

TeMA

Journal of
Land Use, Mobility and Environment

There are a number of different future-city visions being developed around the world at the moment: one of them is Smart Cities: ICT and big data availability may contribute to better understand and plan the city, improving efficiency, equity and quality of life. But these visions of utopia need an urgent reality check: this is one of the future challenges that Smart Cities have to face.

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METHODS, TOOLS AND BEST PRACTICES TO INCREASE THE CAPACITY OF URBAN SYSTEMS TO ADAPT TO NATURAL AND MAN-MADE CHANGES

METHODS, TOOLS AND BEST PRACTICES TO INCREASE THE CAPACITY OF URBAN SYSTEMS TO ADAPT TO NATURAL AND MAN-MADE CHANGES

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EDITORIAL PREFACE: TEMA JOURNAL OF LAND USE MOBILITY AND ENVIRONMENT 1 (2017)

METHODS, TOOLS AND BEST PRACTICES TO INCREASE THE CAPACITY OF URBAN SYSTEMS TO ADAPT TO NATURAL AND MAN-MADE CHANGES

ROCCO PAPA

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The 10th volume of TeMA Journal, given the relevance of the topics, dedicates the three issues of 2017 to promotes the scientific debate on the definition and the implementation of methods, tools and best practices aimed at improving, in the forthcoming decades, the capacity of the urban areas to cope a range of climate, technological and socio-economic challenges that will require the development of integrated and adaptive strategies. The articles published in this first issue address some themes, such as the resilience capacity of urban system, the smart cities, the urban transportation planning, the urban water infrastructure, the socio-cultural facilities, the urban green spaces and the governance of metropolitan areas.

The section "Focus" collects two articles. The first one, "Conurbations and resilience. When growth makes us fragile" by Valerio Cutini (University of Pisa), is focused on the conurbations, extensive urban areas resulting from the expansion and coalescence of several neighbouring cities. The work of research is based on two theses. The first is that in the development of a conurbation, traffic has actually a role of maker and breaker of cities and the second is that the merging of the nuclei and their embedding into a conurbation reduces the resilience of the whole settlement. The author selects a specific configurational technique named axial analysis to study the effect of conurbations, that was applied to the case study of Florence and to the Versilian conurbation.

The second article, titled "The Water Sensitive Future of Lahijan", by Masoumeh Mirsafaa (Polytechnic University of Milan), tackles a crucial topic on the uncontrolled expansion of the cities and the human activities, causing a growing frequency and intensity of extreme events, producing significant impacts and being one of the most serious challenges faced by society in coping with a changing climate. The author presents an interesting analysis of the stormwater management development for Lahijan city in the history and a final reflection on the future strategies to reduce the impact of climate change.

The section "Land Use, Mobility and Environment" collects four articles. The first one, titled "The Effectiveness of Urban Green Spaces and Socio-Cultural Facilities" by Mehmet Faruk Altunkasa (Çukurova University) addresses an important issue in urban planning that is related with the distribution of public facilities such as urban parks, libraries, museum and concert halls. It presents a useful and transferable methodology for assessing intra-urban variation in the provision of these services and applies the proposed methodology in the city of Adana, the 5th largest Turkish city. The results of this application provide useful

insights for local authorities and policy makers interested in achieving a more equitable and effective distribution of public services.

The second article, titled "Planning Assignments of the Italian Metropolitan Cities. Early Trends", by Giuseppe Mazzeo (Consiglio Nazionale delle Ricerche), proposes to analyse the first activities taken by the Italian Metropolitan Cities in the sector of territorial government, three years after the adoption of Act 56 of 2014. Focal point of the analysis is the jurisdiction in the formation of two plans (the Strategic Plan and the Metropolitan Territorial Plan) and the following relationships among them, in the logical assumption that between them a necessary and strict consistency there should be. Other interesting element are the connections of the new institution with the previous institutional subject (the Province), especially with regard to the experience of the Provincial Territorial Plans (PTCP) and their use as metropolitan planning tool.

The third article, titled "Smart city planning and development shortcomings", Margarita Angelidou (Aristotle University of Thessaloniki) by the analysis of about eleven cases of smart cities tries to underline the shortcomings that occurred during the realization of their smart projects. The analysis shows that the economic aspects as well as the bureaucratic problems are among the top challenges that hinder the advancement of smart city strategies. Some mitigation propositions are suggested in order to support the smart city project upon a clear and simple business and governance model.

The fourth article, titled "Active Transport to School and Children's Body Weight: A Systematic", by Houshmand E. Masoumi (Technische Universität Berlin), proposes a systematic review by screening of 310 English scientific papers published between 2005 and 2015, about the themes of Active Transport to School, Body Mass Index and Childhood Obesity. The study focuses the final analysis on the 13 selected papers to verify the correlation between the three study themes. The study has been conducted as a part of the project "Multisport Against Physical Sedentary"-M.A.P.S. funded by the ERASMUS+ program of the European Commission.

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 Maria Rosa Tremiterra describes three web resources of: (i) Transitioning towards Urban Resilience and Sustainability project; (ii) Flood Resilient City project and (iii) The Institute for Social and Environmental Transition-International. The Books section by Gerardo Carpentieri briefly reviews three relevant books related to the Issues' theme: (i) Metropolitan Governance: A Framework for Capacity Assessment; (ii) Financing urban adaptation to climate change and (iii) The lightweight city. Smart city and operative planning. The Law section by Laura Russo keeps readers up to date with comparison of three different national laws on the governance of metropolitan areas (Italian, French and German). The Urban Practices section by Gennaro Angiello presents two examples of sharing mobility plan in the US: (i) Los Angeles Metro Bike Sharing Plan and (iii) Philadelphia Bike Sharing Plan. The News and Event section by Andrea Tulisi, proposes a selection of conferences on the topic of green infrastructure and its multiple-use role in the increasingly pressing challenges that cities have to face.

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CONURBATIONS AND RESILIENCE. WHEN GROWTH MAKES US FRAGILE

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ABSTRACT

This paper is focused on the conurbations, extensive urban areas resulting from the expansion and coalescence of several neighbouring cities. Two theses underlay the research. The first is that, in the development of a conurbation, traffic has actually a role of '*maker and breaker of cities*', just to paraphrase the title of a well-known article by Colin Clark, focusing on the double role of roads and traffic in urban development: on a one hand, the making of a unique road network, encompassing the whole grid, actually allows movement and interaction all over the settlement, making possible the working of the conurbation as a wide urban system; on the other hand, the resulting pattern of movement concentrates its major flows on few roads connecting the original nuclei and the new development areas, actually bypassing the pre-existing urban fabric and diverting a significant amount of local traffic from the streets of the urban grid, what involves the loss of the fertilisation benefit the irrigation of through movement provides. The second thesis, complementary to the former, is that the merging of the nuclei and their embedding into a conurbation reduces the resilience of the whole settlement, in that it affects the capability of the system to adsorb accidental events and transformations without significantly changing its global behaviour.

The phenomenon of conurbations and the diachronic analysis of their resilience will here be observed from a configurational point of view, analysing by means of space syntax techniques the urban settlement of Florence, here assumed as an ideal case study. The results are expected to objectively describe the role of inter-urban roads in the making of a conurbation, and to appraise the extent to which their entanglement within the whole concur in transforming its inner geography and enhancing its global vulnerability. More in general, the configurational approach, suitable for appraising the urban grid as the interface between the physical city and the phenomena that occur along its paths, once again proves its usefulness in linking spatial issues and traffic questions, so as to bridge the traditional gap between urban design, focused on the morphologic features of blocks and buildings, and transport analysis, strictly concerned with the distribution of movement flows on the streets network.

KEYWORDS:

Urban sprawl, conurbation, resilience, configuration analysis

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城市圈与适应力。 城市发展让我们更脆弱

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摘要

本文重点介绍城市圈，即几个邻近城市的扩张和聚集所导致的城市区域扩张。研究从两个方面入手。首先，在城市圈的发展中，交通实际上扮演着“城市创造者和破坏者”的双重身份，这里套用了 Colin Clark 的一本名著的书名，书中主要讲述了道路和交通在城市发展中所起的双重作用（Clark, 1958 年）：一方面，建造一个四通八达的独特公路网，人们便可以相互来往，城市圈便可以像广域市那样发挥作用；而另一方面，主要人流集中在连接原先核心区与新开发区的几条道路上，实际上绕开了原有的城市干道，分散了城市街道的大量本地人流，与此同时还会因人口密集区的人流分流而导致经济损失。第二点，作为对上一条的补充，核心区整合为城市圈会削弱整个居民区的适应力，反过来影响社会应对意外事件和改变的能力，但不会显著改变其整体行为。这里将从全局角度来研究城市圈现象及其适应力的历时性分析，而佛罗伦萨城市居住区被当成了理想的案例研究对象，对其进行了空间句法分析。结果将客观地描述城市圈建设中各城际道路的作用，并探讨在改变内部地理环境和加强整体危机防范方面的一致性程度。通常，顺理成章地将城市网视为连接实际城市及沿路景象之间纽带的全局方法，再次证明了它有助于在空间问题与交通问题之间建立联系，从而缩小关注街区和建筑的形态特征的传统城市设计与严密关注四通八达的街道中人流分布的交通分析之间的差距。

关键词：

城市扩张；城市圈；适应力；全局分析

1 INTRODUCTION

This paper is focused on the conurbations, extensive urban areas resulting from the expansion and coalescence of several neighbouring cities. A special attention will be devoted to the property of their resilience, assumed in relational terms and intended as the capability of an urban system, thanks to its own spatial features, to adsorb accidental events and transformations without significantly changing its inner geography and global behaviour. Such property is today to be considered a key issue, as related to the capacity of the system to continue effectively operating even in case of exceptional occurrences, and, in ordinary conditions, to the flexibility of the road network to adapt to the changing functional asset of the settlement.

Two theses underlay the research. The first is that, in the development of a conurbation, traffic has actually a role of 'maker and breaker of cities', just to paraphrase the title of a well-known article by Colin Clark, focusing on the double role of roads and traffic in urban development (Clark, 1958)': on a one hand, the making of a unique road network, encompassing the whole grid, actually allows movement and interaction all over the settlement, making possible the working of the conurbation as a wide urban system; on the other hand, the resulting pattern of movement concentrates its major flows on few roads connecting the original nuclei and the new development areas, actually bypassing the pre-existing urban fabric and diverting a significant amount of local traffic from the streets of the urban grid, what involves the loss of the fertilisation benefit the irrigation of through movement provides.

The second thesis, complementary to the former, is that the merging of the nuclei and their embedding into a conurbation reduces the resilience of the whole settlement, in that it affects the capability of the system to adsorb accidental events and transformations without significantly changing its global behaviour.

The phenomenon of conurbations and the diachronic analysis of their resilience will here be observed from a configurational point of view, by means of space syntax techniques, stressing the role of spatial relationships within the grid as the primary element of the effects of their development.

Several reasons suggest to assume the specific case of Florence as an ideal case study: the presence of a prominent and dense inner core, a wide recent urban development area, the presence of an important motorway that touches the conurbation so as to remain embedded into its local road network.



Fig. 1 The area of Florence: site plan

Since the beginning of this modern growth, in the post-war years, the presence of steep hills on the southern and eastern sides of Florence induced the development of Florence in a North-West direction, so as to determine the progressive urbanization of the so-called 'piana fiorentina' (literally 'Florentine plain'), binding together within a unique conurbation a number of pre-existing nuclei, namely Calenzano, Campi Bisenzio, Lastra a Signa, Sesto Fiorentino and Signa, up to the edges of Prato and Pistoia.

Over time, the urban congestion and the poor vehicular accessibility of the ancient inner core have gone inducing more and more prominent activities to shift towards this development area, which now houses the administrative departments of Tuscany Region, the regional hospital, the Penal and Civil Court, several departments of the University of Florence, the airport, several huge shopping centres, hypermarkets and department stores. As a result of such a dense concentration of activities, the Florentine plain is today one of the most attractive parts of the whole settlement, counterbalancing the traditional representativeness and the attractiveness of the historic centre of Florence, as well as the evocative strength it holds in the collective imagination.

The administrative fragmentation of the whole settlement, which overlaps the territories of 11 municipalities, prevented the provision of a global infrastructure development and an efficient public transport system all over the area; on the other hand, its local road network seems strongly supported by the national motorway A1, which touches Florence on its western side and actually works as a local road, internally connecting the conurbation.

The distribution of configurational values over time, as a result of the growth of the conurbation and according to the progressive transformation of its grid, will here be determined by means of a diachronic analysis since the beginning of XIX century and up to the present time. Such analysis is expected to provide some significant information on the transformation of the inner geography of Florence and its movement pattern with the making of the conurbation. The same results are also expected to pinpoint the role the motorway actually plays within the present pattern of urban vehicular movement, highlighting the degree to which it substitutes the connecting role of the local streets, what causes their impoverishment and decline: maker and breaker of cities, as stated.

2 BACKGROUNDS

Two main issues, variously crisscrossed, appear here interwoven. On the one hand, a wide issue is the growth of the urban settlement, which sprawls over time so as to form a conurbation, merging and binding together several pre-existing urban nuclei; such growth and merging involves the modification of the inner geography of the original nuclei and the shifting of the higher values of centrality towards the new development areas; accordingly, also the movement pattern is affected by these changes, which cause a different distribution of traffic flows. Another general issue is the matter of vehicular traffic in towns, the problems and the benefits it brings to urban settlements, as 60 years ago Clark pointed out; the presence of a motorway within the conurbation enriches the matter in the case study of Florence, thus extending the attention to the issue of the inclusion of motorways within the urban road network, and their use for local movements. Despite their evident connection, those two issues - urban morphology and dynamics, on the one hand, and traffic distribution, on the other hand - are generally approached from different points of view, as a result of a disciplinary division entrusted by a long-lasting traditional split.

The matter of the split between the treatment of roads as traffic channels and their assumption as streets - composing the public space of a settlement and narrowly connected with blocks and buildings - has been so far deeply investigated. The question of vehicular traffic in towns in fact dates back to the middle of the 20th century, when the increase of car traffic imposed the need for solutions, suitable for making the presence of vehicles compatible with buildings, pedestrians and urban life. The key idea of Modern Movement, explicit in

the Athens Charter and destined to widely affect town planning in the decades to come, was to split buildings and roads, liberating their own forms from each other, providing the urban roads with the unique role of circulation route and thus hierarchically classifying them with reference to traffic flow and road capacity. It is worth reminding that the split between urban roads and buildings necessarily involves the removal of traffic away from the building fronts, and hence the extinction of the street as intended so far: *'il faut tuer la rue-corridor'* (Le Corbusier, 1930) is the well known battle cry with such position.

Setting aside its effect on architecture and urban morphology, such traffic-driven approach was equated to a 'cataclysm' (Llewelyn-Davies, 1968) or even a real schism, definitely partitioning the two fields of traffic engineering and street (urban) design (Marshall, 2005). Since the middle of the 20th century, the main focus on the matter of vehicular traffic suggested the severe distinction between roads for traffic and access paths to buildings as well as their classification as 'entirely different and mutually antagonistic' (Tripp, 1950; p. 297), prelude to the subsequent hierarchical classification of urban roads by the Buchanan Report: *'basically, there are only two kinds of roads – distributors designed for movement, and access roads to serve the buildings'* (MoT, 1963; p. 44). Such distinction hence involved the assumption of the 'traffic conduits' as incompatible with the urban fabric and preventing them from approaching and giving access to buildings (Tripp, 1950); Oxford Street, London, is here cited as a very bad example of dangerous promiscuity, causing that *'on average, one pedestrian is injured by the traffic every shopping day'* (Tripp, 1950; p. 297).

The division between 'urban corridors' and 'urban rooms', represented by the metaphor of the hospital, whose departments are individually accessible and cannot be affected by through routes (MoT, 1963), as well as the paradigmatic planning of Radburn, in New Jersey, is well suited to represent this method, whose basic rule is to facilitate origin-destination movement and to repel through traffic: *'shopping, business and residential areas must be kept quite separate from all arterial and sub-arterial roads, and confined to local roads (...); the layout of systems of local roads must be such as will afford no short-cuts to through-traffic'* (Tripp, 1950; p. 310). On the whole, the result is what was said *'a division of traffic and towns into separate areas of priorities'* (Marshall, 2005; p. 48).

Relevant and recurring criticisms have long been raised against such approach - milestones, among others, Jane Jacobs and Christopher Alexander -, mainly complaining the impoverishment of the streets it involves, the weakening of social life and the shifting of accessibility from the historic centre towards the periphery (Jacobs, 1961; Alexander, 1966); yet the split between movement and urban space still persists nowadays, and the question concerning the road network and the accessibility to places and activities are mainly faced as mere infrastructural issues and a specific matter of traffic engineers, or, as it was said, *'from the traffic point of view'* (Tripp, 1950).

In light of the above considerations, it will be clear why a configurational approach was here selected for the present case study. In that it assumes the urban grid as the primary element in the distribution of movement, such approach allows to consider the configuration of the streets network as the key element in the patterns of human behaviour (Hillier, Hanson, 1984) and hence in most urban phenomena (Hillier, 1996b); what does not involve that a configurational approach can substitute any transportation model, nor it can provide the numeric amount of traffic flows. Nonetheless, in a configurational view *'the discovery that the spatial integration pattern of the street network shapes movement is more important than perfect prediction. It puts us in a position to design space for movement, and then assign the land uses to the right places according to their need to be close to movement'* (Hillier, 2005; p. 99); since *'in shaping movement'*, the spatial pattern of the street network *'also shapes the patterns of human co-presence - and of course co-absence - that seems to be the key to our sense that good cities are human and social things as well as physical things'* (Hillier, 2005; p. 99). The matter is therefore not in movement itself, but in the relationship between movement and

urban space; what is exactly the matter this research is concerned with, that is the dual phenomenon of the urban sprawl of Florence and the actual distribution of traffic flows.

Two wide issues appear therefore crisscrossing in the matter that is here concerned.

The first one obviously is the matter of traffic, due to the presence of a motorway, lapping the western side of the conurbation and arguably playing in this area, to some extent, also an urban role. The second issue regards the properties of the whole conurbation and its road network, with special reference to its resilience. And both issues can be usefully investigated by means of a configurational approach.

