysis consists of four steps. Accordingly, the first of the following four sections focuses on the content of the regulations for participation in land-use planning in Germany and the Netherlands. The second analyses the institutional positioning of the regulations: what are the superior laws and what is the

position of the regulations? Third, the historic development of participation regulations will be elaborated upon by contextualizing the law within the political debate. Fourth and finally, we will look for the teleological meaning of the regulations. This implies that we want to identify the legislator's intended purpose to recognize gaps between intentions and their realization. These four steps will help conclude how the law constrains or supports participation in large spatial planning projects. In each step, the two countries are addressed individually.

3.1 THE LITERAL CONTENT

GERMANY

In Germany the Federal Building Code (*Baugesetzbuch*, *BauGB*) is the most important law for municipal land-use planning. Municipal land-use planning is the central and most important instrument of spatial planning (besides regional planning) (Krautzberger, 2007). The Federal Building Code demands that municipal bodies regulate land use within their administrative territory; the municipality may not plan beyond this territory (Krautzberger, 2007). Besides the Federal Building Code, the Regional Planning Act (*Raumordnungsgesetz, ROG*) regulates spatial planning above the municipal level.

Section 3 of the Federal Building Code (BauGB) contains the most important regulations for participation procedures in German land-use plan procedures. German spatial planning law distinguishes here between early-stage participation and the plan display. Early-stage participation is open to the "general public" (Pahl-Weber & Henckel, 2008).

Nobody may be excluded from this early-stage participation (Berghäuser & Berghäuser, 2009). The text of the law also implies that this formal participation step needs to be taken in early phases of the project to create an opportunity to seriously take alternatives into consideration (Braam, 1999) and to incorporate hitherto neglected or overlooked arguments, facts, and ideas in the planning process (Bergäuser & Berghäuser, 2009).

The display of the draft plan ('Planauslegung') serves to collect recommendations for and objections to the plan (Pahl-Weber & Henckel, 2008). It is an independent and free-standing procedural step in the planning process (Battis, 2007). It is not so open in terms of both content and citizen participation. Section 3.2 BauGB determines that the display of the plan needs to be announced in a customary manner in the municipality. This formulation was intended as a minimum requirement for the announcement, but it also implies that it is not necessary to include citizens beyond the municipal boundaries in the participation process. Every citizen who puts forth a comment, proposal, or objection for or against a plan is entitled to an individual response. Only when more than 50 similar comments have been handed in, will the municipality respond with a public announcement of their answers (Battis, Krautzberger, & Löhr, 1997). This regulation is quite relevant for large projects because in such cases, the total of 50 comments is easily exceeded. In contrast to the early-stage participation, the plan display is quite strongly predetermined by law.

Yet, certain large projects may not fall under the regulations of the BauGB, but rather under the ROG—the Regional Planning Act. In general, the Regional Planning Act is not binding for individuals, but only for administration. An exception is the '*Raumordnungsverfahren'*, according to Article 15 of the law. It describes a special planning procedure for large projects.

This means that not all large projects require such a special planning procedure, but only projects that are relevant beyond municipal boundaries or have a supra-local impact. At a first glance, public participation on the regional level has many similarities with the municipal planning, but an important difference is that on the regional level there is no early-stage participation, only a single-step procedure for public participation (Spannowsky et al. 2010). In addition, participation as regulated in the Regional Planning Act is not obligatory, but a "can" regulation. Planning authorities may decide if, when, and to what extent the general public will be involved.

THE NETHERLANDS

The most relevant Dutch law on participation in land-use planning is the "Wet ruimtelijke ordening" (Wro) from 2008, which replaced the WRO (in capital letters) (van der Schoot, 2011). The new Wro aims at strengthening decisions at the local level, deregulation, and accelerating planning procedures (Kamphorst, Pleijte M., Kistenhas, & Kersten, 2008). Accordingly, it provides more flexible and more open planning processes (Kamphorst et al.), which strengthens the citizens' role (Tweede Kamer der Staten-Generaal, 2007, p. 14). Like the German BauGB, the Dutch Wro is a national-level law. Only the constitution and treaties or other international rules are superior (Taekema et al., 2011).

The Wro prescribes the procedure for the land-use plans (bestemmingsplannen) in which the first and last phases are relevant: the first is a fairly open participation process, similar to the German early-stage participation, and the last is the plan display ('terinzagelegging'), which is an opportunity to raise final objections. Besides binding land-use plans, the Dutch planning system under the Wro also prescribes 'structuurvisies'. These are strategic plans on the national, regional, and municipal level, which are only self-binding for the respective authority. For participation procedures, the Wro offers no binding regulations (van der Schoot, 2011, p. 57). The Wro is the most important planning law in the Netherlands (Faludi, 2000). The 'Algemene Wet Bestuursrecht' (AWB) (the general law for the actions of public administration) and the 'Besluit ruimtelijke ordening' (Bro) (spatial planning decree) specify the regulations laid out in the Wro. The Bro prescribes the details of the announcements for early-stage participation and the formal plan display (1.3.1 Bro). Section 1.3.1 Bro then refers to the AWB, which enables the administration to determine according to section 3.12 AWB who is, in fact, entitled to take part in early-stage participation (van der Schoot, 2011, p. 27). Therefore, the procedure is not open to everyone. The details of the formal procedure of the plan display are also regulated in the AWB, as section 3.8 of Wro prescribes (Needham, 2007) which are: the announcement, the length of the display, the entitled group, and the procedures (3.11 AWB). To be entitled to participate, a person or organization must have an interest that is directly affected by the intentional consequences of the plan in question (Needham, 2007).

3.2 THE INSTITUTIONAL POSITIONING

GERMANY

In Germany, the competence to govern within their own territory is an important and much valued principle. It is founded in German constitutional law (section 28 Grundgesetz, GG). Accordingly, German participation in land-use planning has a strong emphasis on municipal territory. Although Battis et al. (2007) see in the formulation of section 3.1 of the BauGB a right to participate for every legal body or natural person that might be affected, or that has any other interest in the plan (including from outside the municipality) (Battis, Krautzberger, & Löhr, 2007), the fact that the municipality determines who potentially might be affected (Battis et al., 2007) makes participation beyond municipal boundaries unlikely. At the regional level, which is relevant for large spatial projects, it is important to recognize that since the last reform of federalism in Germany, regional planning belongs to the "concurrent legislation". This means that the states in Germany may deviate from the national regional planning law and make their own regulations on participation. Finally, all 16 states have a regional planning law that involves the general public in regional planning procedures in one way or another (Spannowsky et al. 2010), whereas in some states participation is obligatory for regional planning. Because of the legal character of the regional planning legislation in Germany, however, participants may only object and comment on the spatial impact of projects and plans, but they may not comment or object against private interest (those are regulated at the local land-use planning level). This requires the planning authority to filter only those comments and objections that are in the general public interest (Spannowsky et al., 2010). This makes public participation on the regional level in Germany labour-intensive and complicated.

THE NETHERLANDS

Besides the written formal rules, the Netherlands has a tradition of unwritten law. Of great importance are the "rules of responsible public administration" (Needham, 2006) or "principles of good governance" (Taekema et al., 2011). Although they are not formally determined, courts recognize them as an accepted codex for governmental activities (Needham, 2006). Therefore, they have considerable impact at the local level. Such rules include that an agency should honour earlier promises, make decisions carefully, and consider all relevant facts (Taekema et al., 2011). This also implies that citizens' objections to plans are taken seriously, even if they are raised outside the formal planning procedures. Like in the German case, in Dutch practice, major decisions about a plan are often already made before a project enters the formal planning procedure in accordance with the Wro (de Leede, Smaal, & Spit, 1993). This means that citizens are often confronted with detailed plans for large projects, rather than being involved in the design of the projects. Although regional and national planning authorities explain this as a necessity, due to careful preparation (complicated calculations, mandatory environmental impact assessments), citizens can consider this a closed process.

3.3 HISTORICAL CONTEXT

THE INFLUENCE OF EU LEGISLATION

The Aarhus Convention of 1998 can be seen as a milestone for participation in planning (Dreijerink et al., 2008). It is an international treaty on participation in environmental planning, which initiated the 2003 passing of a European Union directive to support participation (Directive 2003/35/EC, 2003). National planning laws in Germany and the Netherlands have implemented it in their BauGB and Wro (respectively WRO). It is important to recognize that both laws were influenced by the same superior EU legislation, because this partly explains the similarities in both planning laws. Although land-use planning in Germany and in the Netherlands is in many respects crucially different (Tennekes & Harbers, 2012), regulations for participation in land-use planning pursue considerably similar approaches in both countries.

GERMANY: DARE DEMOCRACY, BUT SPEED UP PROCEDURES

The German Chancellor Willy Brandt's State of the Nation Address from 1969 is often quoted as the origin of public participation in Germany (Selle, 2010). With his famous sentence "Wir wollen mehr Demokratie wagen"—we want to brave more democracy—he argued for more co responsibility for citizens in different policy fields (Bundeskanzler Willy Brandt, 1969). In accordance with this, and with Arnstein's idea of participation as a form of citizen empowerment (Arnstein, 1969; Fagence, 1977, p. 4), the 1976 reform of the Federal Building Code aimed at a more intensive and earlier involvement of citizens in the planning process (Söfker, 2009, p. XIII).

Later, arguments against participation arose in reference to the efficiency of planning procedures (Battis et al., 2007). In the 1980s, the Western German parliament discussed the participation of citizens in regional planning procedures, while the government was concerned that this might affect the efficiency of planning processes (Deutscher Bundestag, 1980; Deutscher Bundestag, 1986). Also before the major reform in 1998 ('BauROG'), participation was under pressure from attempts to speed up processes, but finally the regulations for participation were strengthened (Battis et al., 1997). In 2006, a law was passed to accelerate planning and reduce participation processes (Söfker, 2009), making the tension between participation and plan efficiency quite obvious.

And today? In today's planning practice, participation is often conducted as a formality as Selle (2010) concludes. A "culture of participation" is missing in spatial planning (Berghäuser & Berghäuser, 2009). Some authors even speak about "Kommunikationsverweigerung"—refusal to communicate—on the authorities' part (Selle, 2010). It seems that, in the last few years, spatial planning practice has become almost fatalistic

towards participation, as is quite adequately illustrated by an early observation from Cvetkovich & Earle: "'public involvement' in practice often means holding a hearing primarily to inform the public, after the fact, of a decision that has been made" (Cvetkovich & Earle, 1992). Accordingly, the commitment of German administrations is regarded as deficient (Selle, 2010).

The Netherlands: 'Sneller en beter' (quicker and better)

As in Germany, different phases of participation can be identified over time. Participation has historically developed not only from spatial planning practice but rather from major political arguments and milestones in legislation, projects, and societal change (van Coenen, de Rob, & Johan, 2001). In the positivistic planning period after the Second World War, planning was predominantly technocratic, and not only in the Netherlands. Planners were assumed to know the public interest (Needham, 2007). In addition, 'pillarization' framed Dutch society at this time: society was split into subgroups along religious and socio-economic lines. The period is considered to have been characterized by a passive political attitude among Dutch citizens. By the end of the 1960s, 'depillarization' began to nurture new forms of participation (Michels, 2006).

Van Coenen et al. (2001) investigated how participation evolved in the period between 1970 and 2000 in the Netherlands (Yang & Pandey, 2011). They distinguished three phases during that time span in which participation had different functions: in the phase between 1970 and 1980 it functioned as a catalyst for protests and to authorize democratic decision-making. This style of governance in environmental policy is regarded as top-down regulation (Schreuder, 2001). The period is also characterized as a time of rationalistic planning, solving engineering planning problems (Baum, 1977; Rittel & Webber, 1973). In this phase, public participation was only about specific aspects of planning.

Guided by the idea of preserving natural resources, stronger legal and financial constraints were installed in the 1980s (Schreuder, 2001). At that time, policymakers pursued a broader and more integrated approach towards participation (Dreijerink et al., 2008). The famous Dutch "polder model" became more of a principle in public decision-making (Needham, 2007; Schreuder, 2001). Van Coenen et al. (2001) identified the 1980s as a time when participation became an important formal instrument to legitimize governmental actions.

Then, until the 2000s, participation developed as an instrument of reconsideration in the negotiation of agreements and covenants (Schreuder, 2001). Trust and common interest were considered the driving forces of Dutch economic and environmental problem solving (Schreuder, 2001). Meanwhile, land-use plans gradually became a less important planning instrument in Dutch planning practice because they were considered too inflexible. The requirement to be both a plan and a juridical ordinance made it difficult to react flexibly to new developments (Buitelaar, 2012) so the exemption procedures ('vrijstellingsprocedure') of former section 19 Wro became popular (van der Schoot, 2011) and often replaced the land-use plan itself. Participation was obligatory for this procedure only from 1999 onwards (van Buuren et al., 1999). From 1999 onward, every legally binding spatial planning procedure included participation in the formal procedures, including early-stage participation and a plan display.

A study of participation in 2006 advises that regulations in the Dutch Spatial Planning Act need to be adjusted to facilitate better participation (Tweede Kamer der Staten-Generaal, 2008). Accordingly, the law was revised in 2008. It strengthens the role of citizens in formal planning procedures (Tweede Kamer der Staten-Generaal, 2007). In 2011, the Dutch parliament proclaimed that public participation in urban planning is of national interest, as it leads to more democratic planning processes (Tweede Kamer der Staten-Generaal, 2011). At the same time, governmental agencies wished to accelerate planning procedures (Kamphorst et al., 2008). This is expressed by the term used by the Commission Elverding: "quicker and better"; accordingly, the Crisis and Recovery Act of March 2010 shortened planning procedures. This required smooth and well-functioning citizen participation processes, but simultaneously decreased the ability to appeal to municipal plans (for specific projects). Michels concluded that although several approaches aimed to improve participation have been discussed in the Netherlands, the "traditional

hierarchical approach to policymaking" has not been revised (Michels, 2006). Still, in the past few years, a counter-movement to participation that aims to speed up planning processes has been the trend.

3.4 TELEOLOGICAL MEANING OF A LEGAL TEXT

GERMANY AND THE NETHERLANDS: SIMILAR PROCEDURES

Roughly spoken, the participation procedures for land-use plans are quite alike in the Netherlands and in Germany. In both countries, formal participation is organized procedurally, and the procedures are similar. In broad terms, the participation regulations in both Germany and the Netherlands pursue a "linear and sequential" planning process (Enserink & Monnikhof, 2003). This is not surprising, because Dutch law was inspired by German legal thinking (Taekema, de Roo, & Elion-Valter, 2011). A "linear and sequential" planning process clearly determines the planning steps where the public is involved and where it is implicitly excluded. However, a less sequential process is required, such as a participatory co-design (Enserink & Monnikhof, 2003). The basic idea of such a process is not to separate participation from the design process; but participation is envisaged as accompanying the whole planning process. Such a concept seems highly appropriate, since a procedure with just two occasions for formal participation (at an early stage and at the end of the planning process) seems outdated, and certainly not suitable for changing stakeholders, large areas, complexity, uncertainty, and the long duration of planning processes for large projects.

The question of who may participate in a planning process has a crucial impact on the result of the participation (Ibert, 2007). The early-stage participation and the plan display under both laws—the BauGB and the Wro—are related to the formal proceedings of land-use plans at the municipal level. Consequently, the regulations on participation also refer to the territory of the municipality. Large projects are here considered as exceeding the territory of the municipality in size, importance, or effect. However, regulations for participation do not reach beyond municipal boundaries. Particularly in the case of large projects, this can be crucial: most large projects unfold their positive effects on a large spatial scale, whereas the negative effects most often affect local people directly on a local scale. For example, a huge new inner-city shopping centre might bring nuisances such as traffic jams, noise emissions, or economic threats upon shops in the direct neighbourhood, but it produces jobs, convenient shopping opportunities, and economic growth on a large spatial scale, which may even exceed the regional level. Furthermore, as large planning processes are very long and dynamic, municipalities—burdened with implementing participation—have difficulty in coping with them (Needham, te Raa, Spit, & Zwanikken, 2000). Public participation in such large urban planning projects is criticized as too vague because citizens' actual influence is regarded as limited (Dziomba & Matuschewski, 2007; Enserink & Monnikhof, 2003). When trying to understand citizen participation, the issue of the right scale is crucial (Crow, 2009). Often, participation in such projects is reduced to pure information regarding already decided issues (Dziomba & Matuschewski, 2007).

4 LEGAL POSSIBILITIES TO PARTICIPATION IN LARGE SCALE INFRASTRUCTURE PROJECTS

Earlier (see paragraph 1), we distinguish four purposes for participation in planning: support, legitimization, improving plan quality, and education. In this section we discuss how these purposes are taken up in German and Dutch planning law and what that entails for large projects. Our analysis shows legislators are not very concise in their definition of what they want to achieve with participation. Rather, multiple andpartly contradictory purposes of participation are mentioned in policy documents. Achieving one purpose (e.g., increasing support) means neglecting or at least not focusing on other purposes (e.g., increasing plan quality). Participation thus always remains imperfect, and an optimal balance between these partially contradictory purposes needs to be struck.