For what concerns urban movement, an amount of researches have been conducted in the last decades, in a wide range of directions: discussing the role and importance of 'natural movement', uniquely referred to the grid configuration (Hillier et al., 1993), discussing the capability of space syntax based models to reproduce the pedestrian flows (Jiang, 1999), demonstrating the strong relationship of the configurational values with the distribution of pedestrian flows (Cutini, 2001), proposing the use of space syntax to enhance the safety of pedestrians (Raford, Ragland, 2004), discussing the relationship between cycling routes and urban morphology (Raford, Chiaradia, 2007), showing the possible use of space syntax to support the planning of cycling routes (Dalton, 2015), or suggesting the applicability of space syntax to bicycle facility planning (McCahil, Garrick, 2008). All these researches agree that the integration value and the choice value are to be acknowledged as useful and reliable indicators of centrality. Different notions of centrality, in hindsight: while integration reproduces the to-movement potential of a spatial element as a destination (Cutini, 2005), choice measures the through-movement potential of an element as a piece of route (Hillier et al., 1993; Hillier, 1996a; Penn et al., 1998; Hillier, Iida, 2005).

Also for what specifically concerns the analysis and improvement of vehicular traffic in urban areas, the use of space syntax has already been variously tried and tested, focusing on several issues; among others, the use of space syntax in transport analysis (Pereira et al., 2008), the correspondence between planning choices and traffic (Giannopoulou et al., 2012), the use of space syntax as a traffic assignment tool (Barros et al., 2007), centrality measures for traffic (Scoppa et al., 2009; Kazerani, Winter, 2009), traffic optimization (Zheng et al., 2008), car crashes (Dasanayaka, Jayasinghe, 2014), traffic noise (Dzhambov, 2014) and so on. Also different methods, using street-based representations for predicting traffic flows, have been proposed and successfully tested (Jiang, Liu, 2007). And interesting observations have stressed the strength of the law of scaling also with reference to vehicular movement, showing the street hierarchies as a good indicator for traffic flows (Jiang, 2008).

It is not the purpose of this paper to discuss on the most reliable method for narrowly approximating traffic and thus predicting the distribution of its flows. It will rather address the matter of the relationship between traffic and urban fabric, discussing the way the distribution and pattern of traffic change with the sprawling growth of the settlement, as the whole grid goes so far as to encompass and include extra-urban roads. In such cases those roads frequently seem to remain entangled within the conurbation so as to work as local traffic distributors, mainly operating between the single urban nuclei that have gone generating it. Here issues of urban dynamics and matters of traffic go combining and intertwining, influencing each other and causing several problems, both in urban and infrastructural field. And here, therefore, a configurational approach, aimed at connecting and integrating those aspects, can actually play its part.

Closely linked to the matter of traffic is the further issue of urban resilience, which is increasingly regarded as a key property of urban systems and has been variously declined in order to indicate and reproduce different features. A relational notion of resilience, to be called 'network resilience' will be here taken into account, assumed as the capability of an urban system, thanks to its own spatial features, to adsorb accidental events and transformations without significantly changing its inner geography and global behaviour (Cutini, 2013); and, when it comes to vehicular traffic, it is clear which kind of events or transformations are here mainly

concerned: car accidents, road disruptions, traffic jams, traffic regulations. What in particular makes network resilience strongly related to traffic issues is that fundamentally it is appraised as a result of the diffused richness in alternative paths from any origin to any destination; while, on the other hand, resilience clearly affects traffic, as related to the vulnerability of the road network to any turbulence, as well as its flexibility and capacity to adapt to different functional assets.

With reference to the network resilience, three main indices have been so far introduced and tested (Cutini, 2013): the mean connectivity value of the grid (suitable for roughly reproducing the density and variety of paths connecting each line to all the others of the axial map), the frequency value (suitable for reproducing the degree to which the shortest paths are diffused all over the grid) and the synergy coefficient (reproducing the strength of the correlation between the distribution of integration values at different scales). In this paper a further parameter will be introduced and discussed with reference to the case study of Florence, aimed at appraising the degree of polarization of the movement flows distribution, to be regarded as clue of vulnerability of the system.

3 METHODOLOGY

As hinted above, a configurational approach was here selected as a tool for the analysis of conurbations. What suggested this choice is its assumption of the urban grid as the primary element in the distribution of movement and hence in determining the patterns of human behaviour (Hillier, Hanson, 1984): mainly movement, which is oriented and led by the visual perception of the spatial layout, and through movement, also the location of activities, land value and so on. At the root of the configurational approach is the assumption that an urban grid contains, due to the spatial relations between its elements, an intrinsic vocation for attracting movement flows (Hillier, 1996); which is liable to drive movement-seeking activities towards the most crowded spaces and to address the movement-avoiding ones towards the most segregated and deserted. Several operational techniques – encompassed under the denomination of space syntax - have been so far developed, differing from one another in respect of the way of reducing the grid into a system, and hence on the single spatial element composing it: the line in axial analysis (Hillier, Hanson, 1984), the vertex in visibility graph analysis (Turner et al., 2001), the segment in segment analysis (Turner, 2005), the road-centre line in road-centre line analysis (Turner, 2007), the mark point in Ma.P.P.A. (Cutini et al, 2004). Despite these differences, still all those techniques share the same conceptual basis sketched above; and all provide each element of the grid (either line, vertex, segment, road-centre line or mark point) with a set of parameters suitable for reproducing different urban aspects. Among those parameters, integration and choice value are acknowledged suitable for describing the changes in the inner geography of the settlement. Integration is the normalised value of the mean depth of an element with respect to all the other elements of the grid (Hillier, Hanson, 1984), and should describe its accessibility, that is how easy it is to get to from all other elements; concretely, in fact, it was proved suitable for narrowly reproducing the actual density of the located activities, and hence the distribution of attractiveness, or the vocation of a place to work as an appealing location (Cutini, 2005). Choice, defined as the frequency of a spatial element on the shortest paths connecting all pairs of other elements, is suitable for measuring how likely an element is to be passed through: in fact, several studies attest a strong correlation of choice with the distribution of movement flows (Hillier et al., 1993; Penn et al., 1998; Hillier, Iida, 2005). In other words, while integration reproduces the to-movement potential of a spatial element as a destination, choice measures the through-movement potential of an element as a piece of route (Hillier, 2012).

With reference to the network resilience, three main indices have been so far introduced and tested (Cutini, 2013). A first parameter is the mean connectivity value of the grid, which measures the density and variety of paths connecting each element to all the others. High values of connectivity are likely to guarantee a dense

presence of alternative paths and hence the capability of the urban system to absorb a material grid transformation without significantly modifying its relational state (Cutini, Rabino, 2012). A further index takes into account the distribution of shortest paths: being resilient the systems that are provided with a widespread presence of shortest paths all over the grid and, on the contrary, vulnerable those that are characterized by their dense concentration through a small number of spatial elements. On such basis, an indicator of resilience was introduced (Cutini, 2013) as the ratio of the highest choice value and the maximum frequency a spatial element could present, what would occur if it were located on all the shortest paths between any couple of the other elements. In a system of n elements, this index, called frequency index, is expressed as follows:

$$v = \text{choice}_{\max} / (n^2/2 - 3/2 n + 1)$$

The frequency value obviously varies from 0 to 1, increasing as the resilience of the system decreases. In the extreme case, should a line be located on all the shortest paths connecting all the couples of lines ($v = 1$), the system would result vulnerable to its highest degree, in that each of its paths will share (and depend on) that single line.

A further parameter, called 'synergy coefficient', reproduces the strength of the correlation between the distribution of integration values at different scales (local versus global). Since integration was proved suitable for reproducing the distribution of urban centrality at different values of radius, a strong correspondence of global and local integration can be assumed as a clue of steadiness of the system. Those three parameters can hence be used as tangible indicators of the network resilience of the whole system and to reproduce its trend over time.

The configurational technique named axial analysis was applied to the case study of Florence and to the Versilian conurbation; in both cases the actual grid consistency at different dates was analysed in order to obtain the respective configurational state and hence its diachronic trend during the making of the conurbation.

4 THE CASE STUDY

As presented above, this research is applied to the case study of the Florentine conurbation, which has gone growing on the northern side of the historic core of Florence since the middle of the 20th century. This paper aims at using space syntax in order to reconstruct the diachronic genesis of the configuration of this whole system, from the date preceding the modern growth of Florence, up to the present point in time. Given the strong relationship that correlates the configurational indices with traffic flows, the analysis of the grid configuration at different dates (before and after the north-western growth) will allow appraising the actual role of the motorway A1 within the urban grid, since its first encompassment within the whole area of the conurbation and up to the present date. The present configurational state will then be cross-referenced with the available vehicular traffic data, in order to evaluate the actual degree of inclusion of the motorway within the urban system of Florence and its likely influence in the distribution of local traffic flows. On this regard, those data can be preliminarily presented, in order to describe the general matter of the motorway traffic in the area of Florence.

The motorway A1, opened in 1964 and thereafter subject to upsizing works, was actually reached by the sprawling Florence in the first '70s and then swallowed within the conurbation at the end of the century. In the Florentine area, the motorway is provided with 5 gates for entrance and exit (namely, from south to north, Firenze Sud, Firenze Impruneta, Firenze Scandicci, Firenze Nord and Calenzano); in addition, the settlement hosts two other motorway gates, that is Prato Est and Firenze Ovest, on motorway A11. The traffic data of the motorway A1 (light vehicles) in 2014 around the gates of Florence is here represented in figure 2, which allows to easily notice the sharp rise of average traffic volume as soon as the motorway enter the Florentine area.

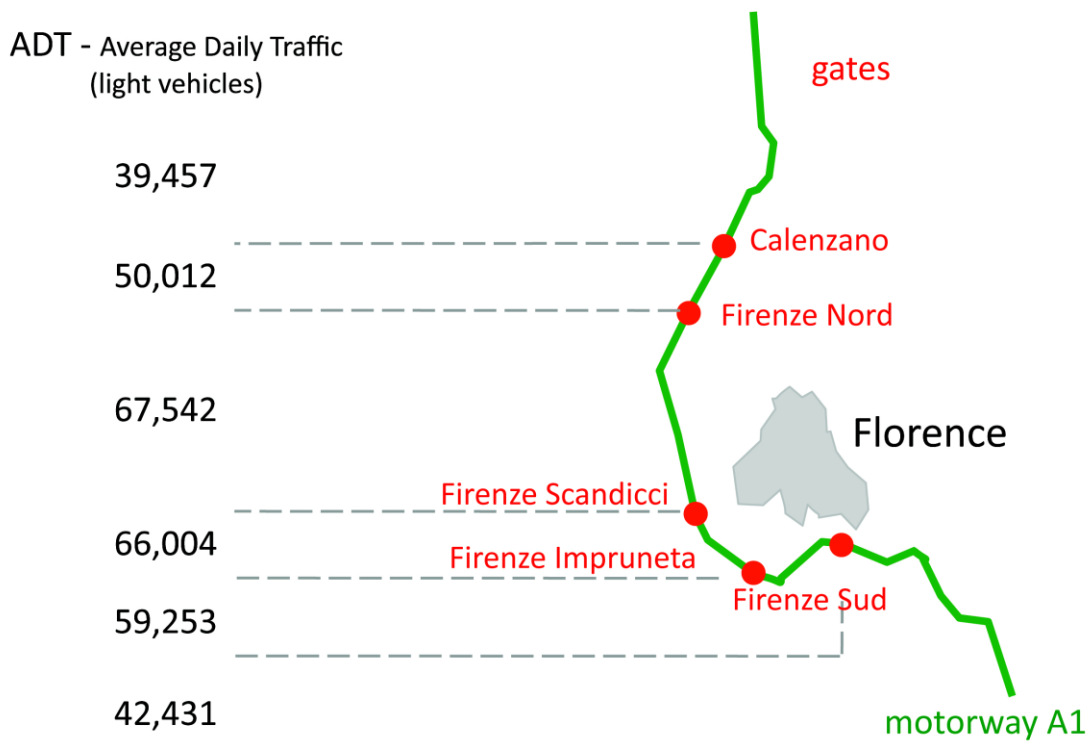


Fig. 2 Traffic data (light vehicles) of motorway A1 in 2014

It hence appears clear that traffic on motorway A1 is strongly increased by local traffic, that is car movements with both origin and destination within the Florence urban area. In other words, the difference between the average values within the Florence area (50,000/67,500 light vehicles) and the values outside (around 40,000 light vehicles) can be clearly considered just as urban traffic. If we then focus on the Florence area, and observe only the vehicles that in 2014 passed through the local gates of the motorway A1, their traffic data, provided by Autostrade per l'Italia S.p.a., operator of the motorway, are here shown in tables 1 and 2.

destination origin	Calenzano	Firenze Nord	Firenze Scandicci	Firenze Impruneta	Firenze Sud	Firenze Ovest	Prato Est	Total
Calenzano	-	252,756	839,648	426,949	513,567	188,070	32,946	2,253,935
Firenze Nord	428,050	-	136,699	391,774	342,737	19,051	46,453	1,364,764
Firenze Scandicci	925,831	82,256	-	798,686	1,463,240	225,205	864,720	4,359,938
Firenze Impruneta	406,377	59,541	671,864	-	1,387,202	475,406	361,514	3,361,904
Firenze Sud	474,631	52,495	1,458,769	1,452,646	-	372,237	435,636	4,246,414
Firenze Ovest	76	46	127	167	149	-	3,312,974	3,313,539
Prato Est	32,202	30,388	836,452	373,474	486,617	3,211,232	-	4,970,365
Total	2,267,167	477,481	3,943,559	3,443,696	4,193,512	4,491,201	5,054,243	23,870,859

Tab. 1 Vehicular flows in the Florence area in 2014 (source: Autostrade per l'Italia S.p.a.)

Destination Origin	Whole Florence area	Total	Percentage Florence area
Calenzano	2,253,935	3,556,668	63.4 %
Firenze Nord	1,364,764	2,800,640	48.7 %
Firenze Scandicci	4,359,938	7,149,299	61.0 %
Firenze Impruneta	3,361,904	4,922,532	68.3 %
Firenze Sud	4,246,414	6,950,527	61.1 %
Firenze Ovest	3,313,539	6,677,345	49.6 %
Prato Est	4,970,365	7,075,529	70.2 %
total	23,870,859	39,132,540	61.0 %

Tab. 2 Vehicular flows in the Florence area in 2014 – total data

The data reported in the last table are specially clear and highly impressive: over 60 per cent of the total vehicular movements locally entering the motorway actually has a local destination, confined inside the Florentine area, values that go as high as 70 per cent in some of the gates: a significant amount of the motorway traffic in the area of Florence is hence actually local – that is urban – traffic, going on top of the heavy vehicular traffic running down the peninsula and making the Autostrada del Sole a very crowded motorway, with high percentage of troubles, traffic jams and car accidents. Conversely, a large amount of vehicular traffic to and from locations within the Florentine conurbation does actually use the motorway, preferring it to the urban grid, despite the toll payment its use involves. As a matter of fact, the seven motorway gates appear mainly working as urban network nodes, rather than extra-urban movement terminals. The question is whether this traffic assignment is to be acknowledged as influenced by the structure of the settlement; or, in other words, if it is possible to find any clue that the grid configuration itself is the primary element addressing the route choice towards the use of the motorway. In order to answer this questions, a configurational analysis of the settlement was carried out, beginning from a diachronic analysis, aimed at reconstructing the genesis over time of the grid configuration, and then focusing on the present state of the system.

As for the diachronic analysis of the settlement, nine significant dates have been selected, suitable for identifying as many epoch-making moments in the modern growth of Florence. The first one is 1825, date of the Lorraine cadastral registry, reliably reproducing the layout of the city in 1:1,250 scale just before the beginning of modern urban growth. Apart from few punctual transformations, such state appears fundamentally unchanged with respect to the golden era of the Renaissance. The second date is 1858, just the year before the annexation to the Kingdom of Italy. The third date is 1867, representing the 6 years when Florence was the capital of Italy, and, above all, reproduces the transformation works carried out for such role; among them, in particular, are to be mentioned the demolition of the ancient townwalls, their substitution with a ring boulevard and the realization of the first extra-moenia residential developments. The fourth and fifth date are 1910 and 1938, witness dates of the progressive consolidation of the radial growth out of the inner core. The sixth date is 1955, reproducing the saturation of the flatland towards south and east, as well as the beginning of the unidirectional growth towards north-west, which appears developed at the following date, 1970; the conclusion of this growth is attested by the cartography at the eighth and ninth dates, respectively 1990 and 2015, with the progressive merging of the north-western urbanization with the surrounding settlements and the making of the present conurbation, swallowing and including the layout of the motorway. The grid corresponding to each of the dates above was analyzed by axial analysis.

The diachronic trend in the distribution of integration value in Florence is here summarized in figure 4. As the system has gone greatly increasing over the years (as can be seen in figure 3), it was here preferred to use here different scales of representation, in order to maintain a full view on the whole system and clearly describe the distribution of values and their trend over time.