Still, we have looked at the four purposes of participation as mentioned above. First, we identified support as raising the number of citizens who agree with the plan. Even though historical analysis shows participation in planning has increased, it does not match the requirements and realities of large projects. Decisions are often already fixed before the formal planning procedure starts. Second, achieving legitimate participation would entail having a majority of involved citizens that agree to the plan. Our analysis shows that the legal emphasis on the municipal level does not suit large projects with effects beyond municipal territories, especially in the Netherlands, as our analysis shows that even in early-stage participation procedures, the government can choose whom to involve (and whom to exclude). Third, for improving plan quality, one could argue that open participatory processes and early-stage participation will improve the quality of the plan, as more and diverse stakeholders are involved. Our historical analysis shows initial improvement, but the recent focus on the formal plan display in large projects could reduce open participatory processes again. As such, we are curious to see if the new Dutch Environment and Spatial Planning Act—aimed at more flexible and inclusive planning processes—can turn the tide. Fourth, the formulations in the BauGB and the Wro are not adequate to satisfy an ambition of education, especially in large projects, especially since the historic development of participation in both countries has emerged from political debate and not from planning practice or citizen protests. This helps to understand the struggle among planning practitioners to implement sufficient participation, which is particularly visible in large projects.

5 DISCUSSION: RATIONALES FOR PARTICIPATION

There is some confusion about the rationale for participation (Brownill & Carpenter, 2007a). “Civil servants are often confused about the role and function of participatory practices in urban planning” (Leino & Laine, 2011). Although it is not easy to identify one single rationale for participation, it remains possible to identify several reiterated and important motives. From planning theory, we drew four different rationales of citizen participation in planning processes. It should increase the (public) support for a decision, assist in legalizing plans, improve the quality of a decision, and raise awareness for certain processes and projects, or educate civil society on planning processes (Brownill & Carpenter, 2007b; Donders et al., 2014; Dreijerink et al., 2008; Enserink & Monnikhof, 2003; Hartmann & Spit, 2016; Leino & Laine, 2011; Wesselink, Paavola, Fritsch, & Renn, 2011).

Although land-use planning in Germany and in the Netherlands is in many respects crucially different (see also Tennekes & Harbers, 2012), regulations for participation in land-use planning pursue similar approaches in both countries. Participation regulations in Germany and the Netherlands do not fit large projects reaching beyond municipal boundaries. The juridical analysis shows law considering participation does increase the legitimacy of plans. Still, one could wonder if creating a majority by choosing who to involve is the most fair manner to address participation. Increasing the number of stakeholders to increase public support conflicts with increasing plan quality. It is not necessary to have many stakeholders, but it is necessary to involve stakeholders who are informed and who can add their (lay) knowledge to the project. Increasing the plan quality in this way is more likely to create support for the project. In this respect, the planners involved in large scale projects need facilitative law, rather than law dictating the number of stakeholders involved. Finally, to increase plan quality and add to the number of informed stakeholders, more education, in general, is vital. Yet, planning law cannot force education on stakeholders, so acilitating civil society in communication and understanding of large urban projects will have the largest yield.

Previously we argued that planning law formally determines the boundaries and frontiers of urban planning (Stierand, 1993; Yang & Pandey, 2011). We conclude that law is indeed a key variable for the functioning of participation in planning, especially legitimacy of planning processes (Hartmann & Needham, 2012). Still, we

argue other forms of governance are required to facilitate participation in large projects: regulations that focus beyond municipal planning procedures.

The commitment of regional or state public authorities is crucial. The analysis above crucially uncovers a feature of planning law and participation: viable participation for large spatial planning projects cannot be comprehensively regulated by codified law but merely facilitated. Law can enhance the legitimate character of participation, but currently lacks the ability to organize support, improvement of planning, or education at the regional planning level.

Finding approaches to creating or to increasing such commitment requires analyses outside the realm of planning law or a major change in planning law itself. Planning law for the most part focusses on the local scale, especially in relation to participation. If citizen participation were to be legally enforced in large urban projects, planning law itself needs restructuring towards the regional level or at least an ability to accommodate cross boundary projects. If we have a first look towards the new Dutch Environment and Planning act, which aims to stimulate citizen participation in large scale projects, we see that the law is still oriented at the local scale.

The new Act suggests that regional planning is possible, but regulation is established in such a manner that it counteracts regional enforcement via law. As such, commitment of regional and state public authorities to facilitate citizen participation is a key variable for the success of large urban projects.

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Società Italiana degli Economisti dei Trasporti e della Logistica
Italian Society of Transport and Logistics Economists

XX Scientific Meeting
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The italian society of transport and logistics economists (società italiana di economia dei trasporti e della logistica, siet) is organising its annual conference to be held at politecnico di milano, milan, italy. The conference, hosting original scientific contributions from scholars and practitioners in all fields of transport economics, is introduced by a plenary session focusing on the relationship between cities, territories and mobility. This complex relationship, now often faced under the label of "sustainable mobility", is actually made of many interconnected layers: economy, governance, land-use planning, technical and technological choices, environment, etc. The session will try to explore such dimensions, in particular taking into account the role of land-use planning and of governance structure in the mobility-related outcomes.

The conference is organised in one initial plenary session followed by parallel sessions. The 3-days are concluded by a side-event, open to non-academic participants, about the rising phenomenon of travel platforms and their influence on market regulation. Special session reference persons and normal sessions moderators are invited to join the final parallel session, fully devoted to the discussion of results and of possible research topics.
Two type of sessions will be organized:
- sessions with pre-defined discussant;
- sessions with open discussion.

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REVIEWS PAGES

THE RESILIENCE CITY/THE FRAGILE CITY. METHODS, TOOLS AND BEST PRACTICES 1(2018)

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.

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

author: Maria Rosa Tremiterra
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04_UBAN PRACTICES
Urban practices describes the most innovative application in practice of the journal theme.

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

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评述页：

提高城市系统对自然及人为变化顺应能力的方法、工具和最佳实践

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，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（Smart Cities）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（Review Pages）。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，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
网站报告为读者提供与主题直接相关的网页。

author: Rosa Morosini
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02_BOOKS
书评推荐与期刊该期主题相关的最新出版著作。

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03_LAWS
法律部分提供主题相关标准方面的大量综述。

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04_URBAN PRACTICES
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05_NEWS AND EVENTS
新闻与活动部分让读者了解与期刊主题相关的会议、活动及展览。

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01

THE RESILIENCE CITY/THE FRAGILE CITY. METHODS, TOOLS AND BEST PRACTICES 1(2018)

REVIEW PAGES: WEB RESOURCES

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In this number

AWARDS FOR GREEN CITIES

The protection of our territory has become one of the highest priorities and the concept of sustainable development has increasingly taken off among the various countries of the European Union. Sustainable development has long been the focus of attention in the European project, and the EU's commitment supports a development that meets the needs of today without compromising the ability of future generations to meet their own needs (COM (2016)), 739 final).

In urban areas, population and therefore the density of urban activities are increasingly growing, with a consequent increase in pollution. However, though cities represent a significant source of global pollution, they can develop mitigation and adaptation strategies to combat the effects of climate change (Papa et al., 2014). In recent years, in fact, the European Commission has recognized the role and commitment of local authorities in implementing strategies for achieving a sustainable development and in this regard it has presented several projects aimed at rewarding efforts and initiatives of those cities that strive to promote a more environmentally-friendly urban life. Moreover, prizes are awarded to the cities that have stood out for intelligent planning, i.e. those cities which propose models and tools for sustainable urban development on the basis of new requirements (energy, waste, sustainability, etc.) as a priority imposed by global challenges (climate change, land use, etc.) (Papa et al., 2015).

The prizes identify the winning cities as the "role-models" to inspire other cities by creating a sort of friendly competition so that cities can share their experiences and then try to overcome themselves in a challenge that may only grant a higher level of common well-being.

Awarding a prize to a city can also be a source of pride for its citizens who can be encouraged to lead an environmentally-friendly lifestyle, not underestimating the fact that a green city becomes a pole of attraction for new green investors.

European Green Capital
http://ec.europa.eu/environment/europeangreencapital/

ENVIRONMENT EUROPEAN GREEN CAPITAL is the website developed by the European Commission which shows two prizes awarded each year to different cities: the European Green Capital Award and the European Green Leaf Award. The European Green Capital Award is the result of an initiative organized by 15 European cities (Tallinn, Helsinki, Riga, Vilnius, Berlin, Warsaw, Madrid, Ljubljana, Prague, Vienna, Kiel, Kotka, Dartford, Tartu & Glasgow) and the Association of Estonian cities on May 15, 2006 in Tallinn, Estonia.
At the top of the webpage are present two sections: about ECGA and Applying for ECGA, where applicants can read all the information on how to participate in the award, the jury and selection criteria as well as the cities that won the prize in previous years.
This award is open to any EU Member States and candidate countries for EU membership, Iceland, Liechtenstein, Norway and Switzerland. Another key requirement is that the cities of the countries listed above, which aspire to the prize, must have a population of more than 100,000 inhabitants. The winning city will not be able to resubmit the application for a period of ten years after its year as European Green Capital.
After submitting the application, the city that aspires to the role of European Green Capital will be evaluated by a jury made up of representatives of seven European institutions, including the Commission itself. The jury will evaluate the city on the basis of 12 environmental indicators:
– Climate change: mitigation;
– climate Change: adaptation;
– sustainable urban mobility;
– sustainable land use;
– nature and biodiversity;
– air quality;
– noise;
– waste;
– water;
– green growth and eco-innovation;
– energy performance;
– governance.
The jury will assess the information provided by each city on the basis of the 12 indicators above listed and will draw up a shortlist of cities. The shortlisted cities will be invited to submit to the jury the communication strategies supported by the action plans in order to explain how they intend to realize their green year project. Following these presentations, the jury will select the European Green Capital. Stockholm was the first winning city in 2010, followed by Hamburg in 2011, Vitoria-Gastiez in 2012, Nantes in 2013, Copenhagen in 2014, Bristol in 2015, Ljubljana in 2016, Essen in 2017, Nijmegen in 2018 and Oslo in 2019.
All the cities are recognised for their coherent record of achieving high environmental standards and commitment to ambitious targets. Lastly, in the "about ECGA" section, by clicking on Quicklinks it is possible to connect to social media like YouTube, Facebook and Twitter. Furthermore, under the section board, there is a string which allows to view videos on YouTube.

EUROPEAN GREEN LEAF
https://ec.europa.eu/environment/europeangreencapital/

Another award shown on the ENVIRONMENT EUROPEAN GREEN CAPITAL website is the European Green Leaf Award. This competition is aimed at cities and towns across Europe that have populations of between 20,000 and 100,000 people, recognizing the commitment to improving environmental performance, with a particular focus on the efforts that generate green growth and new jobs. In the top bar, by clicking on the European Green Leaf it is possible to access ten sub-sections displaying information about the competition: the rules of participation, the award criteria, the cities that previously won the prize, the jury's training and the objectives of this competition.

Every year cities can apply for the European Green Leaf Award but the previous years' winners of this award can not apply for a three-year period, and in the same year the same city can not apply for the Green Leaf Award if it has already applied for the Green Capital Award.

The Green Leaf Award has a two-stage evaluation process. First, an international independent expert group assesses each city's application by selecting a shortlist for the next phase of the competition. Applicants are assessed on the basis of six topic areas:

– Climate change and energy performance;
– sustainable urban mobility;
– nature, biodiversity and sustainable land use;
– air quality and noise
– waste and circular economy;
– water.

The European Green Leaf Award application form also includes a 'City Introduction and Context section', where every applicant is asked to briefly present the respective city, indicating the main challenges it faces and how to address them. A Good Practice Section is also included at the end of the application form where cities are invited to submit three good practices they are undertaking across three different environmental topic areas.

This information and the links from which it is possible to download all the material for participation in the competition are available in the subsection EGLA Evaluation process. Moreover, by clicking on EGLA Winning Cities, it is possible to view all the cities that have received the prize in previous years, as the Spanish city of Mollet del Vallès and the Portuguese city of Torres Vedras, which won the inaugural European Green Leaf Awards in 2015; the Irish city of Galway is the winner of the European Green Leaf Award 2017 and the Belgian city of Leuven and the Swedish city of Växjö are the joint winners of the European Green Leaf Awards in 2018.

In addition, within the same section, for each city the winner is linked to the respective press release documents. In the EGLA subsection 2019 (in the lower right side) there are links to social media such as YouTube, Facebook and Twitter. Lastly, by going back to the initial page of the site and clicking on the section of the European Green Leaf Award (in addition to a brief description of the award and the background) it is possible to view an animated video that shows how to make cities greener with a link to a YouTube section dedicated to the same theme.

CRESCO AWARD
https://crescoaward.ideatre60.it/

CRESCO AWARD is the website promoted by the Sodalitas Foundation which has been committed to supporting and spreading the culture of sustainability for over 20 years. The website is organized into six sections:
– CRESCO AWARD: sustainable cities;
– competition;
– how to participate;
– evaluation criteria and processes;
– companies awards;
– partnership.
This award (unlike the two above mentioned) is addressed to Italian and non-European cities and aims to enhance the innovative drive of Italian Municipalities by establishing a recognition for the most effective initiatives to promote the sustainable development of territories in a widespread way.
Participation in the CRESCO AWARD is open to Municipalities, Metropolitan cities and the Union/Association of Municipalities that can submit one or more projects related to the themes presented in the Sustainable Development Goals. Participants will have the opportunity to become part of the ANCI "Smart Cities Observatory" and to give visibility to their projects through the "Agenda Urbana" portal, the national platform promoted and implemented by ANCI that collects the innovative design experiences implemented by Italian cities. The results of the CRESCO AWARD will be disseminated through a communication plan drawn up by Fondazione Sodalitas, ANCI and the project partners. Applicants for the CRESCO AWARD can access the crescoaward.ideatre60 website by clicking in the "Participate in the Competitions" section and selecting the entry "CRESCO AWARD Sustainable Cities".
Lastly, in the home of the website, at the top right side, there are links with social networks like facebook and twitter.

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IMAGE SOURCES

The images are from: http://ec.europa.eu/environment/europeangreencapital/; https://crescoaward.ideatre60.it; https://pixabay.com/it/la-tutela-ambientale-886669/

02

THE RESILIENCE/THE FRAGILE CITY. METHODS, TOOLS AND BEST PRACTICES 1(2018)

REVIEW PAGES: BOOKS

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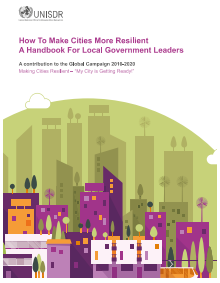
In this number

STRATEGIES AND POLICIES

Over the fifty percent of the world's population now live in urban areas, and this is projected to increase to sixty-six percent by 2050. Growth and the complex characteristics of cities can present occasions for sustainable development, while at the same time they have the potential to increase vulnerabilities and risk. Physical and spatial characteristics of urban areas, the socio-economic vulnerability of the population, the inadequacy of institutional capabilities and environmental challenges are some of the risk drivers that thrive under the complex situation that is in cities. Strategies and policies can be developed to address each of these issues and move towards safe, equitable and sustainable urban development. Cities are not only the places in which a majority of people live, they are also the core of the world's economy, generating over of eighty percent of global GDP. Today, almost all disproportionately phenomenon born in the cities, as the effects of climate change, aging infrastructure, population growth and migration, and social and economic inequity (Balaban & Şenol Balaban, 2015). In these places, there are important political centres and stand at the forefront of the challenges and opportunities. The spatial planning tools potentially can make a significant contribution in tackling the uncertainty and complexity of climate change (Salata & Yiannakou, 2016). So, the world has grown more urban, more integrated, and with a greater number of people at risk than ever before. These conditions require new models of urban governance. From extreme weather events to refugee crises, from disease pandemics to cyber-attacks, business-as-usual models of reactive planning and decision-making will not engender the fundamental strength and flexibility essential for the human to live. Building urban resilience is to survive, adapt, and grow the capacity of individuals, communities, institutions, businesses, and systems to live within urban areas. Acute shocks are sudden, sharp events that threaten the urban areas, such as earthquakes, disease outbreaks, or terrorist attacks. Chronic stresses, such as high unemployment, overtaxed or inefficient public transportation systems, or chronic recurrent flooding, weaken the urban area over time and exacerbate the effects when they inevitably occur. Mayors, local government officials, and decision makers are at the forefront of dealing with the impact of these negative phenomena. According to these themes, this section suggests three books and reports that help to better understand the issue of this number: How To Make Cities More Resilient A Handbook For Local Government Leaders; The London Plan - The Spatial Development Strategy for Greater London; and Cities Taking Action.