Fig. 3 The grid of Florence at the present date and (above and highlighted in the box) at 1825

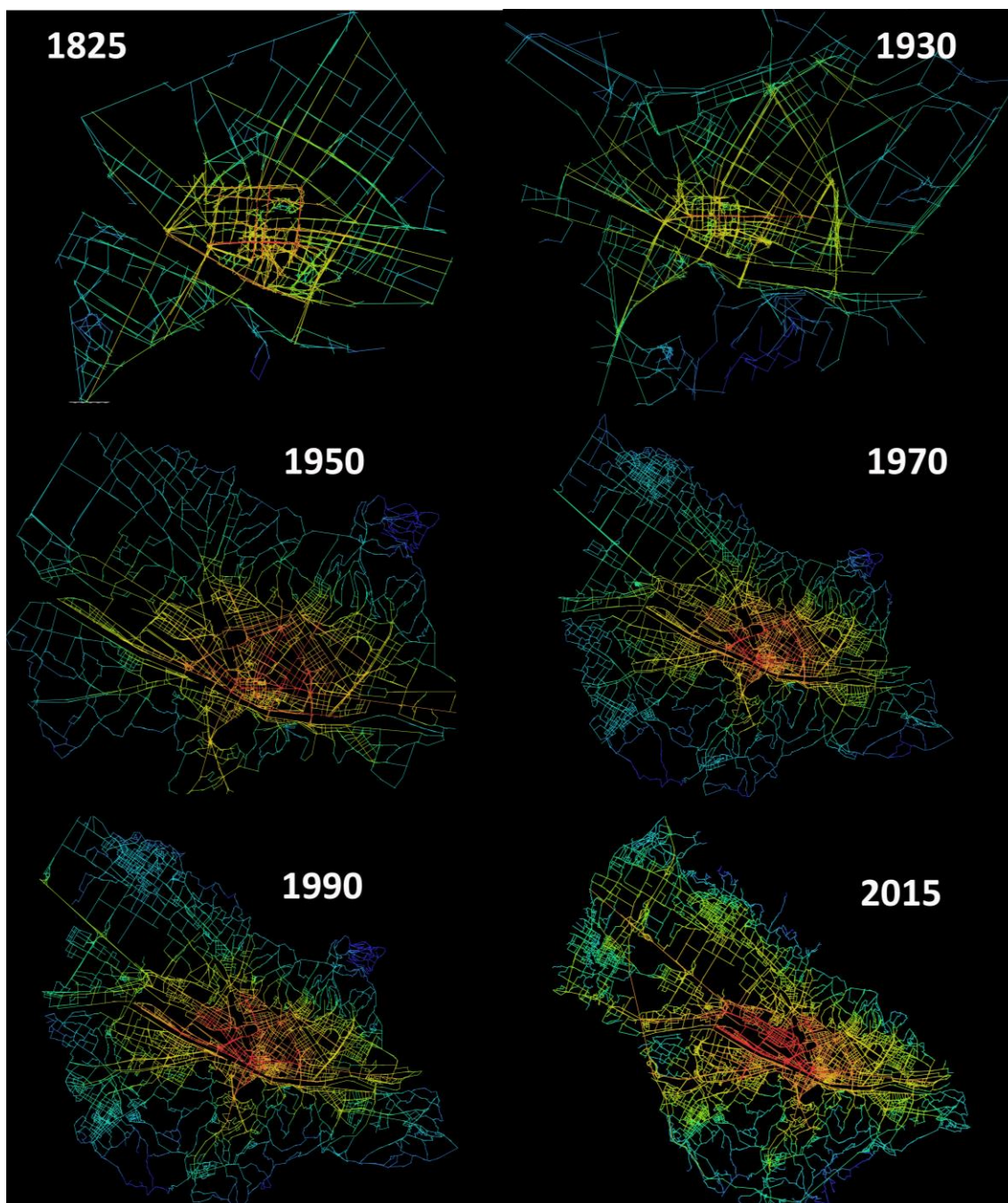


Fig. 4 Distribution of global integration in Florence 1825-2015

Some considerations easily arise from the observation of those results. First, a progressive shift of centrality, from the geometric centre of the inner core towards the external radial developments, is clearly shown in figure 5: while in the first three maps of the 19th century the strongest integrators appear to steadily persist coinciding with the *cardo* and *decumanus* of the original Roman layout of the city, in the very heart of Florence, since the early twentieth century the outer ring appears gaining more and more attractiveness. The making of the conurbation, in the last decades of the century, appears to involve the clear orientation of the integration core towards north, up to the last state, at 2015, showing it steadily anchored between the ancient townwalls and the recent north-western developments.

The images in figure 5 represent the correlation of local integration versus the global one, whose coefficient was mentioned above as 'synergy value', accounting for the extent to which local centralities depend on the

whole pattern of centrality. This index can be assumed as an indicator of the degree to which the different scales of the settlement are actually correlated, so as to concur in synergy to the global working of the city, which is commonly acknowledged a vital property in urban areas: in case of a strong correlation, local integrators are also prominent integrators at a global scale, thus creating a stronger and perceivable interface between the whole settlement and its single parts. The diachronic trend of synergy coefficient, since 1825 up to the present time shows a clear weakening of the correlation in the second half of the twentieth century (from $R^2 = 0.92$ to $R^2 = 0.55$), as a result of the sprawl of Florence and the growing of the conurbation.

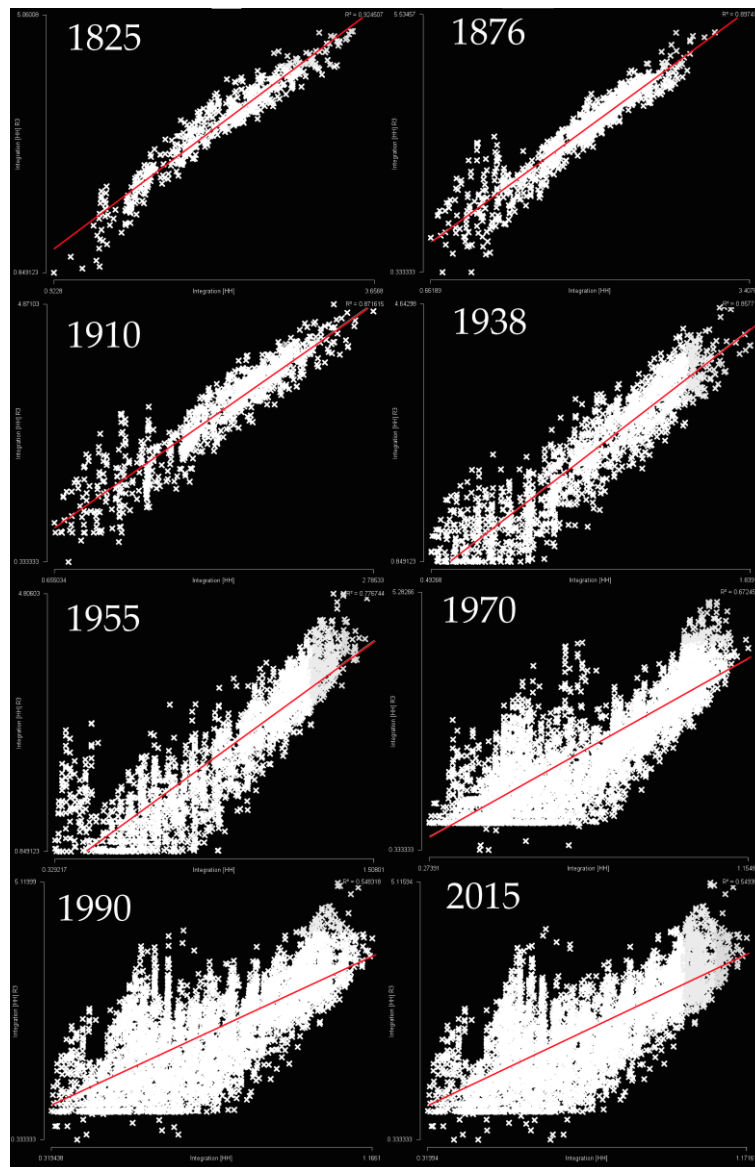


Fig. 5 Correlation local ($R = 3$) vs. global integration in Florence 1825-2015

The figure 6 summarizes the diachronic trend of the three resilience parameters in the period 1825-2015, highlighting the recent increase in the spatial vulnerability of the system. In fact, the decrease in the mean connectivity value stands for the decrease in redundancy of connections, what is commonly acknowledged as a fundamental element of urban resilience (Salingaros, 2005), as well as a precious source of urban life (Dupuy, 1991). Moreover, the decrease in synergy value stands for the weakening of the spatial relationship between the whole settlement and the local centres, which are scattered around and drift away, detached from the

global spatial structure. Furthermore, the sharp rise of the frequency value stands for the strong polarization of the network structure around a limited number of road axes. Just like the tree-like pattern described by Christopher Alexander, a tree whose major trunk is here the motorway, distributing movement flows to the neighbourhoods scattered around: 'Whenever we have a tree structure, it means that within this structure no piece of any unit is ever connected to other units, except through the medium of that unit as a whole' (Alexander, 1965; p. 50).

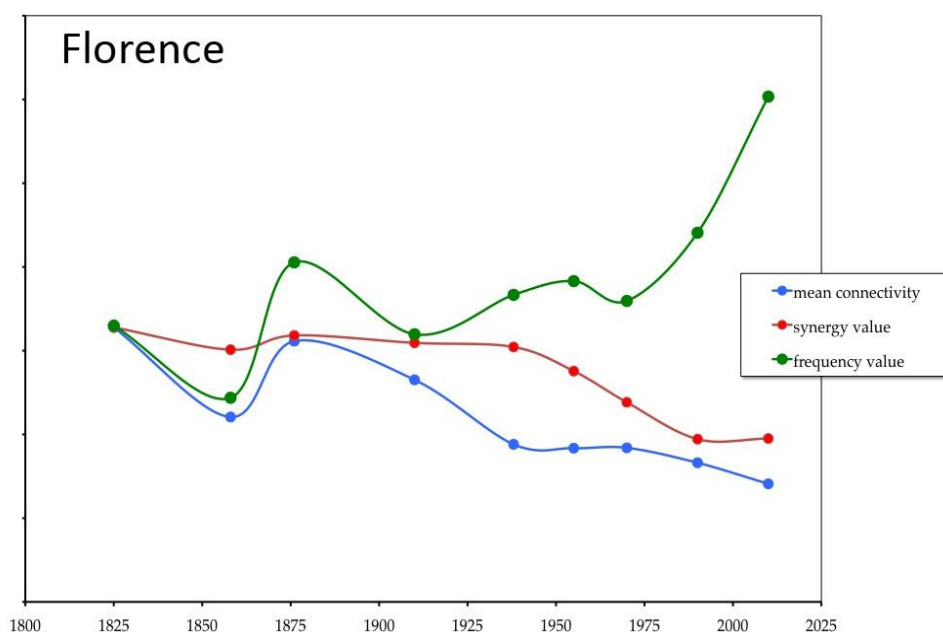


Fig. 6 The trend of resilience parameters in the grid of Florence in the period 1825-2015

All those phenomena appear attested in the grid configuration corresponding to the first '70s, and can be easily referred to the making of the conurbation and the embedding of the motorway within its grid: at present, the whole settlement actually appears highly depending on a handful of distributor roads, and above all on the motorway itself, provided with the highest values of choice: should any perturbation affect this road (as it is likely to occur, due to possible car accidents or traffic jams, unfortunately so frequent in this crowded section of road), the whole urban system would be at risk of globally collapsing.

A qualified literature on the issue (Penn et al., 1998; Hillier, Iida, 2005; Iida, Hillier, 2005; Turner, 2005) suggested to use angular segment analysis, according to different values of metric radius, in order to determine likely patterns of movement. Such analysis was therefore applied to the present grid of Florence, with radius varying from 400 m up the highest value of 15,000 metres in order to encompass the whole conurbation. Obviously the lowest values of radius are expected to provide the likely pattern of pedestrian movement, while the highest are suitable for reproducing the distribution of vehicular traffic.

The results of these analyses, for what concerns the distribution of choice values, are summarized in figure 7 and reveal that the distribution of pedestrian movement ($R= 400/800$ metres) mainly involves the streets of the inner core, making to clearly emerge the orthogonal grid of the ancient Roman city; on the other side, the vehicular traffic flows ($R= 15,000$ metres) are particularly intense outside the historic centre, towards the northern edge of the conurbation.

A further, appropriate refinement in the representation of vehicular movement pattern would then result from the clearing of the limited traffic zone out of the urban grid. As a matter of fact the streets of this zone, which at present approximately covers the area encircled within the ancient townwalls, do not actually concur to the

road network of the settlement. As a result of the cancellation of those streets, the distribution of choice values, with a radius of 15,000 metres, appears as shown in figure 8.

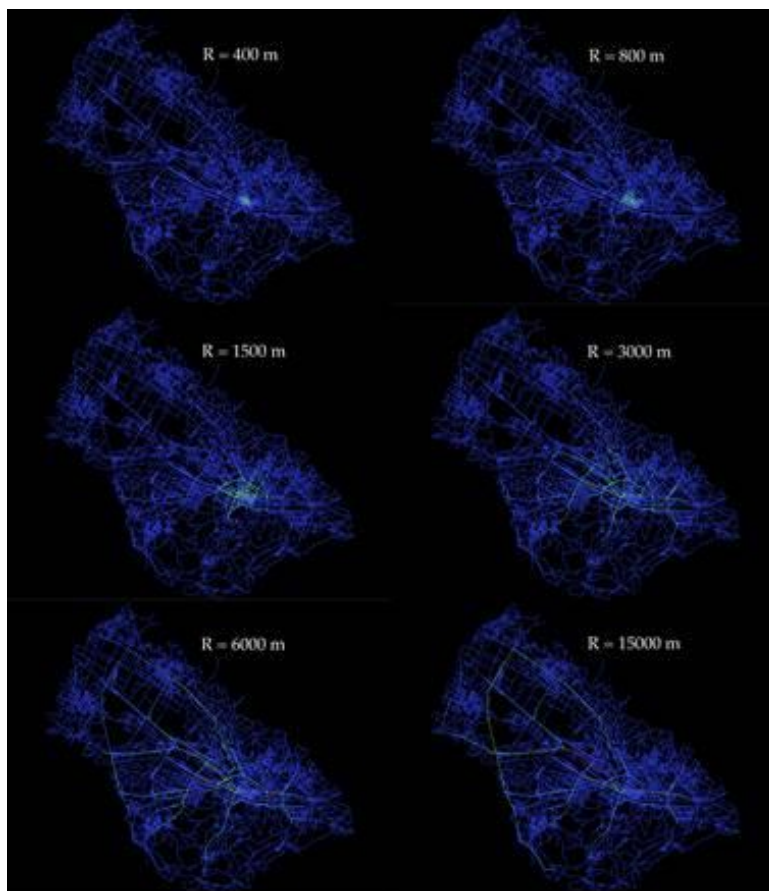


Fig. 7 Distribution of choice value in Florence for different values of metric radius



Fig. 8 Distribution of choice value in Florence (R= 15,000 m), net of the limited traffic zone

The figure above highlights two major traffic distributors, as provided with the highest choice values: the road segments composing the ring route surrounding the historic centre – the so-called 'viali', which in 1865 substituted the pre-existing townwalls; and the Florentine section of the motorway A1, appearing an outer ring on the western side of the conurbation. This result appears to exactly correspond to the actual phenomena of traffic congestion in the area of Florence, as it is perceived in the common sense as well as objectively measurable by direct survey. But it also appears to clearly materialize the traditional classification of traffic engineers in 'roads to be built as traffic conduits' (here in green and red) and 'roads to be built for the needs of the local communities to give access to their homes' (here in blue) (Tripp, 1950; p. 297) that was mentioned above. Two aspects are worth highlighting. First, the motorway appears to divert a significant amount of traffic from the streets of the urban fabric, thus depriving them from the precious by-product of origin-destination movements (Hillier, 1996b). Moreover, on the traffic side of the matter, it has to be noted that, while the few large scale movement arteries mostly run on the edge of the settlement, the short range movements, suitable for pedestrian movement, are exclusively encompassed within its inner core and hence are practically non-existent all over the wide conurbation. The hierarchical sequence traffic distributors / local traffic roads / pedestrian paths traditionally established by the manuals of traffic engineering for the efficient distribution of urban movement here appears broken and incomplete in most of the settlement, mainly due to the absence of a much finer scale structure outside the historic centre, suitable for receiving and distributing local traffic: a serious deficiency, since cities, as Hillier wrote, quoting John Peponis, 'in a sense, are interfaces between scales of movement' (Hillier, 1996b; p. 56).

This evidence induces to deeply investigate on the hierarchy of configurational values, observing the change of the frequency distribution of choice values in 2015 and in 1930, before the merging of the conurbation (fig. 9). It can be seen that over 95% of values is today under the 5th percentile, while in 1935 such percentage was around 83%. The choice values appear hence to follow a Paretian distribution: few lines (2% in 1930, 0.2% in 2015) take the overwhelming majority of the shortest paths between any couple of the others, and the slope of the function gets steeper with the progressive making of the conurbation.

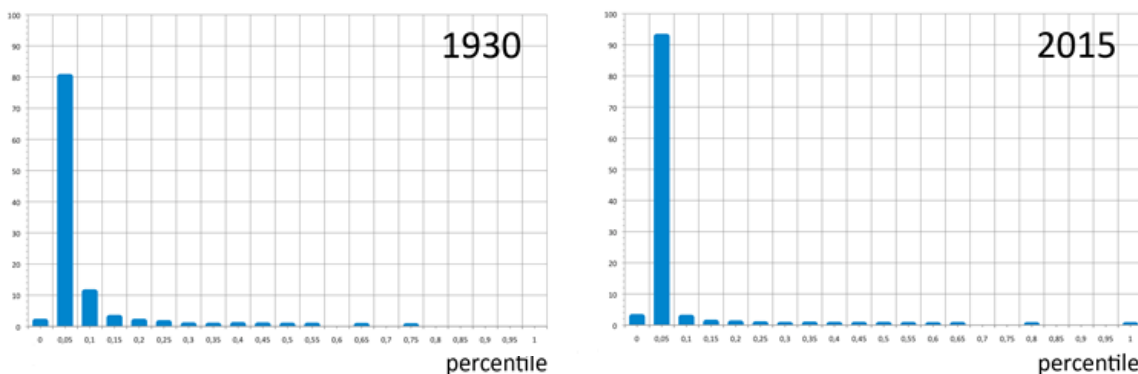


Fig. 9 Frequency distribution of choice values in the axial map of Florence at 2015 and 1935

The decrease of choice values appears so steep as to suggest representing their distribution by means of log-log rank-choice diagrams, having on x-axis the logarithm of rank (ordered by decreasing values of choice) (fig. 10). Those diagrams appear to narrowly correspond to a typical Zipf's function

$$\beta \log R_i + \log Ch_i = \log Ch_1 = \text{constant}$$

up to a cut-off threshold, after which such correspondence sharply weakens and choice values rapidly drop.

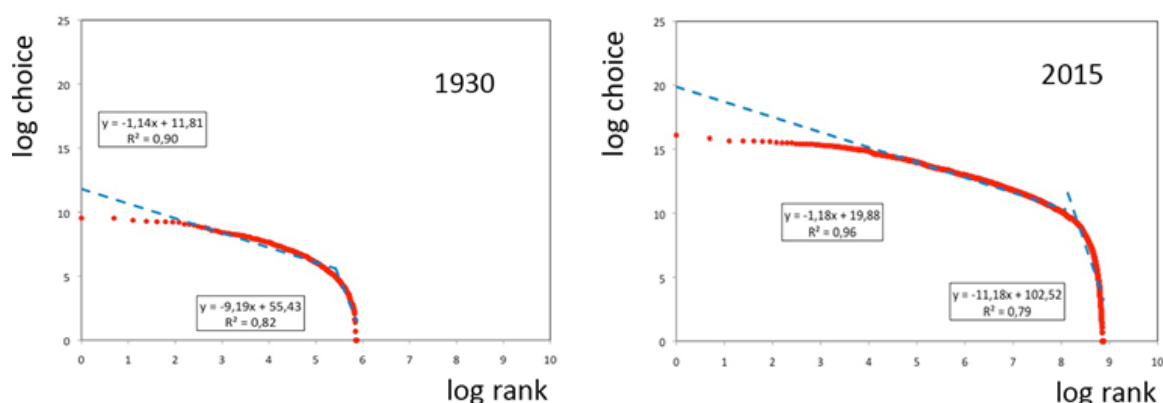


Fig. 10 Log-log rank-choice values in the axial map of Florence at 2015 and 1935

The distribution represented in figures 9 and 10 certifies that the merging of the conurbation has determined a strong polarization of the movement flows along a very limited number of spatial elements, hosting the vast majority of traffic. Conversely, an increasing number of lines (over 95% in 2015) appear excluded by the through movement all over the grid. Comparing such findings with the actual distribution of choice values represented in fig.8, we may easily observe that the very heart of this phenomenon of polarization is the motorway, while the suburban fabric appears almost entirely segregated from the major traffic flows.