Title: **How To Make Cities More Resilient A Handbook For Local Government Leaders**
Author/editor: Ebru A. Gencer (CUDRR+R and UPAG)
Publisher: The United Nations Office for Disaster Risk Reduction (UNISDR)
Publication year: 2017
ISBN code: 978-92-1-101496-9

This handbook is designed primarily for local government leaders and policy makers. It seeks to support public policy and decision making so they can implement activities to reduce disaster risk and build resilience. It sets out practical guidance for putting the "Ten Essentials for Making Cities Resilient", into action. This handbook showcases the knowledge and expertise of several Campaign cities. It responds to the call for better access to information and knowledge resources, and tools to effectively deal with the impacts of natural hazards and climate change. It provides an overview of key strategies and actions as part of an overall sustainable urban development strategy. The annex to this Handbook contains links to tools, resources, and examples from partner cities. A web-based information platform, where cities and local governments can share their own tools, plans, regulations, and practices complements the handbook. Throughout the handbook, we refer to "cities" and "local governments." The approach to resilience, as described, also applies to sub-national administrations of different sizes and levels, including at regional, provincial, and metropolitan, city, municipal, township, and village levels.

A Resilient City is one, where: There is strong leadership and coordination and responsibilities in disaster risk management are clearly delineated. This includes effective stakeholder engagement, well defined policies and strategies and distribution of tasks, effective lines of communication and mechanisms that facilitate effective risk management; The city is up-to-date on knowledge about hazards. Risk assessments are routinely prepared as a basis for urban planning and long-term development, including current and future investment decisions that contribute to improved resilience; There is an adequate financial plan that complements and promotes mechanisms to support resilience activities; Urban planning is carried out based on up-to-date risk information with a focus on the most vulnerable groups; Natural ecosystems within and around the city's territory are identified, protected and monitored to sustain and safeguard their protective functions as natural buffers; All institutions relevant to a city's resilience are strengthened to have the capabilities they need to execute their roles; The social connectedness and culture of mutual help are strengthened through community, education, and multi-media channels of communication; There is a strategy to protect, update and maintain critical infrastructure to ensure that services continue and to increase resilience against hazards and the impacts of climate change; Effective disaster response is ensured by creating and regularly updating preparedness plans, connecting to early warning systems and increasing emergency and management capacities through public preparedness drills; Post-disaster recovery, rehabilitation, and reconstruction strategies are aligned with long term planning and provide an improved city environment after disaster events. The four priorities for action are: disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment; Disaster risk governance at the national, regional and global levels is very important for prevention, mitigation, preparedness, response, recovery, and rehabilitation. It fosters collaboration and partnership; Public and private investment in disaster risk prevention and reduction through structural and non-structural measures are essential to enhance the economic, social, health and cultural resilience of persons, communities, countries and their assets, as well as the environment; The growth of disaster risk means that there is a need to strengthen disaster preparedness for response, take action in the anticipation of events, and ensure capacities are in place for effective response and recovery at all levels.

Title: **The London Plan - The Spatial Development Strategy for Greater London**
Author/editor: Mayor of London
Publisher: Greater London Authority
Publication year: 2017
ISBN code: -

Under the legislation establishing the Greater London Authority (GLA), the Mayor is required to publish a Spatial Development Strategy (SDS) and keep it under review. The SDS is known as the London Plan. As the overall strategic plan for London, it sets out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years. The general objectives for the London Plan, and the process for drawing it up, altering it and replacing it, are set out in the Greater London Authority Act 1999 (as amended) and supporting detailed regulations. The Plan has been developed in line with these requirements. The legislation stipulates that the London Plan should only deal with things of strategic importance to Greater London taking account of the principal purposes of the Greater London Authority which are: promoting economic development and wealth creation in Greater London; promoting social development in Greater London; and promoting the improvement of the environment in Greater London. In developing this strategy, in accordance with the legislation and associated regulations, the Mayor has had regard to: the principle that there should be equality of opportunity for all people; reducing health inequality and promoting Londoners' health; achieving sustainable development in the United Kingdom; climate change and the consequences of climate change; the desirability of promoting and encouraging the use of the Thames, particularly for passenger and freight transportation; the resources available to implement the Mayor's strategies. The document brings together the geographical and locational aspects of the Mayor's other strategies, including those dealing with Transport, Environment, Economic Development, Housing, Culture, Health and Health Inequalities. The draft Plan has been developed alongside the Mayor's other statutory strategies to ensure consistency with those strategies. The London Plan is legally part of each of London's Local Planning Authorities' Development Plan and must be taken into account when planning decisions are taken in any part of London. Planning applications should be determined in accordance with it, unless there are sound planning reasons (other material considerations) which indicate otherwise. The Plan provides the strategic, London-wide policy context for borough local development plan documents; all local development plan documents and Neighbourhood Plans have to be 'in general conformity' with the London Plan. This means it is not an alteration or update to previous Plans. This Plan will be the third London Plan, the previous ones being the 2004 Plan produced by former Mayor of London Ken Livingstone and the 2011 Plan produced by former Mayor of London Boris Johnson. All of the other iterations of the London Plan from 2004-2016 have been alterations. Once adopted this Plan will replace all previous versions. This Plan is different to those that have gone before it. It is more ambitious and focused than any previous Plans. The concept of Good Growth – growth that is socially and economically inclusive and environmentally sustainable – underpins the Plan and ensures that it is focused on sustainable development. The drafting of the Plan aims to ensure that London is ready to implement this ambitious Plan as soon as possible and that the policies do not take years to implement due to the time it can take to update local development plan documents. As the London Plan is part of every borough's development plan, there is no requirement for the policies to be repeated at the local level before they can be implemented. However, in some instances a local approach is required within the context of the overall policy. The Plan clearly sets out where this is the case. This Plan provides the framework to address the key planning issues facing London. This allows boroughs to spend time and resources on those issues that have a distinctly local dimension and on measures that will help deliver the growth London needs.

Title: **Cities Taking Action**
Author/editor: 100 Resilient Cities
Publisher: Rockefeller Foundation
Publication year: 2017
ISBN code: -

The Rockefeller Foundation has been a leader in urban policy since the late 1950s when it launched an Urban Design Studies program. One of its first grants was to a then-obscure author for the research and writing of The Death and Life of Great American Cities. In 2013, building on this long tradition, and in celebration of its 100-year anniversary, the Rockefeller Foundation launched 100 Resilient Cities (100RC), a non-profit dedicated to helping cities around the world become more resilient to the physical, social, and economic challenges of the 21st century. The mission is to catalyze an urban resilience movement, and we have rapidly built a dynamic global organization. The Foundation work along four key pathways in pursuit of our mission: City action; Resilience solutions; Local leaders; and Global Influence. 100RC's diverse and dynamic network of cities is facing a common set of shocks and stresses. Member cities face rainfall flooding, infrastructure failure, earthquake, extreme heat, and disease outbreak as their most common shocks, and aging infrastructure, a lack of affordable housing, inadequate public transportation, environmental degradation, and economic inequality as their most common stresses. The more than 30 Resilience Strategies published by 100RC member cities so far contain more than 1,600 action-oriented initiatives – from discrete social programs to ambitious infrastructure projects, running on timescales from a few months to multiple generations. These cities are already hard at work implementing these actions, and thus far have leveraged more than $535M in external funding from private, public, and philanthropic sources to that end. This report focuses on some of the ways cities are now taking action, looking closely at the following seven projects, and illustrates how resilience thinking can maximize the impact of a city's efforts and ensure each project returns multiple benefits for residents: Boston is incorporating racial equity goals into its plans for extending its metro transit system; Medellín is protecting informal communities from landslides while improving social cohesion among residents; Melbourne will create a cohesive strategy for managing urban forests across its many jurisdictions; Surat will address its twin problems of insufficient water quantity and quality; New Orleans is developing new systems for flood protection; New York is exemplifying the ethos of "build back stronger" in a highly vulnerable community; Mexico City is deploying innovative finance to meet the basic water needs of its vulnerable populations in a manner that will also protect its ecosystems and boost its resilience to climate change.

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03

THE RESILIENCE CITY/THE FRAGILE CITY. METHODS, TOOLS AND BEST PRACTICES 1 (2018)

REVIEW PAGES: LAWS

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In this number

CLIMATE CHANGE ADAPTATION OF COASTAL AREAS IN THE EU MEMBER STATES

In 2013 European Union adopted the EU Strategy on Adaptation to Climate Change, in line with the Green Paper on "Adapting to climate change in Europe – options for EU action" of June 2007. This strategy was one of the steps that European Union has been sweeping in order to encourage the Member States to adopt adaptation strategies at different levels that are national, regional and local (Papa et al., 2014). In particular, the aim of the strategy is "*to contribute to a more climate-resilient Europe […] enhancing the preparedness and capacity to respond to the impacts of climate change at local, regional, national and EU levels*". The EU Adaptation Strategy focuses on promoting:

- the adoption of adaptation strategies by the Member States and supporting adaptation also at the local level through the Covenant of Mayors for Climate and Energy;
- the climate-proofing action at EU level in specific key vulnerable sectors (e.g. agriculture, cohesion policy, etc.) for making Europe more resilient (Swart et al., 2009);
- the sharing of knowledge about adaptation among decision-makers through the development of specific platform such as Climate-ADAPT.

Together with the EU Adaptation Strategy there are several documents, named Commission Staff Working Documents (SWDs). Those SWDs focus on how to implement adaptation policies in specific fields, one of which – the SWD (2013) 133 - is referred to coastal areas. Coastal areas are considered the most productive areas in the world but, at the same time, the most vulnerable areas to climate change and natural hazards (Neumann et al., 2015). Such document highlights the importance of those areas as pointed out firstly by the Recommendation on the Integrated Coastal Zone Management (ICZM) in 2002 and then by the Directive 2014/89/EU of the European Parliament and of the Council establishing a framework for maritime spatial planning. In particular, the document highlights that "*under a no-adaptation scenario, it is estimated that between 200,000 […] and 780,000 people […] could be affected by coastal flooding by 2100*". In this perspective, effective adaptation action can influence positively the resilience of coastal areas to climate change impacts. Nowadays, the majority of EU Member States have adopted their own National Adaptation Strategies. Nevertheless, the National Adaptation Strategies adopted by Member State with coastline include specific strategies or addresses for coastal zones.

Hence, in this number the National Adaptation Strategies of the Netherlands, Denmark and Germany are presented in order to highlight which strategies they propose for coastal areas in relation to the EU Adaptation Strategy and eventually which addresses are provided for the future territorial and urban planning.

NATIONAL ADAPTATION STRATEGY IN THE NETHERLANDS

The National Adaptation Strategy in the Netherlands has been adopted by the Council of Ministers in December 2016 and it is one of the most recent National Adaptation Strategy in Strategy updates the previous National Adaptation Strategy "Make Space for Climate", laid down in 2007. Its formulation has been addressed by the Climate Agenda for Adaptation and Mitigation adopted by the Dutch Cabinet in 2013. The aim of the strategy is to help to "climate-proof" the Netherlands through initiatives at different territorial levels.

The strategy is articulated into five parts: the first one introduces the NAS and describes its main characteristics; the second one sets out the main effects of climate change in the Netherlands; the third and the fourth ones illustrate which actions are necessary to implement and how to reduce the susceptibility of the Netherlands to the negative effects of climate change; in the last part the Climate Adaptation Implementation Programme is paved. The 2016 NAS defines four conceptual frameworks. In each framework opportunities and threats are reported for specific effects of climate change which are warmer climate, wetter climate, drier summers and rising of the sea level. Moreover, for each framework implications for nine specific sectors are also identified. Those sectors are: Water and spatial management; Nature; Agriculture, horticulture and fisheries; Health; Recreation and tourism; Infrastructure (air, road, rail, water); Energy; IT and telecommunications; Safety and security. Even if the strategy identifies different policy sectors, it highlights the importance to consider the integration between spatial planning and those policy sectors for defining effective solutions. Indeed, for climate-proofing the Netherlands the NAS promotes the development of the Delta Plan for Spatial Adaptation. In particular, the NAS highlights how much "*it is important to formulate the climate adaptation process in a broader context, to include consideration of the consequence of climate change for nature, health, the food supply chain, spatial design, cultural heritage, housing, urban transformation, and so forth*". In this context, spatial planning plays a key role. The NAS introduces a specific approach for identifying single solutions, which address multiple issues. Such solutions are named "crossovers". Several "crossovers" are referred to the spatial planning and, in particular, to the spatial planning of coastal areas. Coastal areas are not specifically defined and analyzed by the strategy, but the relationships between the Dutch land and the water is clear. The Strategy, indeed, identifies specific crossovers, referred to the interaction between Water-Spatial Planning-Public Spaces-Housing-Infrastructure. The crossovers are:

- Urban transformation based on climate-proof design;
- Use new planning and environmental legislation to promote cooperation and create cohesion;
- Tackling potential flooding within the spatial structure is cheaper than doing so within the water system;
- Knowledge-sharing between local authorities and suppliers such as tree nurseries with a view to promoting climate adaptation through the choice of species to be planted;
- New design requirements for (residential) buildings and roads;
- Subsidence and water table management in relation to spatial functions: there can be conflicts of interest which lead to economic dilemmas and a need for transformation.

NATIONAL ADAPTATION STRATEGY IN GERMANY

The German Adaptation Strategy (Deutsche Anpassungs Strategie, DAS) has been adopted by the German Federal Cabinet in 2008, before the adoption of the EU Adaptation Strategy, but in line with the EU principles expressed by the Green Paper on "Adapting to climate change in Europe – options for EU action" in 2007. The objective of the DAS is "*to reduce the vulnerability of natural, social and economic systems and to maintain and improve their capacity to adapt to the inevitable impacts of global climate change*".

The Strategy is articulated into five parts that illustrate: the principles of the strategy; the current state of knowledge with regard to the expected climate changes worldwide and in Germany; the climate change impacts and the ways for facing them; an overview of the international context and Germany's contribution to adaptation in other parts of the world; finally, the approach and the next steps of the German Adaptation Strategy. The Strategy identifies the future climate change impacts on 15 sectors and areas that are referred also to urban planning. Indeed, among the sectors, there are the Building sector, Energy sector and the Transport infrastructure. A specific focus is given to the Water regime, Water management, coastal and marine protection sector and its impacts. Indeed, studies indicate that it could be an increase in the frequency and size of storm surges and, consequently, coastal areas could be at risk of flooding. Therefore, the Strategy proposes an integrated approach in order to reduce potential risks in the German coastal regions of the North Sea and Baltic Sea by means of the Integrated Coastal Zone Management (ICZM) approach. ICZM "*is intended to bring about better reconciliation of the protection and development of natural resources and near-natural land with economic and social demands*". In addition, spatial planning plays a key role in the adaptation of coastal areas. Indeed, spatial planning has "*the important function of reconciling different claims on the same space*", supporting at the same time both mitigation and adaptation. In particular, in coastal areas "*regional planning must lay the foundations for ensuring continued maximum protection from increasing storm surge and flood risks in the future. Adaptation to climate change requires not only dyke building and refurbishment measures, but also the development of new forms of safety precautions – especially passive ones*". In this perspective, the DAS supports the integration between spatial planning and ICZM approach.

In order to guarantee the implementation of the Strategy, in 2011 the German Federal Cabinet has adopted the "Adaptation Action Plan". Moreover, the Strategy defines some institutional structures for supporting the strategy process. The last part of the DAS, indeed, has provided for the institution of an inter-ministerial working group on adaptation to climate change, called IWG Adaptation Strategy (IMA Anpassungsstrategie), consist of delegates from the Federal Government. The aim of this working group is to prepare the Adaptation Action Plan, propose updates of the DAS and monitor their implementation. With regard of the cooperation with the German Federal States, the Strategy promotes another wide mandate about the "Federal-Länder dialogue on adaptation to climate change", initiated by the Ministry of the Environment, Nature Conservation and Nuclear Safety.

The DAS highlights also the importance of the Competence Centre on Climate Impacts and Adaptation (KomPass) and of its services, which will be constantly expanded and opened to all users. Finally, also research plays a key role in the implementation process of the strategy. The need of improving information and advisory facilities for developing effective strategy is the core task of the Climate Service Centre (CSC), coordinated with KomPass and other establishments (e.g. German Weather Service).

NATIONAL ADAPTATION STRATEGY IN DENMARK

In 2008 the Danish Government has adopted the Danish strategy for adaptation to a changing climate. The Danish Strategy is based on the concept that climate change impacts are uncertain and adaptation to climate change is a long-term process. Its purpose is "*that that in future climate change should be considered and integrated into planning and development in the most appropriate way*". In order to define solutions, the strategy describes the future climate with a focus on the variability of the temperature, precipitations and sea level in Denmark and it identifies vulnerabilities of 11 relevant sectors, including Coastal Management and Land Use Planning, for its implementation. With regard to the coastal areas, the Danish Strategy highlights that the risk of flooding and erosion will increase and cities may face complex issues "*since they can be under pressure from higher sea levels, increased precipitation and runoff, as well as changes in groundwater levels*". Therefore, the Strategy defines some recommendations. In particular, concerning new construction or renovation of dykes, coastal protection or harbor installations, "*it is important to consider how many years' climate change should be included in the basic design*". Even if there are no regulations about the coastal protection, the Strategy points out that the Danish Coastal Authority will recommend minimum heights for building footings and dyke heights. Furthermore, even if a socio-economic analysis is required for a better adaptation to the climate change of those areas, the Danish Strategy doesn't consider at all the ICZM approach. The basic approach of the strategy is to consider the future climate change "*integrated into planning and development*". In this perspective, especially in the coastal areas where about 43% of Danish population lives, the Strategy pushes for a more effective planning of land use in order to better face the climate change impacts. Municipalities have a guiding role for integrating adaptation measures in their plans. Indeed, municipal planning should reflect and adapt to the risks and consequences of climate change. The national authorities, indeed, will monitor municipal planning. In this framework, national legislation could be "*limit building and construction in high-risk areas*" or support significant and expensive solutions such as coastal protections, dyke construction, infrastructure protection or water pumping.