5 CONCLUSIONS

The results sketched above allow certain conclusions to be drawn on the effect of the making of the Florentine conurbation. First, the diachronic analysis of its configurational state confirms the actual progressive shifting of centrality from the original inner core towards the north-western development area. Besides, the resilience of the whole system appears weakening as a result of the recent growing of the conurbation and to the strong polarization of the network structure around a limited number of road axes; among them, the motorway A1 in particular, lapping the urbanized area on its western side, appears to polarize most of the whole traffic within the conurbation. Moreover, a large amount of internal movement bypasses the urban grid of the conurbation, moving from an urban origin to an urban destination through the motorway, even at the cost of the toll payment: the vast majority of the accesses to the motorway through the gates of the Florentine area actually corresponds to local (that is internal) movement. Furthermore, the motorway A1 appears supplementing the urban streets, thus improperly concurring in supporting the working of the system; what obviously involves a local worsening of its traffic condition, heavy in itself because of the heavy traffic running down the Italian peninsula. Yet, apart from this effect on traffic, the local role of the motorway also diverts a significant amount of vehicular traffic flows from the streets of the urban grid, involving the loss of the fertilisation benefit the irrigation of through movement provides. And each of these aspects appears worth highlighting, as they clearly affect both the inner geography of the settlement and merely traffic issues, linking them and making evident the mutual influence of one on the others.

More in general, leaving aside the case of Florence, two aspects deserve a special focus.

The proposed method can be applied to the general issue of motorways in metropolitan areas, in order to evaluate the relationship between the motorway and the urban road network and the actual entanglement of inter-urban roads within the system of the conurbation: a widespread phenomenon, commonly resulting from the growth of the urban settlements and their sprawl into the surrounding areas.

Even more in general, the configurational approach, suitable for appraising the urban grid as the interface between the physical city and the phenomena that occur along its paths, once again proves its usefulness in linking spatial issues and traffic questions, so as to bridge the traditional gap between urban design, focused

on the morphologic features of blocks and buildings, and transport analysis, strictly concerned with the distribution of movement flows on the streets network.

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IMAGE SOURCES

Fig. 1: Google Earth

Fig. 2: Autostrade per l'Italia S.p.a

Fig. 3, 4, 5, 6, 7, 8, 9, 10: elaborated by the author

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THE WATER SENSITIVE FUTURE OF LAHIJAN. PUBLIC SPACES AS INTEGRATED COMPONENTS OF STORMWATER MANAGEMENT INFRASTRUCTURE

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ABSTRACT

The emergence of the modern urban water system in Iran, albeit facilitated access to clean water and accelerated discharge of waste- and stormwater, it left some negative imprints on country's urban and natural environment. Among which larger stress on natural water cycles and pollution of water resources are of great importance. More importantly, such impacts are occurring when cities are going through a changing climate, and are facing higher risks of water shortages and flooded urban surfaces in warm and wet seasons, respectively. The present research is built upon a case study conducted in Lahijan, a small city in northern Iran. Bridging between traditional urban design principles and water management practices, the study aims to find ways to connect place making with urban water infrastructure design in order to reintegrate water into the design of public spaces to create visually pleasant, environmentally sustainable and yet resilient contemporary urban forms. The analysis of the water-state of the traditional city reveals that stormwater has been an integrated into the design of Lahijan's public spaces for centuries, and that the blue and green surfaces were the key components in constructing the porous landscape of Lahijan. As an endeavour to build new techniques upon the old traditions, the paper concludes that after a long period of absence of water in urban settings, water must be reintegrated in the design of public spaces. Accordingly, urban spaces of the future water sensitive Lahijan through various storage, conveyance, infiltration, and evaporation capacities shape the distributed on-site stormwater management infrastructure of the city which can adapt to the impacts of a changing environment while addressing the problems of water scarcity, floods, and pollution.

KEYWORDS:

Urban water infrastructure, Public space, Stormwater, Lahijan, Iran

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水敏型城市 LAHIJAN 的未来。

公共空间作为 LAHIJAN 雨水管理基础设施的综合组成部分

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摘要

虽然伊朗现代城市供水系统的兴起促进了清洁水的获取，同时加速了废水及雨水的排放，但还是给这个国家的城市 and 自然环境带来了负面影响。自然水循环面临的较大压力以及水资源污染是其中的两大问题。更重要的是，当城市面临气候变化，在温暖潮湿的季节面临更大的水资源不足以及洪水淹没城市地表的危险时，也会产生这些影响。目前正在针对伊朗北部的小城市 Lahijan 进行一项案例研究。为了缩小传统城市设计原则与水资源管理实践之间的差距，这项研究旨在设法将公共场所建设与城市供水基础设施设计相融合，从而将水资源利用重新纳入公共空间设计，从而打造出外观优美、环境可持续发展并且满足未来需求的当代城市形态。对传统城市供水状态的分析表明，数百年来，雨水排放和收集系统已融入到了 Lahijan 公共空间设计之中，对于多孔城市 Lahijan，打造蓝天白云、绿树成荫的环境是关键。为了打破旧传统，引进新技术，本文得出的结论是，对于长期缺水的城市环境，必须将水资源利用重新纳入公共空间设计之中。因此，未来的水敏型城市 Lahijan 要通过存储、输送、渗透、蒸发来重塑城市的雨水管理基础设施，以便应对不断变化的环境影响，同时解决水资源短缺、洪水和污染问题。

关键词：

城市供水基础设施；公共空间；多孔城市；雨水；Lahijan；伊朗

1 INTRODUCTION

The emergence of the modern urban water system in Iran, albeit facilitated access to clean water and accelerated fast discharge of waste- and stormwater to the sewers, it left some negative imprints on Iran's urban and natural environment. Among which urban sprawl and horizontal expansion of cities, larger stress on country's natural water cycles, pollution of water resources and depletion of green spaces are of great importance. Such impacts are even more critical in a time when cities are experiencing more frequent extreme weather events including destructive floods and draughts of a changing climate. Consequently, many Iranian cities are facing higher levels of air temperature and risks of water shortage in warm seasons as well as increased risks of urban flooding and pollution of water bodies in wet seasons.

Studying the traditional knowledge and learning from locally practiced techniques can help us to pave the path in finding new ways to face the growing water challenges of the country and to move towards the sustainability of water resources. The strong connection of traditional methods to the regional geography and their adaptation to the local climate are the keys to durability of them. However, after the modernization process, many of such local methods lost their value and effectiveness, and gradually became forgotten. One may argue that traditional practices are not able to solve all water-related issues of the current time; however, combining the traditional knowledge and the recent technological capacities can offer a good mix of "old" and "new" practices and techniques to assist the communities to achieve the sustainable management of their water resources. In Mays' words, "Many present day water problems could be solved using the traditional methods developed and used for hundreds of years. ... This has blinded many people of the forgotten sustainable ways of the ancients. So that in reality highly advanced methods are not required to solve many water problems, particularly in many of the poor and developing parts of the world." (2010, pp.217, 218) Such strategy might become even more fruitful in a country like Iran, where the rapid pace of urban expansion requires further development of urban water infrastructure; while some of the traditional techniques of water management are still in use and there is a tendency to preserve them.

The present research is built upon a case study conducted in Lahijan, a small Iranian city. Lahijan, situated in the Caspian coastal plain in the north of Iran, is one of the oldest cities of the country. With the area of 1013 hectares and population of some 94000 people, it is the third most populous urban settlement of the northern province of Guilan, and was the capital city of the province in the past. Employing desk research and fieldwork, the paper studies the past and the present status of the city and its urban water infrastructure development. Bridging between the urban design principles and traditional water management practices, the research aims to identify the sustainable urban water management techniques of the past, which were fitted into the local context while meeting the water demands of the communities. Following the principles of traditional water management techniques, the study seeks to connect place-making with urban water infrastructure planning in order to reintroduce water into design of public spaces, and turn them into an integrated component of stormwater management infrastructure. Such integration would be the key factor to create visually pleasant, environmentally sustainable and yet resilient contemporary urban forms.

In recent urban planning and design literature there is a convergence of research and case applications addressing sustainable water management systems through place-making projects (Wong & Ashley, 2006; Heaney, 2007; Ahern, 2007; Novotny, 2009; Wong & Brown, 2009; Sipes 2010; Novotny *et al.*, 2010; Hoyer *et al.*, 2011). In contrast to the conventional fragmented system, under an "Integrated" water management system, the urban water infrastructure design has a strong bond with urban design and place-making processes of cities. Integrated water management techniques are known under different names in various parts of the world: Low Impact Development (LID) and Green Infrastructure (GI) in the USA, Sustainable Urban Drainage Systems (SUDS) in the UK, Best Management Practices (BMPs) in Europe, and Water Sensitive

Urban Design (WSUD) in Australia. All of such techniques, however, aim to minimize the hydrological impacts of urban development specifically targeting stormwater.

Contrary to the current stormwater management practices, which are concentrated on reducing peak flow rates to prevent flooding, through mimicking natural hydrologic processes, various integrated water management techniques create functional green spaces to control and manage stormwater as close to the source as possible. Low-impact development (LID) techniques aim to maintain, repair or replicate the predevelopment hydrological functions of urban areas (including storage, infiltration, and groundwater recharge) to control runoff and the transport of pollutants. "In a retreat from decades of large, centralized hard-pipe solutions that treat stormwater as a burden and ship it off-site as quickly as possible, LID is a paradigm shift that keeps stormwater on-site for longer periods and manages it as a valuable resource." (Sarte, 2010, p.104)

Similar to LID, Sustainable urban Drainage Systems (SuDS) seek to shift the paradigm towards surface water and introduce it as a valuable resource. "SuDS aims to slow down and reduce the quantity of surface water runoff from a developed area to manage downstream flood risk, and reducing the risk of pollution; through harvesting, infiltrating, slowing, storing, conveying and treating runoff on site and, where possible, on the surface rather than underground. Water then becomes a much more visible and tangible part of the built environment to be enjoyed by everyone." (Woods Ballard *et al.*, p.19) Accordingly, the SuDS Design Philosophy aims to deliver such multiple benefits, manage surface water runoff through mimicking natural hydrological processes, enhance biodiversity, beauty, and the natural aesthetic of buildings, places and landscapes, deliver resilience, and make developments more sustainable.

Green infrastructure design is yet another technique which employs "an interconnected network of natural areas and other open spaces to conserve natural ecosystem values and functions, to sustain clean air and water, and to provide a wide array of benefits to people and wildlife (Benedict and McMahon 2006). Ahern (2007, p. 267) defines green infrastructure as "spatially and functionally integrated systems and networks of protected landscapes supported with protected, artificial and hybrid infrastructures of built landscapes that provide multiple, complementary ecosystem and landscape functions to a broad public, in support of sustainability". In his definition, Ahern emphasizes the idea of infrastructure as a networked system that follows a multi-scale approach with recognition of pattern:process relationships and an emphasis on physical and functional connectivity. Among others, the concept of connectivity directly applies to water flow as the most important flow in any landscape, particularly in human-dominated and urban environments. Disruption of hydrologic connectivity is a major concern when planning for sustainability.

Comparable to the previous techniques, Wong and Ashley introduce Water Sensitive Urban Design (WSUD) as an interdisciplinary concept, which is based on the integration of the two key fields of 'Integrated urban water cycle planning and management' (IUWCM) and 'urban design'. They argue, "WSUD brings 'sensitivity to water' into urban design, as it aims to ensure that water is given due prominence within the urban design process through the integration of urban design with the various disciplines of engineering and environmental sciences associated with the provision of water services including the protection of aquatic environments in urban areas. Community values and aspirations of urban places necessarily govern urban design decisions and therefore water management practices (Wong & Ashley 2006). Wong & Brown characterize a Water Sensitive City by "three pillars, which must be seamlessly integrated into the urban environment". The three pillars of water sensitive cities indicate: (1) Cities as water supply catchments; (2) Cities providing ecosystem services; and (3) Cities Comprising Water Sensitive Communities (Wong & Brown 2009, p.676).

Hoyer *et al.* (2011) also highlight the multidisciplinary of Water Sensitive Urban Design in which the objectives of the urban water management system is combined with the ones of a responsive urban design and a functioning urban landscape. Although WSUD embraces all different aspects of urban water management

including water supply, sewage treatment, flood management, protection of water bodies such as rivers and creeks, and providing social amenities and improving the livability of the urban environment, stormwater management seems to be a key element.

Unlike the conventional approach in which stormwater is mainly considered a problem, under all various integrated water management techniques, stormwater is not only recognized as a resource but also a great asset to provide the amenity of the city. Echols highlights the failure of engineered stormwater facilities in considering its otherwise ecological, social or aesthetic qualities of the built infrastructure, he states, "sustainable stormwater management can be used to create places that serve both the demands of urban drainage and urban planning. From the urban drainage point of view, people want to have a system that is reliable, simple to construct and easy to maintain, while also considering its costs. Alongside, from the view of urban planning, sustainable stormwater systems should be beautiful, meaningful, and educational (Echols, 2000, p.1).

2 LAHIJAN'S DEVELOPMENT THROUGHOUT THE HISTORY

Similar to the majority of Iranian cities, Lahijan went through rapid urban expansion and population growth within the last decades. Despite its rapid expansion of the 20th century, the current urban form of Lahijan can be traced back in Safavid era. *Safavid city* (1502-1736) of Lahijan experienced a golden age when its agriculture- and commerce-based economy was flourishing. The region owes the richness of its flora and fauna, and the variety of its agricultural resources to its humid subtropical climate and the density of its hydrographic system. Rabino (1916, p.115) says, "Perhaps nowhere else in the world are there so many rivers, streams and torrents as in the Caspian provinces". As a result of a significant amount of precipitation, the region is gifted by innumerable watercourses, permanent streams or seasonal flows which are the primary sources of water to feed the lagoons or the ponds. Hence, the running waters of streams and watercourses and the still water of lagoons and ponds are significant components of Lahijan's traditional urban form. Apart from their original function as a source of water for various domestic and agricultural activities, such water structures were contributing to the quality of urban spaces in different ways. They were improving the aesthetic qualities and visual attractiveness of the urban environment and offering leisure and recreational spaces to people in warmer seasons. The residential neighborhoods, the polo field, which was built by the direct order of Shah Abbas the great, and the pond were the main components of Lahijan's urban landscape in Safavid dynasty. The three components were surrounded by cultivated lands in the north and the south; while the river and the hills were drawing the western and eastern edges of Lahijan, respectively (Figure 1). Qajar city (1758-1925) of Lahijan witnessed the further development of city's residential districts. Lahijan found its seven oldest neighborhoods in this period. Each of which enjoys a specific character and socio-economic status. They, however, share the same physical and functional pattern in which the housing areas surround a functional center. The functional centers contain the public facilities of each neighborhood, and they are connected through key passages of the city to shape the main urban structure of Lahijan.

The diversity of available water resources in the region, which could offer the citizens alternative sources of water for domestic and agricultural purposes, is among the main driving forces of urban development during Qajar monarchs. Since the level of groundwater in the area is very high, digging wells and bringing groundwater up to the surface has always been a common habit of the residents to supply their domestic water demands. In Bromberger (1989, p.16) words, "such easy access to water gives exclusive and original features to the settlements in northern Iran: in central part of Iran activities such as fetching water, watering the livestock and doing the washing, mean daily visits to communal facilities of the neighborhood, village or the city; on the contrary, the easy access to source of water in private sphere of the household have turned

drawing water and bathing into private affairs: the well is virtually a constant component of the house located in the courtyard.”

In addition to the surface- and ground water resources, rainwater was yet another important source to fulfill the water demands of the community. Roof water collection and farm ponds were the main rainwater harvesting techniques which were used by people for a long time. Despite the fact that Guilan province has an annual average precipitation of about 1000 mm, it is not concurrent with cultivation season, and therefore, use of farm ponds sounds to be an intelligent technique to harvest the water in rainy seasons and use it later in the cultivation period (Madani, 2014). Since evaporation rate is never a concern in northern Iran, the uncovered open cisterns (locally called *Istakhr*) became the popular rainwater harvesting technique among the local communities. Historical investigations reveal that almost all the cities and villages in Guilan province had one or more ponds to meet their agricultural demand for water. Ghoddousi refers to farm ponds as “structures which are constructed by small earthen walls on flat or hilly land to collect and store rainwater, surface runoff and flood flows” (1999, p.292). In Banihabib’s words, “the rain and stormwater running from the upper or neighboring catchments is collected and directed into these small reservoirs.” (1999, p.337)

Lahijan has probably seen its most significant changes in Pahlavi period. *Pahlavi city* (1925-1979) of Lahijan is characterized by the emergence of new streets and residential districts, as well as modern urban water infrastructure. The streets of Pahlavi city were not only functioning as physical connections to facilitate the mobility but also providing places of socializing and leisure activities. New residential districts are other components, which were added to the former structure of Lahijan in this period. The development of new residential areas along with modern transportation networks resulted in an increase in hard and impervious surfaces of the city. In the absence of an efficient drainage system, less porosity and perviousness of urban surfaces caused higher risks of flooding in Lahijan (Figure 2).

H.L.Rabino, a British consul serving in Rasht, the capital city of Guilan province, visited Lahijan in 1906; he describes the city in his book, “Lahijan has seven neighborhoods, 2260 houses and a population of some 11000 people...” (Rabino 1916) Since then Lahijan has seen a significant population growth. Just in the last 55 years, the city’s population grew almost fivefold and passed 94000 residents. To accommodate such rapidly growing population, the *Post-Revolution City* (1979-2016) has seen massive expansion (Figure 5). Many agricultural fields inside the city have been reclaimed to provide room for further densification projects and expanding transportation networks. Following the decreased surface of green spaces and cultivated lands inside the city and introduction of modern water infrastructure, Lahijan Pond lost its primary function as a source of water for agricultural purposes. Besides, the growing network of streets of the city cut the natural connections between the streams and seasonal flows and the pond. Covering the floor and walls of the pond by concrete was yet another step in the transformation of the pond. Neither a cistern to harvest the rainwater for future agricultural activities, nor a sponge to hold the excess urban runoff to avoid flooding, the natural pond was transformed into an artificial lake and lost its original character. Such changes, albeit facilitated the maintenance of such large body of water inside the city and ensured sanitary concerns, damaged its natural aquatic life. The artificial lake, however, has become a great recreational space with beautiful scenery inside the city, is one single entity disconnected from surrounding natural environment (Figure 3). Currently, the pond is not a source of water anymore- as it was in the past; rather it is a large artificial component in the city which receives its water from other underground water resources. Instead, to reduce the risk of urban flooding, the city started to further expand its drainage system to convey urban runoff as fast as possible out of the city.

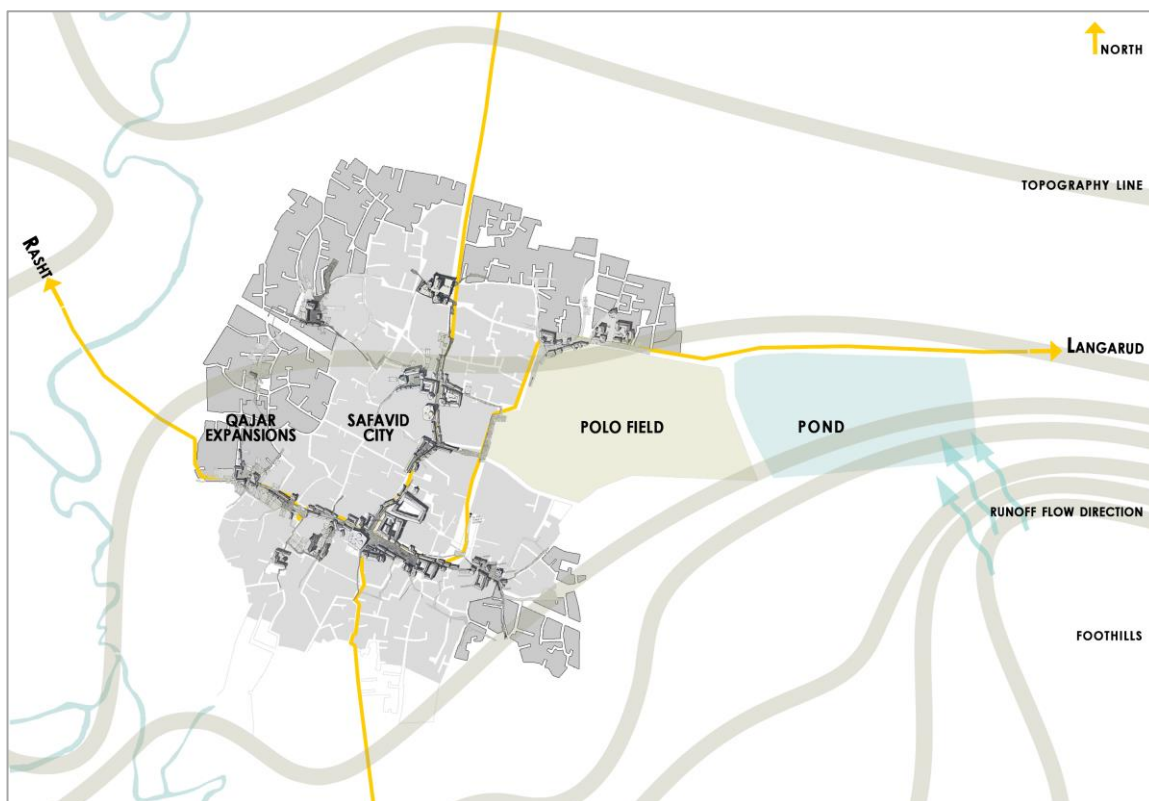


Fig. 1 The urban structure of Qajar city of Lahijan: residential neighbourhoods, the polo field, and the farm pond

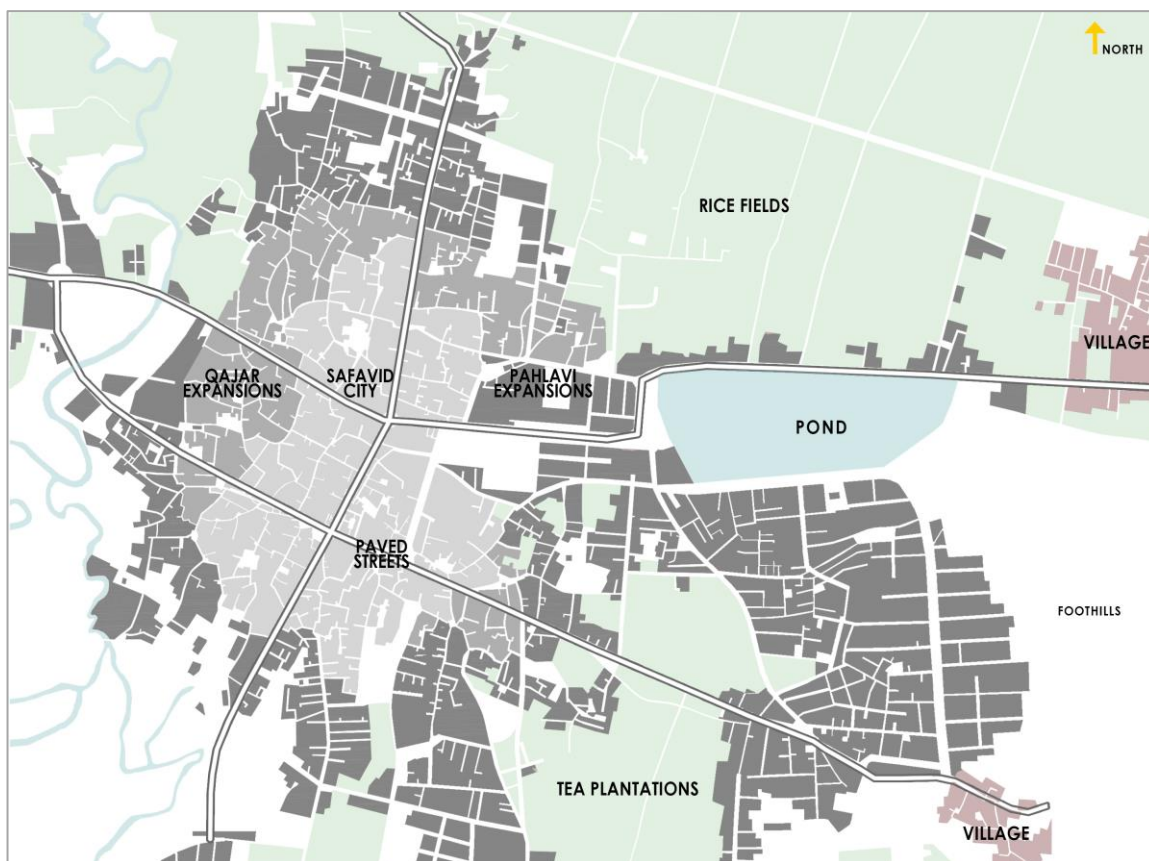


Fig. 2 Pahlavi city; the expanding area of built up spaces and paved streets



Fig. 3 The natural pond in 1970s (left) and its transition to an artificial lake in 2000s (right)

3 ANALYSIS SUMMARY

3.1 CENTRALIZING A DE-CENTRALITY: STORMWATER NOT A SOURCE OF WATER ANYMORE

By the beginning of the 20th century, the city experienced a faster pace of urbanization. Due to the rapid growth of the population, which was followed by fast urban sprawl, the traditional techniques were not able to respond to the increasing demand of the community. The emergence of modern urban water systems in the second half of the twentieth century was yet another reason to accelerate the paradigm shift from a traditional distributed system to the centralized network of underground water pipes. Although the underground urban water networks provided easy access to clean water, and solved the sanitation and maintenance problems of the former infrastructure, it caused less popularity of traditional water management practices. One can mention the example of farm ponds in the region; While harvested rainwater by farm ponds was meeting the water demands of the agricultural activities for centuries, the emergence of modern irrigation systems and lack of proper maintenance caused gradual deterioration and later disappearance of many farm ponds in Guilan. Therefore, unlike traditional systems, which were relying on the locally available sources of water to respond the demands, the current urban water network employs available technologies to bring water from farther distances, and lack the climatic and geographical considerations of the previous system. In contrast with the network of decentralized local practices scattered all over the territory, the present urban water infrastructure is a central system of underground water pipes, which delivers water to each and every household. The new technology-oriented urban water infrastructure paid the slightest attention to the local environment where this new system is implemented. In other words, "this quick-and-fix approach to use of new technologies to solve complex development problems of developing economies dismisses the achievements of the past and underestimates and minimizes the many difficulties some of the new technologies have brought in their work." (Borri & Grassini, 2014, p.112)

The current water supply of Lahijan is partially afforded through 13 deep wellbores located in outskirts of the city as well as the treated water from Water Treatment Plant of Sangar Dam Lake, located some 89 kilometers away. Despite availability of urban water supply, many families still use their private wells as extra free of charge sources of water in case of urban water cut or shortage of water in warm seasons. Long distance water transfer from Sangar Water Treatment Plant as well as uncontrolled abstraction of groundwater from wells affects the hydrological cycles and local ecosystems. More importantly, this is happening in a time when the cities have less and less infiltration capacity to recharge the region's groundwater resources (Figure 4).

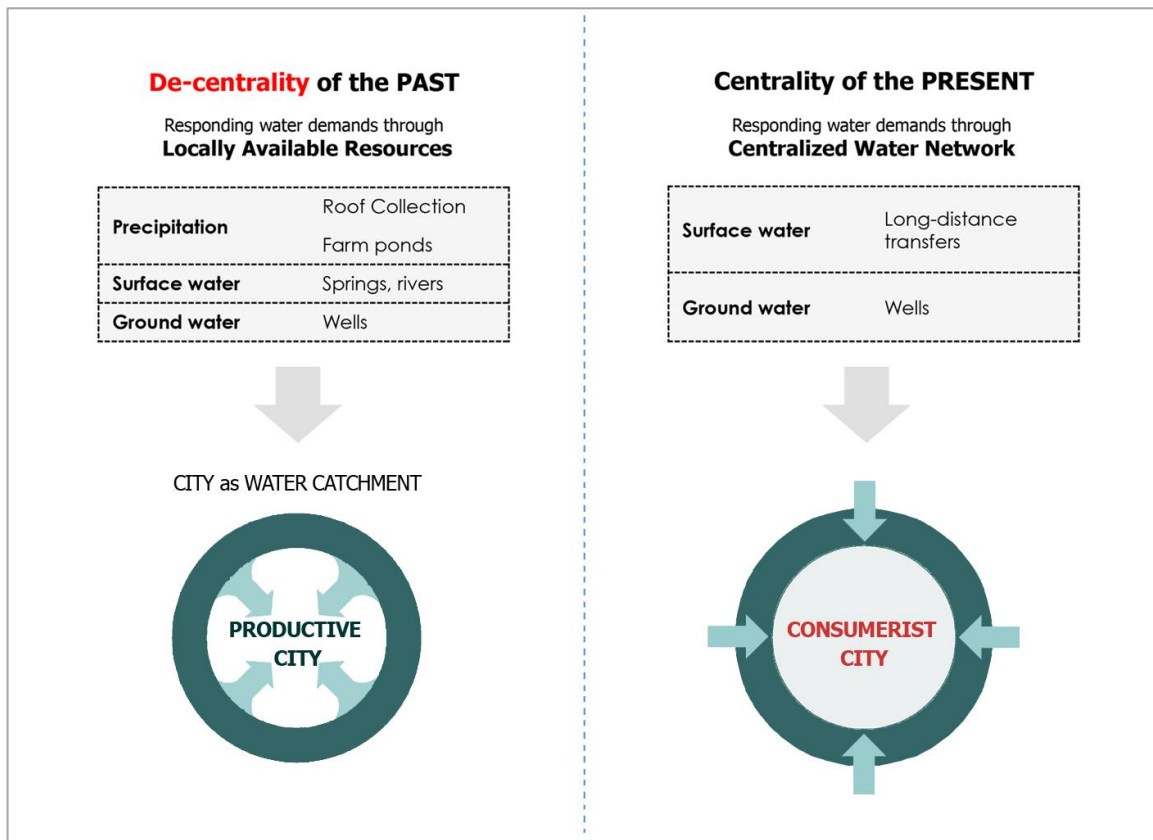


Fig. 4 Water resources in traditional and modern urban water supply system



Fig. 5 Limited number of Green patches in contrast with the expansive impervious areas of post-revolution city represents the limited on-site stormwater management capacities



Fig. 6 Flooded urban streets of Lahijan, October 2013

3.2 MORE WASTEWATER DISCHARGE: STORMWATER EQUALS WASTEWATER

Lahijan enjoys an average amount of 1228 mm of rainfall and 136 rainy days per year. Hence, it has a considerable amount of stormwater to manage. In wet seasons, the city has to manage greater amount of stormwater than wastewater that the residents produce. Currently, the drainage system of the city is a mix of combined (185 km) and separated (61 km) sewers, and thus the larger amount of stormwater and urban runoff is mixed with waste and conveyed through one conduit. Furthermore, the existing wastewater treatment plant of the city does not have the capacity to treat all the loads of wastewater. The construction of Lahijan water treatment facility, which started in 1994, is not yet finished and is projected to be completely done by 2026. The ultimate capacity of the treatment facility will be about 36000 cubic meters per day, while currently, the treatment facility is capable of receiving and treating some 26000 cubic meters of wastewater per day. If the wastewater is not treated, the pollution is just conveyed elsewhere. Discharging effluent water without receiving any treatment impose several challenges to the city and its surrounding natural environment including pollution of nearby water and soil resources. Apart from the pollution of water and soil resources, the treatment facilities consume a lot of energy, and thus, contribute to higher carbon emission and air pollution. On one hand combining stormwater and wastewater in one conduit under the current urban water infrastructure eliminates the possibility of harvesting and treating rainwater and reintroducing it to the system as a new source of water. On the other hand, the traditional stormwater management techniques are not capable to manage all the loads of rain and runoff in the city. There is, however, a lesson to learn from such traditional practices to change the conventional approach towards stormwater as waste and recall the true capacities of rain and stormwater as valuable resources in the urban water management system of the city.

3.3. LIMITED POSSIBILITIES OF ON-SITE STORMWATER MANAGEMENT: STORMWATER NOT AN ASSET BUT A MENACE

As mentioned previously, Lahijan like the rest of Caspian plain enjoys much higher amount of annual precipitation than other parts of the country. Due to such availability, rainwater should be considered a great

asset and source of water for the city. However, lack of proper stormwater management system has turned urban runoff and stormwater into one of the main challenges of the municipality, particularly in wet seasons. Despite lack of proper drainage network, the traditional city was offering various opportunities for distributed on-site stormwater management. Before the onset of rapid urban expansion and densification of Lahijan in Pahlavi and post-revolution period, the urban open spaces including green spaces of orchards and cultivated lands as well as courtyards and gardens of private properties were offering various storage, infiltration, and evaporation capacities to the city. Such capacities were significantly decreasing the risk of urban flooding in cases of intense precipitation. Among the trends, which strongly affected such nature-oriented mechanisms of stormwater management in recent century, is the growing use of automobiles in the cities. Dominance of automobiles in the last 50 years not only affected the urban form of Lahijan, but also negatively influenced air and water quality. Following the new car-dependent lifestyle, the urban form of Lahijan changed to create room for connecting roads and parking spaces. The results were increased imperviousness of city surfaces and lower infiltration capacities, and thus, increased surface runoff and more frequent flash floods (Figure 5). As a consequence of less on-site stormwater management possibilities inside the city, the main goal of stormwater management set to be fast conveyance of urban runoff and stormwater out of sight to the nearby water bodies. Employing the available technologies, the municipality began to develop a drainage network. Time and again, such fast conveyance system of stormwater is neither environmentally sustainable nor resilient to the extreme weather events. The channels have not only a limited capacity to contain all the loads of stormwater but also limited entering points to let the stormwater inflow to the channels. In events like heavy precipitation the entering points cannot manage the intensity of rain and the channels cannot receive the total amount of rainfall and thus, the stormwater will overflow on the streets and other public spaces of the city. Frequency of flooded streets in recent years reveals that the current stormwater management infrastructure does not have enough capacity to manage the urban runoff and that the system is only functional under normal weather conditions. Furthermore, the urban open spaces of the city cannot assist the stormwater management process of the city in emergencies. The failure of the current infrastructure is even more critical in a time when all the cities around the globe are going to experience more frequent extreme weather events of a changing climate including destructive floods (Figure 6)

3.4 SWALLOWED GREENERY IN FAVOR OF A GRAY CITY

Over the centuries, Lahijan was known as a green city with rich and beautiful landscape. Due to the availability of fertile soil and rainfall, city's economy was mainly centered on agriculture, and vast areas of rice and tea cultivations were among the main components to shape the inner and outer landscape of the city. In recent decades, however, Lahijan is losing its original character as a green city; agricultural fields have been swallowed to provide space for new developments, and single-family houses are being replaced by multi-story buildings to accommodate the growing population. Urban forests are destroyed while a few urban parks and sport pitches are added. Consequently, the green character of Lahijan is weakened and a strong division between the natural and built environment is happened. Less greenery in the city means decreased area of permeable and soft surfaces and higher risks of erosion and flash floods due to the increasing area of impervious and hard surfaces. The figures from Municipality of Lahijan reveal that just in the last 40 years, some 250 hectares of cultivated fields and other green open spaces are replaced by various impervious surfaces including roads and streets, paved paths and rooftops.

In addition to lower degrees of perviousness and less on-site stormwater management capacities, the expanding dark and hard surfaces of Asphalt and concrete exacerbate the Urban Heat Islands effects inside the city. On the contrary, neighborhood parks and other large green spaces, which enjoy much cooler environment than other parts of the city in warm seasons, are becoming very rare. Based on the available

data from Iran's national Meteorological Organization (1956-2014), both average minimum and maximum air temperature in Lahijan has increased, a trend which is expected to continue in the future. The higher levels of air temperature in warm seasons increase the energy demands to condition the indoor spaces, which cause further temperature rise in urban areas.

4 DISCUSSION: ENGAGING TRADITIONAL PRACTICES TO THE NEW URBAN WATER MANAGEMENT PARADIGM

In parallel with demographic shifts, Iranian culture is also changing, becoming more consumerist and wasteful and less environmentally friendly. Despite the fact that Iran has limited sources of water, it is exhaustively exploiting and extensively polluting them, imposing so much pressure on its natural water cycles. Due to the limited availability of fresh water and to move towards sustainability of such rare resources, there is a certain need to rethink of our available water and our consumption patterns.