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04

THE RESILIENCE CITY/THE FRAGILE CITY. METHODS, TOOLS AND BEST PRACTICES 1 (2018)

REVIEW PAGES: URBAN PRACTICES

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In this number

PLANNING FOR RESILIENT CITIES: TWO EUROPEAN CASE STUDIES

With a greater concentration of people and assets in urban areas, cities need to address an increasingly complex range of shocks and stresses to safeguard development gains and well-being. Managing disaster risk and the impacts of climate change have long been an important focus of urban resilience (Galderisi, 2014; Galderisi, Mazzeo, Pinto, 2016), but recent examples have shown how economic crises, health epidemics, and uncontrolled urbanization can also affect the ability of a city to sustain growth and provide services for its citizens, underscoring the need for a new approach to resilient urban development. In response of these concerns, in the last few decades, researchers from different disciplines have started investigating the meaning, aspects and elements of urban resilience, suggesting that resilience is a complex and multifaced concept with wide implications for planning practices (Salat and Bourdic, 2012), also arguing that achieving resilience in urban areas requires a strong partnership between local governments, research centres, the non-profit sector, private stakeholders, citizens, and communities (Stumpp, 2013).

Within this context, several initiatives involving both public and private organisations have been created in the last few years, aimed at fostering resilience in urban areas. A notable example in this direction, is the *100 Resilient Cities* initiative, pioneered by the Rockefeller Foundation. The initiative represents one of the most remarkable effort to assist city governments to build greater resilience to climate and disaster. It is dedicated to helping cities around the world become more resilient to the physical, social and economic challenges that are a growing part of the 21st century. The 100 Resilient Cities programme defines urban resilience as "the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience". Based on this definition, the programme has established the "City Resilience Framework" (CRF), in partnership with the global design firm Arup. The framework provides an innovative model for the local authority to develop a holistic city strategy in collaboration with adjacent municipalities, local academic institutions, private stakeholders, and communities of the city and represents the foundation for the developments of a city resilient strategy. The programme has been established in 2013, in honour of Rockefeller's 100th anniversary and had initial funding of $100 million (although the level of funding support has grown since the programme was launched). Since 2013, 102 cities worldwide have joined the programme, and 37 Resilience Strategies (with nearly 1,900 concrete actions and initiatives) have been developed. This contribution presents two relevant Resilient Strategies, developed in Europe within the 100 Resilient Cities framework: ii) the Rotterdam (the Netherlands) Resilient Strategy and ii) the Thessaloniki (Greece) Resilient Strategy.

ROTTERDAM

Rotterdam is a thriving world port city with an urban population of 639,587 inhabitants. The city has a long tradition of continually adapting to new circumstances and anticipating and benefitting from economic and social change. On May 2016, the city of Rotterdam, released its Resilience Strategy within the 100 Resilient Cities framework, outlining its plan to address the main challenges the city will face in the 21th century. The Strategy establishes seven resilience goals, each of them is accompanied by fly wheel actions and additional actions. Fly wheel actions are bigger actions which will make big leaps towards Rotterdam reaching a citywide state of resilience, while the additional actions contribute with lesser impacts. These goals are:

- *Rotterdam: a balanced society.* The goal concerns with building and strengthening resilience in Rotterdam at the individual and the societal level. According to the strategy, this will be achieved trough a coordinated mix of actions such as: i) providing educational opportunities for young people to make them competitive and the ready to work in the "next economy"; ii) supporting a balanced population demographic in Rotterdam and attracting highly educated people to the city by increasing housing affordability for the young population iii) fostering social cohesion through networking initiatives aimed at create permanent links between the different social and ethnic communities populating the city;
- *World Port City built on clean and reliable* energy. This goal concerns with the development of a flexible and sustainable energy infrastructure for the port area of the city. This will be achieved through a mix of joint initiatives (involving industries, government and the Rotterdam Port Authority) focused on renewable energy and energy conservation investments;
- *Rotterdam Cyber Port City*. This goal focuses on increasing the resilience of the port area and of the companies working in the port industry against cyber threats. This will be achieved by enhancing awareness, sharing knowledge and joining forces to realize ICT products able to protect computers, networks, programs and data related to the port industry from unauthorized access or attacks that are aimed for exploitation;
- *Climate Adaptive city to a new level*. This goal will reinforce the efforts already started with the Climate Adaptation Strategy (2013) and finalized to enhance the climate resilience of the city. Actions in this domain include: i) small projects led by citizens and businesses under the motto "many small actions make a big difference"; ii) key projects specifically designed to inspire and create publicity and interest around urban resilience, and iii) effective large–scale government- lead projects such as the redevelopment of the city's waterfront;
- *Infrastructure ready for the 21st century.* This goal deals with increasing the resilience of critical urban infrastructures and networks. The goal is supported by different initiatives, ranging from research initiatives aimed at gaining a better understanding of interdependencies between key infrastructures, to planning initiatives aimed at developing protocols and standard procedures for the asset management of underground infrastructures;
- *Rotterdam network: truly our city*. This goal focuses on fostering the engagement and mobilization of Rotterdam's citizens. To this aim a number of initiatives are included such as: i) the creation of networks of government, citizens and institutions to share knowledge around key initiatives; ii) the

development of a "district controlled planning program" aimed at promoting the involvement of the Rotterdam citizens in the decision-making process concerning with the management and planning of district-level facilities, and iii) the re-development of the city's open-data platform and the implementation of other information and inspiration platforms;

- *Anchoring resilience in the city*. This goal concerns with improving the lives of those living in Rotterdam South, a disadvantage part of the city, where the average educational level is lower, there is a higher unemployment rate and the quality of housing is worse. The strategy intends to improve the neighborhood conditions by locating in Rotterdam South new iconic buildings and new public facilities as well as by improving the design and the quality on the neighbor public space.

THESSALONIKI

Thessaloniki is an important Greece city of 363 987 inhabitants, with an active port, a respected university, and a robust tourist industry. The city has recently experienced significant shocks and stresses including a devastating fire and a major earthquake. On March 2017, the city of Thessaloniki released its Resilience Strategy with the support of the 100 Resilient Cities initiative. More than 2,000 people and 40 organizations from across the city participated in workshops, teams, and questionnaires to express their views on Thessaloniki's resilience, with a notable focus on issues related to the local economy and mobility. The strategy will enable the city of Thessaloniki to better address current and forthcoming main challenges and is organized around four main goals, broken down into 30 objectives and more than 100 actions:

- *Shape a thriving and sustainable city with mobility*. The mobility system in Thessaloniki is facing several significant challenges including limited public transport options, over reliance on private car use, and ageing infrastructure. To address these challenges, the strategy presents a number of coordinated initiatives, including: i) reforming the Public Transport Authority to better meets the needs of a complex and evolving mobility system; ii) re-structuring the metropolitan SUMP and align local SUMPs; iii) developing new mobility options in coordination with new urban developments (i.e. according to the principles of Transit Oriented Developme); iv) developing smart urban logistic solution aimed at minimizing costs for businesses and reducing the environmental impacts v) move to clean power for public transport vehicles;
- *Co-create an inclusive city*. This goal deals with the introduction of new methods for civic engagement that will help the city to source local solutions to urban challenges. To meet this goal, the strategy assigns a central role to the "Boroughs" (administrative entities representing a bridge between citizens and the city administration) that currently have very limited authority and thus a weak impact on the development and progress of the city. In particular, the strategy foresees: i) on the institutional side, a complex reform of boroughs; ii) on the practical side, the development of a portfolio of methods for Boroughs to enable community-led projects. A campaign to re-introduce the Boroughs to the people, followed by capacity building workshops are also included in the strategy;
- *Build a dynamic urban economy.* This goal concerns with the development of an urban economy policy agenda which supports local economic cluster activities and prepares the city for a changing world through financial resilience. The agenda includes a series of interventions in different neighborhoods of the city aimed at clustering in specific areas economic activities. For instance, the agenda introduces

decision-making and integrated planning models for the commercial districts of the city. It also provides an integrated Market Redevelopment Strategy for Kapani market area and support tourism and creative economy through specified zones and incentives;

- *Re-discover the city's relationship with the sea.* The city waterfront forms an integral part of Thessaloniki's identity. It also one of the main reasons for Thessaloniki's commercial, cultural and educational success over thousands of years. However, its potentials for fostering urban resilience have not fully exploited. With this strategy, the Municipality of Thessaloniki intends to put forward different initiatives aimed at maximizing the attractiveness, leisure potential and multi-functionality of the waterfront. Initiatives aimed at achieving these goals include: i) the re-development of the bay area, with the location of new recreational infrastructures along the sea-side; ii) the development of resilient off-shore interventions and iii) the restoration of the matitme ecosystem through environmental engineering artworks.

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05

THE RESILIENCE CITY/THE FRAGILE CITY. METHODS, TOOLS AND BEST PRACTICES 1 (2018)

REVIEW PAGES: NEWS AND EVENTS

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In this number
URBAN RESILIENCE AND SOCIO-ECONOMIC FRAGILITY

As an interdependent global society enters an era of unprecedented change, resulting from unforeseen natural and social disasters and vulnerabilities, the resilience of global cities to survive is a pressing concern, as demonstrated by the growing consideration given to global mitigation and adaptation policies (Galderisi, 2104). In this regard, large attention has been focused on the construction of buildings and infrastructures designed to withstand catastrophic events and ensure greater security for the cities, while another important aspect of urban resilience, the socio-economic one, has been more neglected. If the concept of resilience simultaneously embodies the capacity of urban systems to bounce back, adapt or transform, can we say that a city with a static socio-economic structure is inherently fragile?

There are several tragic examples of difficulties for a population to react to socio-economic factors changes even in the absence of destructive environmental disasters that seem to confirm this hypothesis. It is the case of the so-called *shrinking cities*, a phenomenon that generally refers to a metropolitan area that experiences significant population loss in a short period of time. These are cities that have been depopulated as a result of a process of socio-economic changes that they have not been able to adapt to. Particularly vulnerable in this sense are cities that depend on one or few resources such as a specific industry or a mineral resource, with a high risk of depopulation in case of obsolescence of the technology they serve and the related know-how.

Therefore, the differentiation of resources and functions could be an important element for the increase of urban resilience. In human societies the ability to differentiate one's activities, to find new sources of energy or income, to know how to adapt to contextual change, necessarily passes through a series of specific mechanisms and favorable environmental conditions: education, technology, financial abilities of individuals, the redistribution of wealth, inclusiveness in the decision-making system, corruption, judicial bodies, crime etc. Is it possible to calculate the degree of resilience of a city based on these socio-economic characteristics? Attempts to measure social resilience or, on the other hand, its vulnerability, have been carried out by developing investigative tools such as the Social Vulnerability Index (SoVI), which groups 42

variables concerning the socio-economic conditions of the population of a given geographical area in order to examine the spatial patterns of social vulnerability to natural hazards at the county level in the United States and to understand the related social burdens of risk (Cutter et al., 2003). This kind of tools open the way to a thorough knowledge of the phenomenon and above all to its synthetic measurement. Therefore, while the analytical tools start to be formalized, the questions are: what kind of strategies are the best to improve the identified weaknesses of the urban system in terms of socio-economic fragility? and how to measure their effects?
The following selected conferences could represent a fertile ground for scientific advances on these topics.

SECOND ANNUAL INTERNATIONAL URBAN SECURITY AND RESILIENCE CONFERENCE – WORKSHOP

Where: Toronto, Canada
When: 8-10 May 2018
http://urbansecurityresilienceconference.ca/

The increased risk of catastrophic events, whether accidental or deliberate, or by way of natural disasters, means there is now more so than ever before, a need to ensure the resilience of our cities. Large scale urban built infrastructure is a critical node within the intertwined networks of urban areas, which include not only physical components, but also integrated hardware and software aspects. To date, a comprehensive and holistic approach to improve the resilience and security of large scale urban developments against attacks and disruptions, has not been developed thoroughly; therefore, the Second Annual International Urban Security and Resilience Conference could represent a good opportunity to share different experiences and researches on this topic. The conference is divided in six Panels and three workshops alternated with keynote speakers' speeches. The titles of the panels are the followings:

- Cyber risk and the changing role of leadership;
- innovation;
- critical infrastructure planning, design and implementation;
- urban transportation and soft targets;
- counter-terrorism;
- governance and civil society: European perspective.

AESOP ANNUAL CONGRESS 2018

Where: Gothenburg, Sweden
When: 10-14 July 2018
http://www.aesop-planning.eu/

This event will offer the opportunity for scholars from Europe, as well as from around the world, to contribute to the exchange of experiences, ideas and knowledge regarding planning in the 21st century, in particular in relation to the main congress theme: *making space for hope*. It is divided in sixteen tracks articulated in eleven parallel sessions. Among these tracks the number 13 called *Ecologies* "seeks to critically explore the normative content of today's planning for sustainable development in an era that is often called the anthropocene, but also to discuss alternative ways of working with sustainability issues such as

mitigation and adaptation, zero-carbon urban development, resilience of places, human/non-human interaction within planning, more-than-human approaches to planning and interrelationships between nature and culture in planning". All these elements drive towards one main question: "Do today's challenges call for new planning practices, new designs, new policies and tools and also new ways of teaching planning?", which will represent the main focus of the session discussion.

THE INTERNATIONAL DISASTER AND RISK CONFERENCES (IDRC)

Where: Davos, Switzerland
When: 26-30 August 2018
https://idrc.info/

The International Disaster and Risk Conference IDRC Davos 2018 is organised by GRF Davos, an organization which promotes the worldwide exchange of know-how and expertise, creates solutions and fosters good practices in integrative risk management and climate change adaptation. The IDRC is a multisectoral platform for disaster risk reduction addressed to practitioners and scientific experts from politics, government, business, science, NGOs, media and the public. Through the IDRC conferences and workshops the GRF Davos wants to make the disaster risk reduction a policy priority, hoping for the institutional strengthening, moved by the awareness that urban resilience is a phenomenon of simultaneous reconstruction of individual personalities, collective identities and public apparatus. This commitment is triggered by the great economic, social and environmental losses of events related to extreme weather and climate conditions, including hydrological ones. Along with climate change, socio-economic developments such as population growth and economic wellbeing, developments in risk areas and degradation of natural ecosystems will influence the exposure and vulnerability of many regions all over the world. To deal with the large number of risks and disasters society is facing today, it is necessary a multidiscipline approach. Therefore, reinforcing the resilience imposes cognizant and public procedures for participation of interests, sharing of citizenship experiences and best practices.

ISCRAM ASIA PACIFIC 2018-INNOVATING FOR RESILIENCE

Where: Wellington, New Zeland
When: 5-7 November 2018
http://www.confer.co.nz/iscramasiapacific2018/

The ISCRAM Association's primary mission is to foster a community dedicated to promoting research and development, exchange of knowledge and deployment of information systems for crisis management, including the social, technical and practical aspects of all information and communication systems used or to be used in all phases of management of emergencies, disasters and crises. The conference, which arises from an innovative path of dialogue and cooperation between operators, policy-makers and scholars developed as a result of the earthquakes that hit New Zealand in the last years, will discuss the international experiences presented in the perspective of building the city's resilience strategy, as in the case of Christchurch, Darfield, Seddon and Kaikoura, which developed an appropriate information systems to

support crisis management, after several natural earthquakes. This is a precious opportunity to access valuable knowledge and experience in a field - that of critical asset resilience and strategic infrastructure - of great interest and relevance for the development of our cities' resilience strategy. The purpose of ISCRAM Asia Pacific 2018 is to exchange research into and experiences of information systems use in emergency management, focusing on understanding disaster risk, strengthening disaster risk governance to manage disaster risk, investing in disaster reduction for resilience, and enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction. The conference is articulated in nine tracks, namely:

- Resilience to cope with the unexpected;
- Monitoring and Alerting Systems supporting Business as Usual and Emergency Warnings;
- Data Issues for Situation/Disaster Awareness;
- Geospatial and temporal information capture, management, and analytics in support of Disaster Decision Making;
- Human centred design for collaborative systems supporting 4Rs (Reduction, Readiness, Response and Recovery);
- Understanding Risk, Risk Reduction, Consequences and Forecasting;
- Social Media and Community Engagement Supporting Resilience Building;
- Information systems for disaster healthcare;
- Enhancing Resilience of Natural, Built, and Socio-economic Environments.

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IMAGE SOURCES

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https://redguard.deviantart.com/art/Glass-City-33589180

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