Following the concept of the water sensitive city which emphasizes the unseen potential of cities as 'water supply catchments (Wong & Brown 2009), the future sustainable urban water management must provide access to a diversity of water sources through centralized and decentralized infrastructure. Such diversity reduces the stress on surface and underground water resources, and introduces new sources of water including rain and stormwater to the urban water systems. The revival of traditional water harvesting systems of the region can play an important role in proposing new strategies which benefit from traditional knowledge and solutions as well as advanced technologies of the current time. As explained earlier, distributed water systems and the practices of rainwater harvesting and building cisterns and storage tanks to collect and store the water are not alien concepts in Iran, and particularly in Guilan region. On the contrary, while such practices were common in the past, they are currently almost forgotten and not in use anymore. Recently, however, there is a growing awareness about the importance of stormwater as a valuable source of water and asset for the city. Rather than larger withdrawal and long distance transfer of fresh surface water or extraction of groundwater, stormwater can be stored, treated and reused for various potable and non-potable purposes. For example, stored rainwater can be used for toilet flush or fire sprinklers when treated. Moreover, rainfall and urban runoff are the main sources to recharge depleted groundwater aquifers. Reintroducing rainwater as an alternative source of water of the city decreases the stress on surface and ground water resource and thus, contributes to the sustainability of fresh water resources. Furthermore, collecting rainwater and reusing it for non-potable purposes, rather than mixing it with wastewater and discharging it to the sewers, reduces the loads of waste entering the wastewater management infrastructure and the pressure on Lahijan's water treatment facility.

The current stormwater management infrastructure of the city is a set of surface channels and underground conduits with limited capacity in conveyance of stormwater out of the city. In addition to inefficiency of the existing infrastructure, the current design of the urban spaces is not of any assistance. Among others, the rapidly expansion of hard surfaces is a very important factor to further uncover the weak performance of the current drainage system of Lahijan. An overview of the present status of the city reveals the limited number of green open spaces (soft surfaces) in Lahijan and their uneven distribution within the city. This makes some parts of the urban fabric very vulnerable, so that if the underground wastewater infrastructure fails to manage the urban runoff in case of heavy rains, the urban environment is not resilient enough to adapt to the situation to receive and manage the excessive water temporarily. Hence, the limited capacity of the current drainage of Lahijan along with low on-site stormwater management capacities of the urban spaces calls for a changing paradigm in design of public spaces including urban squares and streets to reduce the impacts of unpredictable weather events.

According to Novotny *et al.* (2010), “the conventional approach which is based on fast conveyance systems should change to storage-oriented, slow-release systems characterized by storage in ponds, on flat roofs, in underground cisterns, ponds, lakes, etc.; infiltration into shallow aquifers; soft treatment (rain garden, bio-filters, earth filters, wetlands, ponds); slow conveyance in grassed swales (rain gardens) and natural or nature mimicking surface channels. Fast conveyance has no social benefit except getting rid of water as quickly as possible.” (p.186) The shift from strictly engineered systems of urban sewers to nature-oriented network of water sensitive urban spaces (Wong & Ashley, 2006) will not only reduce the environmental impact of the urban water system but also provide social amenities and contribute to the higher quality of urban environment and life of the communities.

Borrowed from Ahern’s classification of landscape elements in designing the green infrastructure of cities (2007), Lahijan’s urban surfaces must change to increase their various storage, infiltration, and evaporation capacities. Such capacities will improve the distributed onsite stormwater management possibilities in Lahijan and turn the city into a functioning urban landscape in which each and every component plays a role to sustain the system. Publicly owned green spaces and water bodies such as parks, sport fields, gardens, cemeteries, campuses, vacant lands, wetlands and lakes are examples of urban land use and surfaces that can shape the water sensitive patches of any given urban landscape. In addition to patches, water sensitive corridors would also play critical roles as the main connectors to form and define the backbone of a nature-oriented stormwater management infrastructure of the city. Long strips of publicly owned land within the city including canals, streams, drainage ways and green streets are examples of such corridors to shape the green network of urban landscape.

Rehabilitating and modifying Lahijan’s pond and reintegrating it to the stormwater management infrastructure can be yet another step to build new concepts based on old traditions to achieve the sustainability of urban water management system. In other words, under the new water sensitive urban paradigm, instead of large distance transfers of stormwater, on-site and local harvesting and treatment will form a distributed urban water system, in which the pond plays a crucial role. Moreover, such surface stormwater management system provides recreational amenities to the community and contributes to the aesthetic qualities of the city.

In addition to increasing on-site stormwater management capacity of different urban spaces, creating a distributed yet well-connected network of such water sensitive surfaces within the city is important. Such a network of urban surfaces, however, is not a natural network, mimics the characteristics of a natural landscape. Thus, connectivity is considered as one of the most significant characteristics of a well-functioning landscape. The urban landscape of Lahijan today is suffering from low connectivity. The landscape elements are either disappeared and replaced by urban elements or fragmented and highly separated from each other. Despite the fact that the concept of connectivity is highly related to water flows and a fragmented hydrological system is not capable of well-functioning, water systems seem to be among the most affected ones; in which they are largely disconnected after the development of grey (civil) infrastructure of the city. The significance of connectivity is important in achieving the resiliency of the system, so that if part of the system fails to function, the rest of it goes on and prevents the collapse of the whole system (Figure 7).

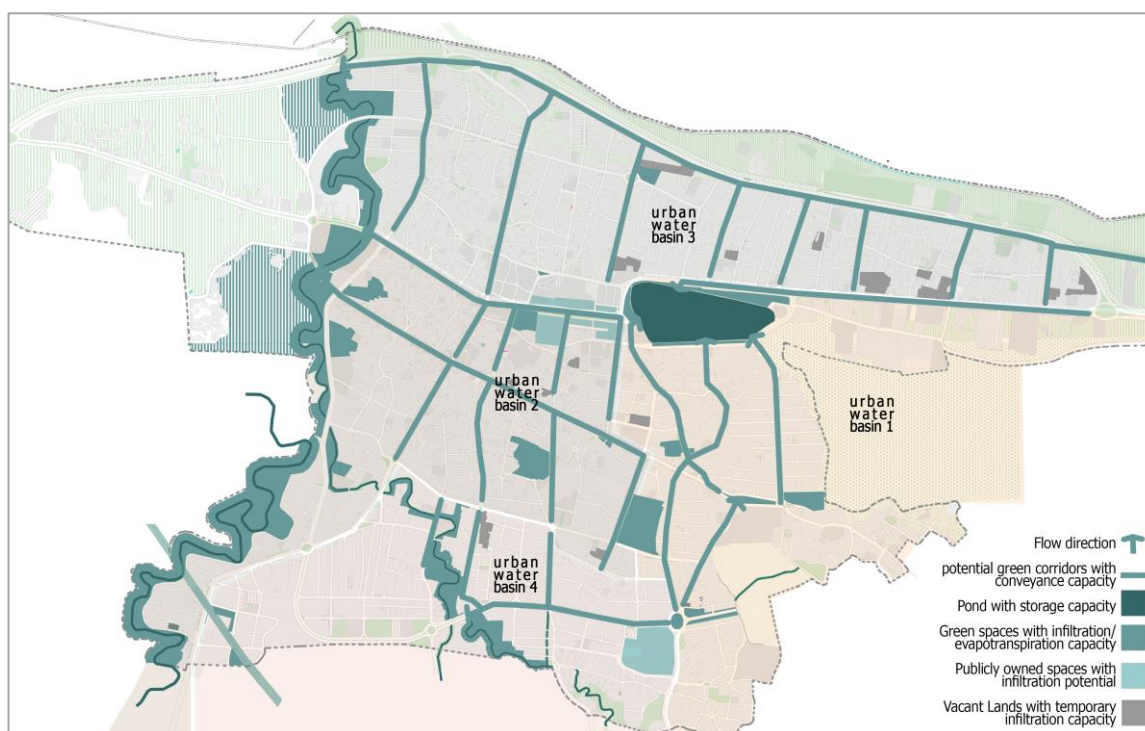


Fig. 7 A scheme of the network of water sensitive public spaces of Lahijan

Due to the small size of the city, the enhancement of the grid of green spaces offers all urban residents walking distances to one or more of such green spaces. Besides their functions, the green spaces will improve the quality of the urban environment and will contribute to the revitalization and regeneration of the green character of Lahijan.

Among the other benefits of increasing on-site stormwater management practices through water sensitive urban surfaces is its effect in moderating the temperature extremes and cooling down the urban spaces. Such capacity is highly appreciated in present time when the city is affected by Urban Heat Island (UHI) phenomenon and the urban areas are experiencing warmer temperature than the surrounding rural environments. Water evaporation absorbs a considerable amount of heat energy. Evaporation of water --direct evaporation from surrounding bodies of water or evapotranspiration from vegetation and surrounding soils, raises the moisture content of surrounding air, lowers the air temperature, and therefore cools down nearby surfaces. Hence, availability of water in urban spaces is the first requirement to apply passive evaporative cooling strategies. As discussed earlier, water can be provided through presence of ponds, pools, fountains as well as vegetation in urban spaces. Brophy *et al.* argues, "the presence of a body of water will help to moderate temperature extremes due to its high thermal storage capacity. ...The temperature of hard landscaping materials can be lowered when water is sprinkled, run over or through them. This is especially beneficial in built-up areas with large surfaces of heat retaining materials, exposed to high solar radiation." (2000, p.13) accordingly, encouraging on-site stormwater management practices inside the city through improving various conveyance, storage, evaporation and infiltration capacities of urban runoff assures the stronger and longer presence of water in public paces of the city, and mitigates the negative impacts of UHI effects inside Lahijan.

5 CONCLUDING REMARKS

The current stormwater management system of Lahijan is neither sustainable to accommodate the future water demands of the city, nor resilient to adapt to the conditions of a changing environment. To overcome such challenges, the stormwater management system of Lahijan must change to become an integrated part of the urban design of the city. After the long period of absence of water in urban settings, water must become a key component in design of the public spaces, which its real values are celebrated and its many benefits are revealed.

To achieve the sustainability of our fresh water resources and to reduce the stress on surface and underground waters, stormwater would be considered an asset and resource of the city rather than a menace. The analysis of the urban water state of the traditional city reveals that stormwater has been an integrated part of the design of Lahijan's public spaces for centuries, and that the urban spaces through various storage, conveyance, infiltration, and evaporation capacities were shaping the key elements in constructing the landscape of the porous city of Lahijan. Accordingly, urban spaces of the future water sensitive city would become an integrated part of a distributed on-site stormwater management to adapt to the impacts of a changing environment. Connecting stormwater water management with place-making will provide higher living standards for the citizens, and it will also address the problems of water scarcity, flooding and pollution. Water sensitive urban surfaces provide the possibilities to collect rainwater and reintroduce it as a source of non-potable water to urban water system; to hold excess amount of water in case of heavy rain and discharge it slowly; to increase the groundwater recharge potentials and decrease the discharged wastewater to public sewers, and so forth. Thus, water sensitive public spaces help communities to achieve the sustainability of their local water resources and the resiliency of their urban environment.

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IMAGE SOURCES

Cover Figure: Lahijan Pond from Ramin Shoraka

Fig. 1, 2, 4, 5, 7: figures from the author

Fig. 3, 5: figures from Lahijan Municipality archive

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An architect by profession, Masoumeh Mirsafo is currently a PhD candidate at Department of Architecture and Urban Studies of Politecnico di Milano. For her PhD, she studies "water-sensitive future of small Iranian cities" in which she aims to identify how integrating place making practices into urban water management can contribute to a more sustainable and yet resilience urban development of the country. Between 2010 and 2012 she studied Sustainable Urban Design from Lund University, Sweden, and later she worked as a researcher at Centre for Middle Eastern Studies of Lund University (CMES). Her research activities focus on sustainable urban development and climate sensitive urban design.

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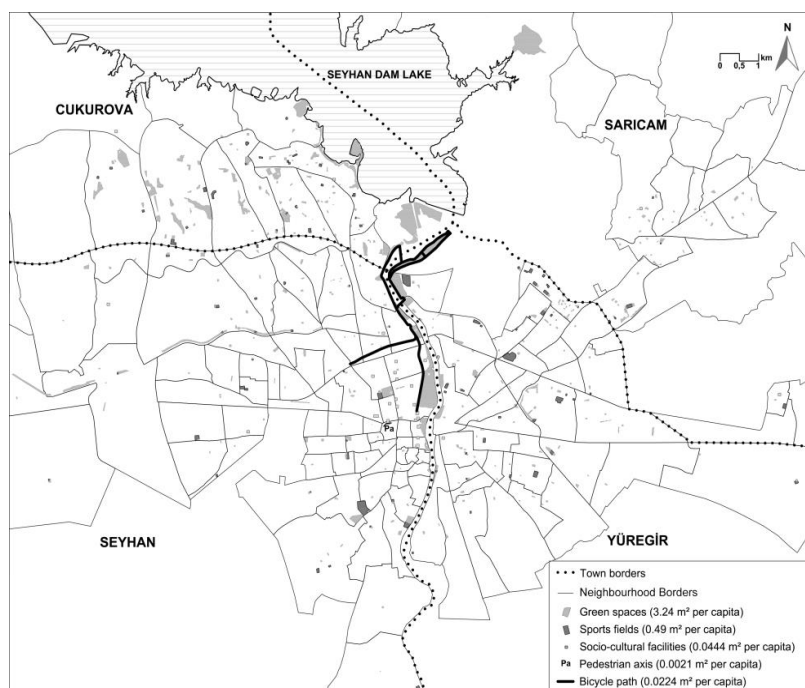
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THE EFFECTIVENESS OF URBAN GREEN SPACES AND SOCIO-CULTURAL FACILITIES

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ABSTRACT

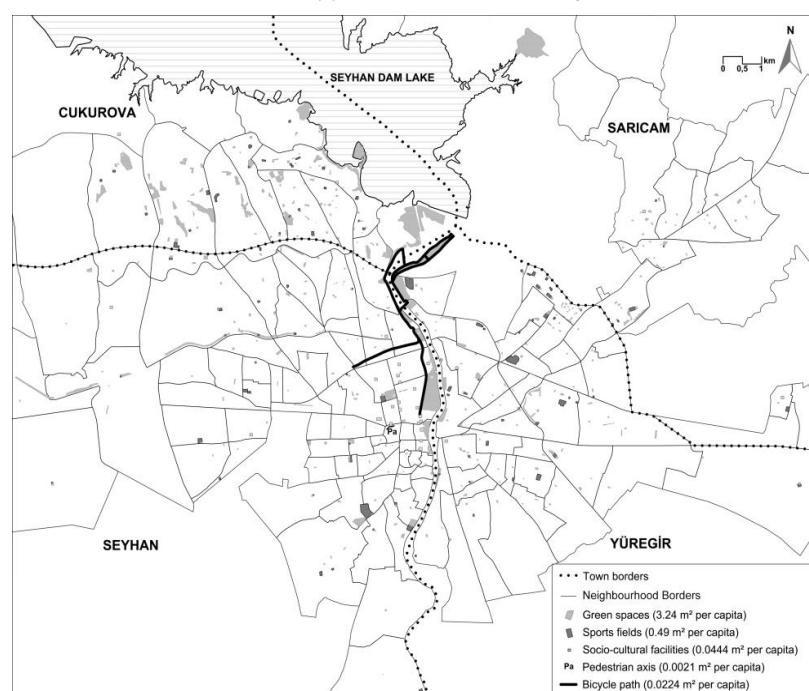
This paper aims to develop a theoretical approach for mapping and determining the effectiveness of green spaces and socio-cultural facilities as providers of urban ecosystem services and urban services in the case of Adana, Turkey. Firstly, green spaces and socio-cultural facilities per capita have been determined and indexed for the neighbourhoods in the city. Then, a distance-based method for estimating the effectiveness of these facilities was used. The distances between the various neighbourhoods and between a given facility and the farthest threshold have been measured and these values have been used to determine the facility effectiveness change value for each neighbourhood. Then, effective values have been calculated and indexed by incorporating the green space and socio-cultural facility values and the effectiveness change values for the neighbourhoods. Finally, point-based effective green spaces and socio-cultural facilities index values have been converted to continuous surface values in a GIS (geographic information system) environment in order to utilize as a base map for urban physical planning purposes. According to the outcomes of this study, the distribution of green spaces and socio-cultural facilities of the neighbourhoods are imbalanced and index values of these facilities range in between 45 and 84 out of 100.

KEYWORDS:

Effectiveness Change Value; GIS; Index Map; Index Value; Socio-Cultural Facilities; Urban Green Spaces

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城市绿色空间与社会文化设施的效益

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摘要

本文旨在建立一种理论方法，帮助土耳其阿达纳的城市生态系统服务和城市服务提供商设计并确定绿色空间与社会文化设施的效益。首先，为城市社区确定了人均绿色空间和社会文化设施并进行了指数化处理。然后，采用基于距离的方法对这些设施的效益进行了评估。对不同社区之间的距离和给定设施之间的距离以及最远的阈值进行了测量，这些测量值已被用来确定各个社区的设施效益变化值。然后，通过合并绿色空间和社会文化设施的价值以及社区的效益变化值计算出了有效值，并进行了指数化处理。最后，基于分数的有效绿色空间和社会文化设施的指数值被转换为GIS（地理信息系统）环境中连续的表面值，以使用作城市实体规划的基图。根据本研究的结果，社区的绿色空间和社会文化设施的分布并不平衡，这些设施的指数值范围介于45和84之间（满分100）。

关键词：

效益变化值；GIS；指数图；指数值；社会文化设施；城市绿色空间。

1 INTRODUCTION

Quality of urban life is quantified by the physical, social and economic characteristics of the urban environment and its inhabitants. Social and economic characteristics are excluded from this research, which focuses on green spaces and socio-cultural facilities although physical characteristics do include components of urban systems.

Urban systems are traditionally able to deliver services for the fulfilment of human needs via the provision of urban services, which are defined as public services and facilities that are historically and typically provided in cities. Urban services are provided by society, generally without the direct use of ecosystems, and include basic provisions such as sanitary sewer systems, Storm drainage systems, domestic water systems, fire and police protection services, public transit services, road construction services, sidewalks, street and road lighting systems, parks and recreational facilities, schools, social and cultural facilities, public health and environmental protection, and so on (Antognelli & Vizzari, 2016). These areas, particularly urban green spaces as providers of urban ecosystem services (e.g., air purification, groundwater recharge, erosion prevention, crop or biomass production), are of great importance for urban aesthetics, culture and recreation as well as, for harmonizing green areas, urban structure and urban ecosystems (Baycan-Levent & Nijkamp 2009; Gomez et al. 2011; Haq 2011; Coolen & Meesters, 2012). The diversity and richness of these areas and spaces contribute to the physical and mental health of urban inhabitants. Additionally, it improves social networks, solidarity, spatial identity and urban culture by enabling various social activities of urban inhabitants (Cohen 1996; Gangloff 1995; Kotler et al. 1997; Bolund & Hunhammar 1999; Madanipour 1999; Willis et al. 2001; Jim 2004; Kabisch & Haase 2013).

The presence of green spaces and socio-cultural facilities in a city can be expressed either qualitatively (e.g., high, medium, low or sufficient, medium sufficient, insufficient) or quantitatively (e.g., total and per capita amount). However, urban life has many components (income and education, housing type and quality, urban green space etc.) and the description of these components with a single criterion is an important constraint. Therefore, creating a common single unit is essential in order to compare and combine all these components and to obtain a life quality value. The index value, as a measurement unit, defines a system both as a whole and by pieces and is an important tool to solve this constraint. The Human Development Index (HDI), Index of Sustainable Economic Welfare (ISEW), Recreation Opportunity Index (ROI), Perceived Quality Index (PQI), Green Index, and Open Space Index (OSI) are some of the indices that define social, economic or physical life quality of the public.

Another question is to decide which values to index for the studied characteristics. Green spaces and socio-cultural facilities are defined by the area (m²) per capita. For example, per capita standards in Turkey are as follows: total 2.5 m² for libraries, museums, theatres and concert halls, cinemas and exhibition places; total 2 m² for pedestrian and bicycle path widths total 20 m² for picnic areas, arboretums, woodland; 20 m² for urban parks; 10 m² for community parks; 8 m² for neighbourhood parks; 6 m² for playgrounds; 8 m² for sports fields; and 0.075 m² for swimming pools (Gurbuz 2012).

This figure is inadequate in evaluating the effectiveness of these areas, the spatial distribution of which may be unbalanced. Some parts of the city may have facilities with high levels of opportunities and diversity, whereas other parts may have poor levels of the same. In such a case, the inhabitants living in areas with poor facilities will tend to use facilities at adjacent neighbourhoods, in which case the use of such facilities will be overloaded by the other users from outside of the neighbourhood. As a result of this over-use, the effectiveness of these facilities will be diminished. The distances of facilities to people's homes should be incorporated with indices calculated on per capita values to create employable indices within urban plans. Integrated index values calculated for each neighbourhood will define the effective supply of green spaces and socio-cultural facilities in a city (English & Cordell 1993; Marcouiller et al. 2009).

Integrated index values indicate urban areas and effective facility levels of the neighbourhoods included in the study. These indices need to be mapped in order to be integrated into the planning process properly. Thus the effectiveness of the facilities in each part of the city will be determined easily through this map. The most important function of these maps are their ability to facilitate a decision support system for the planning and application process of green spaces and socio-cultural facilities which are well balanced with the needs of urban areas.

This study aims to test the application of a theoretical approach for mapping and determination of the effective supply of green spaces and socio-cultural facilities in the example of Adana City, the 5th largest city in Turkey. In the first phase of the study, 16 facility types have been indexed and the average per capita has been calculated for city and neighbourhood scales. These values have been combined with effectiveness change values as a result of the calculated distances to homes and re-indexed to determine the effective supply of the 16 facilities (urban park, community park, neighbourhood park, playground, sports field, swimming pool, picnic area, arboretum, woodland, pedestrian axis, bicycle path, library, museum, theatre and concert hall, cinema, exhibition place). In the second phase, index values have been interpolated within a GIS environment to create contours. As a result of this work a baseline map was created for urban planning.

It can be concluded that the distribution of green spaces and socio-cultural facilities are unbalanced, which diminishes the effectiveness of facilities in the neighbourhoods studied.

2 MATERIALS AND METHODS

2.1 STUDY AREA

Adana, as the 5th largest city in Turkey, is also the centre of the Çukurova Metropolitan area. Agriculture and agricultural industry is developed within the region as it is largely covered with the most fertile soils in the country. This development creates a large employment capacity which results in migration from the countryside to the city. Thus, the population increased from 500,000 to 1,700,000 in between 1980 and 2015. Housing needs of this population were prioritized in the urban development plans of 1990-2010. However, green spaces, recreational and socio-cultural facilities were not developed sufficiently and green area per capita decreased inversely with the population increase. On the other hand, the ecological potential of the city offers great opportunities for the establishment of these facilities. When compared with the other parts of the country, the cities inhabitants spend longer periods doing outdoor activities due to the location of the city in the Mediterranean region, which is characterised by mild and rainy winters and hot summers. The city has a mostly flat topography. Seyhan River, which crosses the city, and Seyhan Dam Lake, located in the northern area of the city, offer great potential for recreational activities. The utilization of all of this potential in the development of green spaces and socio-cultural facilities will increase the quality of urban life in many ways (Berberoğlu et al. 2000; Altunkasa & Uslu 2004; Uslu et al. 2012; Adana Urban Council, 2015).

A new law in Turkey was introduced in 2008 to share the authorization and responsibilities of the municipalities with town administrations. As a result of this, urban development plans are approved by representatives of town municipalities together with the city council, thus authorization and responsibilities are shared amongst municipalities. In this respect, Adana city has been divided into four towns, namely Çukurova, Sarıçam, Seyhan and Yüreğir by the borders of the Seyhan River and the main irrigation channel. These towns include 146 neighbourhoods (Çukurova: 14; Sarıçam: 19; Seyhan: 74; Yüreğir: 39). The populations in 2014 were 330,000, 110,000, 840,000 and 420,000, respectively, for Çukurova, Sarıçam, Seyhan and Yüreğir (Uslu et al. 2012; Adana Urban Council 2015).

2.2 METHODS

Socio-cultural facilities are well developed in Seyhan, which covers the old city centre and surrounding urban development area, and in Çukurova which is a new urban development area. Rural and agricultural life style is still dominant in Sarçam and Yüreğir where the population consists of immigrants from other parts of Turkey.

The study is implemented in four stages:

I Calculating green spaces and socio-cultural facilities index (*GSSF*)

In this phase, 16 facilities within the four towns and 146 neighbourhoods have been converted to area per capita by using city and town municipality inventory reports, aerial photos and ground truth. Herein, different populations have been used for each facility according to its service characteristics: city population for urban parks, arboretums and museums; town population for community parks, picnic areas, woodlands, libraries, theatres and concert halls, cinemas, exhibition places, pedestrian and bicycle paths; and neighbourhood population for other facilities have been used to calculate area per capita. The highest possible value is assumed to be 100 for each facility and other values have been calculated relative to this value. Thus, unweighted index values (*UIV*) for each facility have been derived from the neighbourhoods of the four towns. The priority level of each facility is a crucial question. Gold (1980), English & Cordell (1993), Dunnett et al. (2002) and Gilliland et al. (2006) emphasized that considering all planning units equally may cause misleading results. Thus, the *UIVs* for each facility have been weighted. Gold (1980) points out that a planning process without the contribution of decision makers, planners and users will not progress well. Having considered this fact, weights ranging between 1 and 10 have been assigned by 20 decision makers, 20 planners and 600 randomly selected users. Planners consist of city planners, architects and landscape architects employed in Çukurova University, each having a PhD degree. The total number of these staff was 20 during the implementation period of this research. Decision makers are composed of four members from each metropolitan municipality and four town administrations. This composition enabled a good balance between the two groups. The user survey was implemented using 600 people based on the sampling size recommended by Arkin and Colton (minimum 400 users for settlements with a population of over 100,000) (Pulido 1972). One hundred and fifty randomly selected users over 18 years of age from each town area (total 600 users) have been interviewed face to face, 46 of whom were discharged due to inconsistencies and protests in their answers.

It has been observed that weight values vary between 1-3, 1-5, -3-3, 1-6, 1-10, 1-100 in the literature. Gold (1980) and Giles-Corti et al. (2005) emphasise that the range of weight values may be small if the elements under evaluation are similar in terms of concept, whereas the range of weights should be large for elements with large number and diversity in order to increase discrimination. This research maintains weight values of between 1 and 10 for the 16 different facilities.

Another constraint is that the three actors in the planning progress have different aims and objectives. Gold (1980) points out that political pressures may affect the behaviour of decision makers. They are expected to make investments in the short term, using small budgets to maximum benefit as they have limited time. However, planners aim to reach maximum benefit for the public through a more systematic approach. On the other hand, users seek maximum benefit with minimum willingness to pay. As a result of these differences, the three actors should have different weights for the planning process. The average weight values of planners, users and decision makers have been multiplied by coefficients of 3, 2 and 1, respectively, as suggested by Gold (1980). Weighted scores (*WS_i*) of each facility have been calculated by averaging the weighted values. Weighted index values (*WIV*) for each facility have been calculated by multiplying the *WS_i* with the *UIV*. Values for the green spaces and socio-cultural facilities (*GSSA*) for each neighbourhood have been calculated by

averaging weighted index values and scaled between 0 and 100. Consequently, a green spaces and socio-cultural facilities index (*GSSFI*) of the 16 facilities for the 146 neighbourhoods has been derived.

II Calculating effectiveness change (*EC*) values

calculating effectiveness change (*EC*) values: English & Cordell (1993), English et al. (1993), Coles & Caserio (2003), Giles-Corti et al. (2005), Stahle (2010) and Peschardt et al. (2012) point out that the effectiveness of facilities is assumed to change linearly with distance. This change in effectiveness describes the relationship between two different spatial distances (D_{xy} and TD_i) with the following definitions:

D_{xy} = the linear distance between the centres of any two neighbourhoods x and y ,

TD_i = the longest linear distance between facility i and the threshold regardless of the boundaries of neighbourhoods.

D_{xy} and TD_i values were derived using digital aerial photos of the city within a GIS environment. Measured TD_i values for each of the 16 facilities have been weighted through multiplying by the WS_i and a weighted average of the obtained values have been used to form the integrated threshold distance (*ITD*) values.

EC_{xy} value for green spaces and socio-cultural facilities of any two interacting neighbourhoods (x and y) have been calculated using a modified version of the method of English and Cordell (1993) described below:

$$EC_{xy} = 1 - (D_{xy}/ITD) \text{ if } D_{xy} < ITD$$

$$EC_{xy} = 0 \text{ if } D_{xy} > ITD$$

III Calculating effective green spaces and socio-cultural facilities index (*EGSSFI*) values

The *EGSSFI_x* value for any neighbourhood x depends on the *GSSFI_y* value of neighbourhood y and the relation between the EC_{xy} values of two neighbourhoods and this relationship is described as (English & Cordell 1993; English et al. 1993):

$$EGSSFI_x = \frac{\sum_{y=1}^n (GSSFI_y * EC_{xy})}{\sum_{y=1}^n EC_{xy}}$$

$n = 146$ neighbourhoods.

For any neighbourhood, the most important determinants of the *EGSSFI* value are green spaces and socio-cultural facilities available in that neighbourhood. Proximity to a neighbourhood with good opportunities may greatly augment the effective supply. Similarly, proximity to other neighbourhoods with large population concentrations and few opportunities will reduce the effective green spaces and socio-cultural facilities when these competing populations are taken into account. Small neighbourhoods have larger adjustments due to surrounding ones because of the greater effectiveness changes associated with the surrounding neighbourhoods (English & Cordell 1993; Van Herzele & Wiedemann 2003; Germann-Chiari & Seeland 2004; Schipperijn et al. 2010; Stahle 2010; Yildiz et al. 2011; Kabisch & Haase 2014).

A flowchart summarizing all of the steps described above, as well as each of the acronyms, is provided in Figure 1.

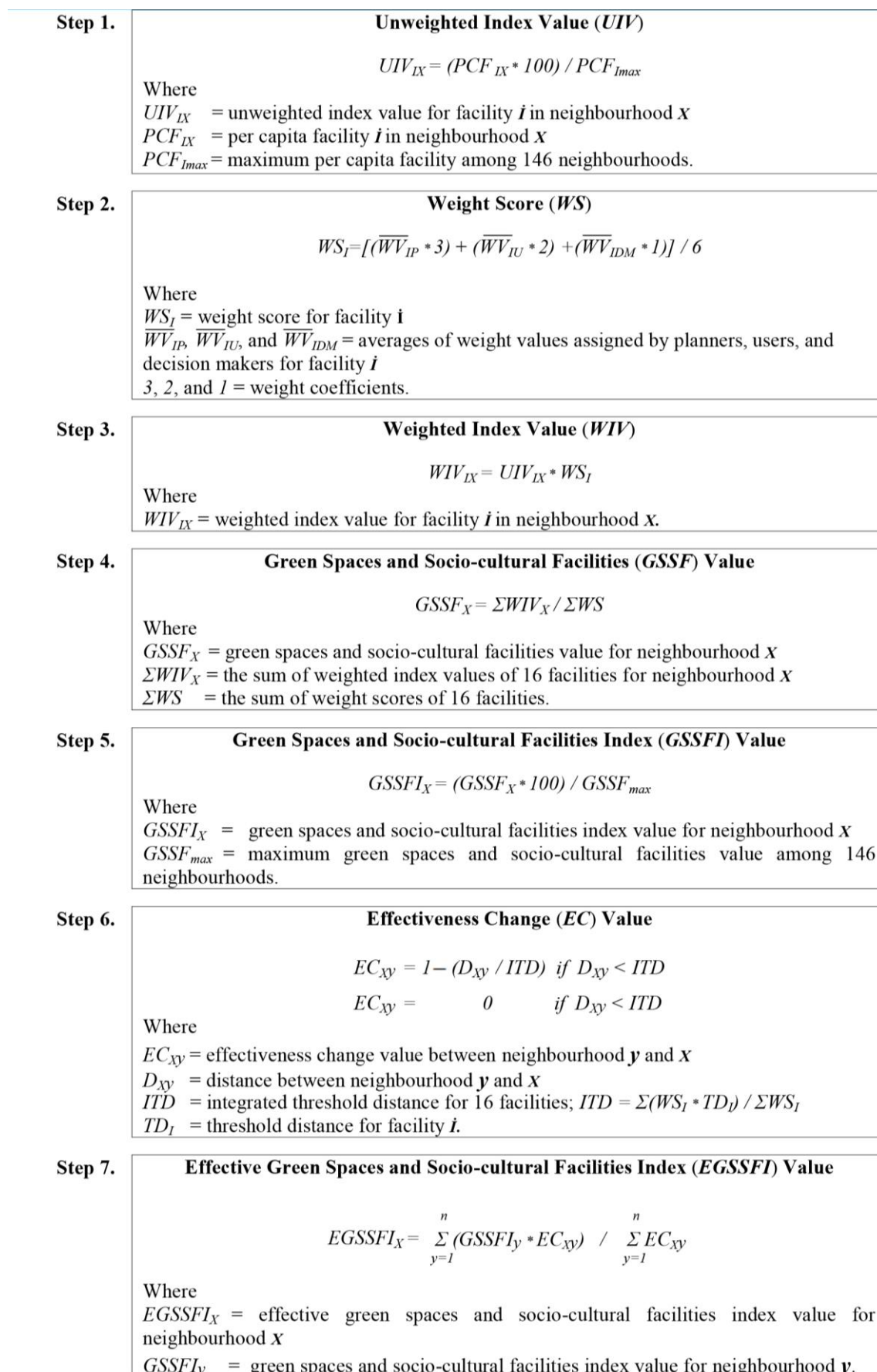


Fig. 1 Flowchart for calculating EGSSFI values.

IV Mapping *EGSSFI* values

mapping *EGSSFI* values: The *EGSSFI* values of the 146 neighbourhoods describe the effectiveness of green spaces and socio-cultural facilities, however, these values are not spatial. In other words, the *EGSSFI* value of a neighbourhood represents the whole neighbourhood. However, the *EGSSFI* values may vary with distance over the area. In such a situation, determining *EGSSFI* values over the city regardless of neighbourhood boundaries would be a more appropriate approach. Converting *EGSSFI* values to contours on a map will enable planners to evaluate the spatial distribution of this index. This approach is implemented in a GIS environment by interpolating point values of *EGSSFI* onto contours. To that end, digital aerial photographs are used as raw data, with a requirement for georeferencing with ground coordinates. This process has been performed by resampling the photographs into a Universal Transverse Mercator (UTM) projection system using ERDAS Imagine 9.1 software. Following the geometric registration, the central pixels of each neighbourhood have been determined and *EGSSFI* values have been assigned. In the final stage, these values have been interpolated using inverse distance weighting (*IDW*) to produce the effective green spaces and socio-cultural facilities index map. The distribution of *EGSSFI* values occurred in a large range (45-85), thus creation of contours for each value might cause difficulties in interpretation, which decreases the practical use in the physical planning process. For this reason, *EGSSFI* values were grouped into 8 classes (45.0-50.0; 50.1-55.0; 55.1-60.0; 60.1-65.0; 65.1-70.0; 70.1-75.0; 75.1-80.0; 80.1-85.0) and these classes were integrated into the map. *EGSSFI* values can be considered to be an important tool in the making of development plans for a particular location in terms of the levels of green spaces and socio-cultural facilities across the city.

3 RESULTS

The spatial distribution of green spaces and socio-cultural facilities which have been derived from Adana metropolitan and town municipalities' inventory reports, development plans and digital air photographs is shown in Figure 2.

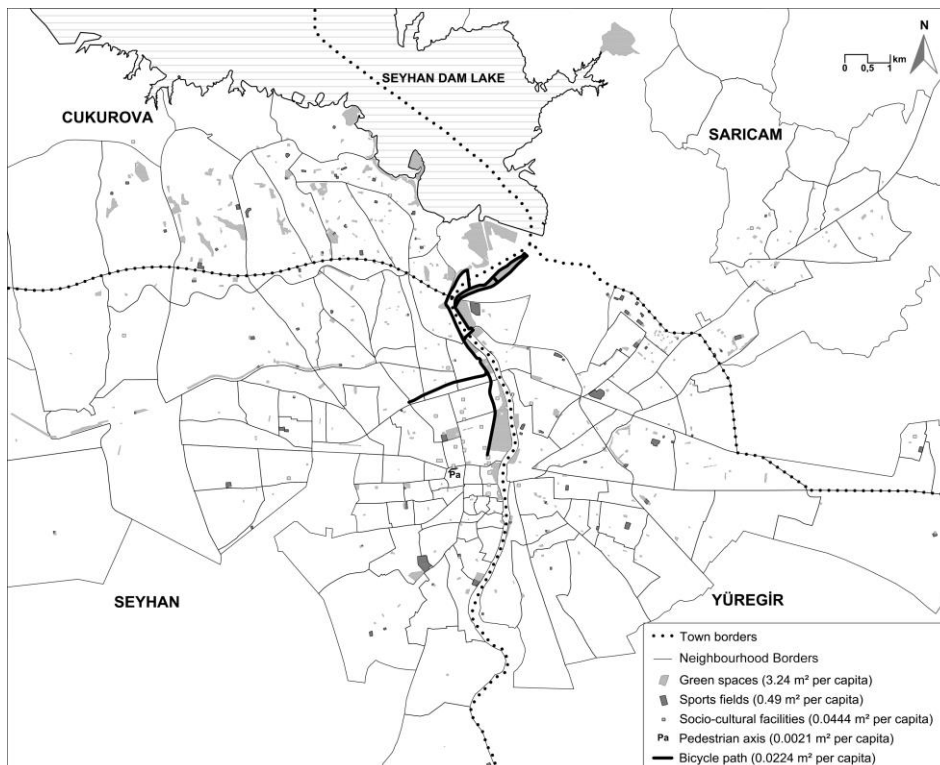


Fig. 2 The spatial distribution of green spaces and socio-cultural facilities.

The amount of green space and socio-cultural facility area per capita for the four towns is given in Table 1. Additionally, the WS_i , TD_i and ITD values which were used to calculate the $GSSF$ and EC , are also shown in Table 1.

Facilities	Per capita green space and socio-cultural facility (m ²)										Weight score (WS _i)	TD _i (m)
	Çukurova		Sarıçam		Seyhan		Yüreğir		Average value for city			
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)				
Urban park	0.25		0.25		0.25		0.25		0.025	8.942	13124	
Community park	0.29		0		0		0		0.06	8.770	13825	
Neighbourhood park	1.44	33.76	1.45	3.45	0.80	54.40	0.69	13.01	0.93	8.785	5080	
Playground	2.19	23.64	0.30	2.92	0.88	13.67	1.42	7.92	1.22	8.912	5162	
Sports field	0.35	13.35	0.52	3.88	0.26	3.70	0.71	7.45	0.42	8.758	6291	
Swimming pool	0.01	0.41	0.03	0.17	0.01	0.16	0.01	0.14	0.01	7.960	5576	
Picnic area	3.04		0		0		0.06		0.58	8.202	10347	
Arboretum	0.22		0.22		0.22		0.22		0.22	7.889	16829	
Woodland	0.68		0		0.16		0		0.21	7.177	12175	
Pedestrian axis	0		0		0.0032		0		0.0021	8.396	13778	
Bicycle path	0		0		0.0301		0.0308		0.0224	7.907	11601	
Library	0.0012		0.0026		0.0014		0.0015		0.0015	7.509	8069	
Museum	0.0021		0.0021		0.0021		0.0021		0.0021	7.460	12457	
Theatre and concert hall	0.0124		0		0.0282		0		0.0162	8.545	11824	
Cinema hall	0.0064		0		0.0212		0.0062		0.0132	8.449	12720	
Exhibition place	0.0512		0		0.0021		0		0.0114	7.353	12639	

(1) Average value for town, (2) The highest value measured between neighbourhoods in each town.

Tab. 1 Distribution of green space and socio-cultural facility area per capita in the towns of Adana City, weight values of 16 facilities (WS_i) and threshold distances (TD_i).

Table 2 includes the lowest and highest $EGSSFI$ values in the 146 neighbourhoods within the four towns together with UIV , $GSSF$, $GSSFI$ and ΣEC values. $EGSSFI$ values of other neighbourhoods ranged between the highest and lowest values.

	Unweighted Index Values (UIV)														GSSF	GSSFI	ΣEC	EGSSFI		
	Up	Cp	Np	Pg	Sf	Sp	Pia	Arb	Wdl	Pa	Bp	Lib	Mus	Tch					Ch	Ep
Çukurova																				
1	100	100	7.5	16.5	0.2	0	100	100	100	0	0	46.2	100	44.3	28.6	100	51.6	80.9	64.3	67.7
13	100	100	0	0	100	100	100	100	100	0	0	46.2	100	44.3	28.6	100	62.7	98.3	1.8	84.3
Sarıçam																				
19	100	0	0	0	0	0	100	0	0	0	0	100	100	0	0	0	24.3	38.1	13.3	70.3
21	100	0	0	0.00	0	0	100	0	0	0	0	100	100	0	0	0	24.3	38.1	16.8	45.0
Seyhan																				
62	100	0	0	1.6	0	0	100	2.1	100	100	53.8	100	100	100	100	3.9	47.5	74.4	16.8	45.1
99	100	0	85.6	0	0	0	100	2.1	100	100	53.8	100	100	100	100	3.9	53.1	83.2	27.4	76.9
Yüreğir																				
119	100	0	0.8	10.0	41.1	0	1.9	100	0	0	100	57.7	100	0	28.6	0	33.3	52.2	72.2	65.5
146	100	0	0	32.3	0	0	1.9	100	0	0	100	57.7	100	0	28.6	0	32.0	50.2	28.8	48.6

Tab. 2 The lowest and highest $EGSSFI$ values and UIV , $GSSF$, $GSSFI$ and ΣEC values of 16 facilities within the 146 neighbourhoods of the four towns.

Analytical example of calculating GSSF and EGSSFI values for neighbourhood number 146:

$$GSSF = (100 * 8.942 + 0 * 8.770 + 0 * 8.785 + 32.3 * 8.912 + 0 * 8.758 + 0 * 7.960 + 1.9 * 8.202 + 100 * 7.889 + 0 * 7.177 + 0 * 8.396 + 100 * 7.907 + 57.7 * 7.509 + 100 * 7.460 + 0 * 8.545 + 28.6 * 8.449 + 0 * 7.353) / 131.014 = 32$$

$$EGSSFI_{146} = (GSSFI_{146} * EC_{146} + GSSFI_1 * EC_{146,1} + GSSFI_2 * EC_{146,2} + GSSFI_3 * EC_{146,3} + \dots + GSSFI_{143} * EC_{146,143} + GSSFI_{144} * EC_{146,144} + GSSFI_{145} * EC_{146,145}) / \sum EC_{146}$$

An effective green spaces and socio-cultural facilities index (EGSSFI) map is shown in Figure 3.

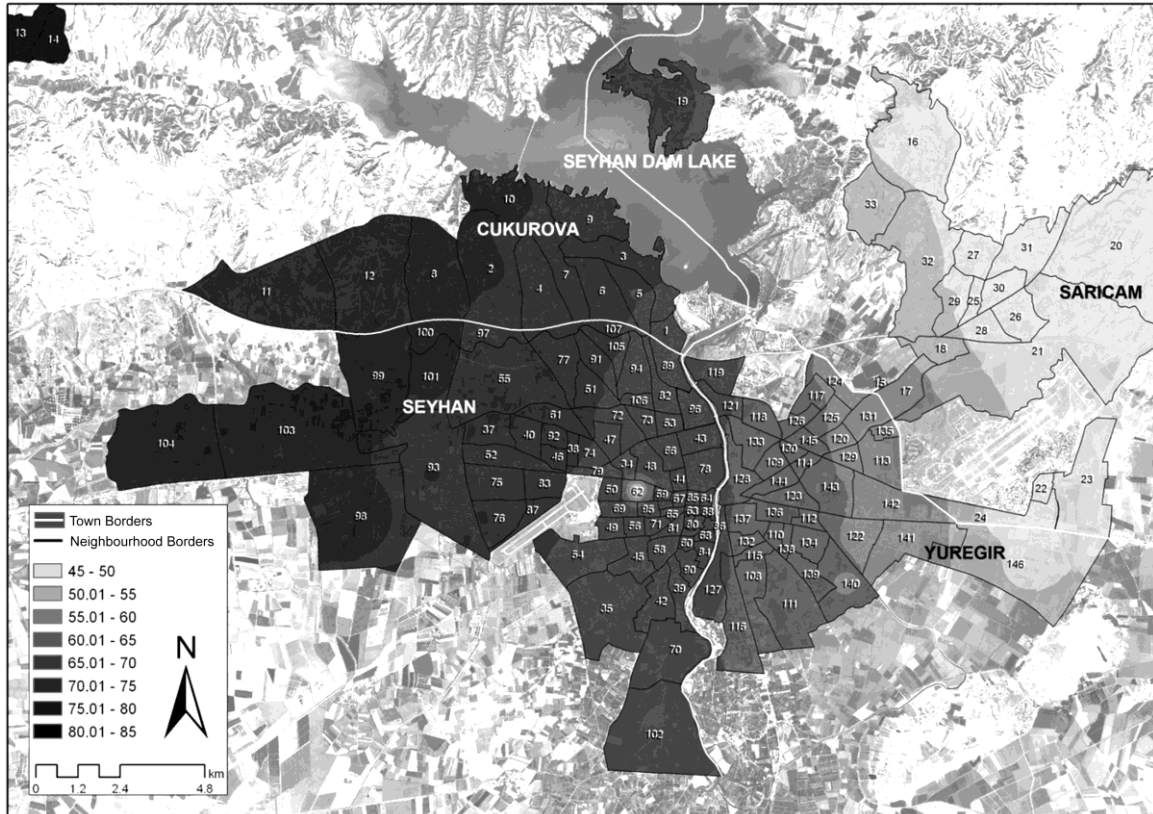


Fig. 3 Effective green spaces and socio-cultural facilities Index (EGSSFI) map.

The interpretation of Tables 1 and 2 and Figures 2 and 3 can be summarised as follows:

- the green spaces and socio-cultural facilities of Adana are below the standards introduced in Turkey. The amount of green space and socio-cultural facilities per capita suggested by national urban planning law and the ratio of the current amount to the suggested amount are given in parentheses as follows: 2.50 m² for libraries, museums, theatres and concert halls, cinemas, exhibition places (0.2%-2.9%); 2 m² for pedestrian and bicycle paths (0%-1.7%); 20 m² for picnic areas, arboretums, woodland (1.1%-19.7%); 20 m² for urban parks (1.3%); 10 m² for community parks (0%-2.9%); 8 m² for neighborhood parks (8.6%-18.1%); 6 m² for playgrounds (5%-36.5%); 8 m² for sports fields (3.3%-8.9%); and 0.075 m² for swimming pools (13.3%-40%);
- the spatial distribution of green spaces and socio-cultural facilities in the neighbourhoods are unbalanced. Çukurova and Seyhan have more facilities than the others. Seyhan includes more cultural places and historic parks than any other place in the city as it is located centrally and forms the current shape of the city, particularly from the 14th to 20th century. Çukurova is located next to the Dam Lake of Seyhan on an undulating terrain, this environmental structure, including valleys and the coast of the lake, enables

- an increase in the number of parks and woodlands. Development of green spaces and socio-cultural facilities is poor in Sarıçam and Yüreğir, where the rural life style is still the norm. Priority has been given to residential development in these towns, particularly in the neighbourhoods away from the city centre;
- the effectiveness of facilities in a given neighbourhood varies according to the distance to other neighbourhoods having better or poorer facilities due to the unbalanced distribution of green spaces and socio-cultural facilities amongst the neighbourhoods. For example, the *GSSFI* value of neighbourhood number 9 decreases from 100 to 73, whereas the *GSSFI* value of neighbourhood number 19 increases from 38.1 to 70.3. It can clearly be seen that people in poorly facilitated neighbourhoods tend to use the higher level of facilities in adjacent neighbourhoods depending on their distance. As a result of this, the effectiveness of the facilities decreases in the neighbourhoods with a high level of facility due to the increasing population, whereas poorly facilitated neighbourhoods have an increase due to the population tending towards use of facilities in the other neighbourhoods;
 - the spatial distribution of green spaces and socio-cultural facilities can be clearly seen on the maps (Figure 2). Index values decrease from west to east. Urban growth in the west and northwest part of the city took place during the planning revisions in the 1990s. House construction started in the same period, which created opportunities for the growth of green spaces and socio-cultural facilities. There was not such an opportunity on the eastern side due to a long period of unplanned and illegal urban development. Urban transformation projects for the eastern part were introduced in the early 2000s. These projects are expected to speed up the planned development and, consequently, green spaces and socio-cultural facilities shall reach an acceptable level.

4 DISCUSSION

Quantity of green spaces and socio-cultural facilities within a city can be determined with two criteria: quantity per capita and accessibility. Service diversity within a facility is the third criterion which defines quality and quantity together. Service diversity may vary according to social, cultural and economic characteristics, tendencies and demands of the users. It is difficult to set the norms or standards for service diversity as the necessity and sufficiency levels are subjective. Size of the area per capita and accessibility (or distance to homes) can be calculated mathematically and objectively (Gold 1980; Santerre 1985; Phillips 1996; Georgi & Dimitriou 2010; Haq 2011; Higgs et al. 2012; Peschardt et al. 2012). In this respect, the green spaces and socio-cultural facility level of Adana was derived using two criteria, including size of the area per capita and distance to homes.

Coles & Caserio (2003) indicated that the most intensively used open and green spaces are a maximum of 500 m walking distance in their research which was conducted in 15 European cities to determine the effects of accessibility and facility diversity of urban green spaces on usage. Insufficiency of these areas in terms of facility diversity particularly affects the level of short-term usage (maximum 2 hours). For long-term usage, it has been observed that users preferred green spaces to be closer and with highly diverse facilities, however, they should be further than 500 m away. Findings of Giles-Corti et al. (2005) in Perth in Australia showed that accessibility to the green spaces is closely related to the level of usage whereas area and attractiveness have less of an effect. Threshold distance may reach up to 5-6 km for daily use facilities such as neighbourhood parks, playgrounds and sports fields in Adana as a result of insufficiency and uneven distribution of green spaces and socio-cultural facilities. It can be concluded that most of the users are either unable to use these facilities or usage efficiency is poor due to intensive usage of many visitors who come from far away.

The effectiveness method used in this research was proposed by English & Cordell (1993). Similar to this study, there is a clear trend that effectiveness of the facilities decreases in the neighbourhoods with a high

level of facilities due to population pressure from outside, whereas poorly facilitated neighbourhoods have an increase due to lower population use.

English & Cordell (1993) use weights in the range of 1-3 to calculate a weighted opportunity set index (*WOSI*) which is identical to the *GSSFI*. The Adana study is based on stakeholder participation in the planning process. In the first stage, planning experts, decision makers and NGOs determine weights ranging between 1 and 10 for the 16 facilities covered. Average weights of the coefficients assigned by planners, NGOs and decision makers were multiplied by weights of 3, 2 and 1, respectively. Differences in the objectives of stakeholders may result in a large divergence in the values for the 16 facilities so these coefficients have a balancing effect on the values calculated for 16 facilities. These values can be attributed to an adjustment factor to reflect the views of the different stakeholders to the green spaces and socio-cultural facilities.

There are studies mapping some social, economic and physical components of urban life quality in the form of unweighted values or indices. Schyns & Boelhouwer (2002) map the unemployment rate in Amsterdam for example. Point data are interpolated and converted to surface data in the same way as for Adana City. Gilliland et al. (2006) map the playground facilities and demands in the neighbourhoods of London (Canada). Playground facilities and demands are categorised into 5 levels from low to high within the maps and a single value is assigned to whole neighbourhood areas. Li & Weng (2007), map the environmental and economic characteristics of urban life quality in Indianapolis (USA) by converting these characteristics to indices. Present facilities are not associated with distance to homes due to the nature of this study.

These studies show that converting the green spaces and socio-cultural facilities to indices and mapping in the form of contours for the expression of spatial distribution is uncommon in the literature. For that reason, the Adana case study is unique in its mapping approach, which has the potential to bridge the gap in the literature. The effective green spaces and socio-cultural facilities index (*EGSSFI*) map can be used by local administrations as a baseline map in the planning process.

5 CONCLUSION

In the light of the above discussion, solutions which may contribute to an increase of green spaces and socio-cultural facilities to a sufficient level are as follows:

- restricted or limited use of public green spaces (forest, woodland, agricultural land etc.) within the cities should be implement and use not allowed for other purposes by law. Thus, the unity of green spaces will be protected and this will ensure the existence of reserved areas for new green spaces. The effectiveness of the green spaces will increase in the case of continuity of the green spaces with playgrounds and new parks will be achieved;
- seyhan Dam Lake at the north and Seyhan River divide the city on a north-south axis. Irrigation channels which border the four towns provide great potential to develop continuous open and green spaces and socio-cultural facilities. These areas should be kept away from urbanisation and reserved to increase green spaces and socio-cultural facilities;
- public and private rural-agricultural lands have been zoned for construction in Sarçam and Yüreğir towns due to migration from outside of Adana. As a result of this, the land value has increased dramatically. Land owners tended to construct multi-storey buildings to increase their profits. The number of houses within these two towns is approximately 117,000 according to Adana Urban Council (2015) data, this number is very close to the projection fir 2020, which is 136,000. Thus, there will be a more than adequate number of houses available as the number of houses grows with this trend;

- In this respect, more land will be needed to meet this demand. The lands allocated for open green spaces will decrease or become fragmented. Thus, the size, accessibility and effectiveness of open and green spaces will diminish. To prevent such a circumstance, some preventive measures can be taken:
 - first of all, improvement of green spaces and socio-cultural facilities should be made, considering the per capita need for green space within urban development plans, and including accessibility and facility diversity. Preventive decisions should be taken to protect these areas. However, the opportunity cost which will result from conversion of built-up areas to open and green spaces is the major problem for the land owners of the expropriation areas. This problem can be solved either by giving an equal amount of land from urban development areas to land owners or by clearing;
 - less profitable rural lands increase their value following the introduction of urban development plans, as a result, land owners and constructors make profits by constructing vertical structures which increases the number of homes per unit area. The parcel sizes in these areas should be enlarged and more space should be allocated for green spaces within these parcels to convert this speculative profit to public benefit. In this way, public open and green spaces can be managed and enhanced without the need for costly actions.

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IMAGE SOURCES

Fig. 1, 2, 3: author's elaboration

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PLANNING ASSIGNMENTS OF THE ITALIAN METROPOLITAN CITIES.

EARLY TRENDS

GIUSEPPE MAZZEO

ABSTRACT

The last stage of the process of establishment of the Italian Metropolitan Cities, which took place in 2014, follows of a few decades the start of this institutional reform. In 1990, in fact, the Act 142 (Local Autonomies Reform) had planned metropolitan areas as the administrative organization more suitable to provide these territories of structures for the management and the strategic development alike the best international models.

The paper proposes to analyse the first activities taken by the Italian Metropolitan Cities in the sector of territorial government, three years after the enactment in 2014 of Act nr. 56.

Focal point of the analysis is the jurisdiction in the formation of two plans (the Strategic Plan and the Metropolitan Territorial Plan) and the following relationships among them, in the logical assumption that between them a necessary and strict consistency there should be.

In the first part, the paper analyses some factors characterizing the metropolitan areas and the functions that the law assigns to the new institution in the territorial government sector. The second part outlines the updated situation with regard to the formation of the sectoral tools (Strategic Plan, Territorial Plan and homogeneous zones). The third part analyses the progresses in three Metropolitan Cities taken as sample (Milan, Genoa and Bologna) and, in general, to those of Southern Italy. In the last part, the paper exposes some considerations regarding the issues raised in the article, particularly about the innovativeness of the tools and the timeline for the implementation of the act.

KEYWORDS:

Metropolitan city, Strategic planning, Territorial planning

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意大利广域市的规划任务。 早期趋势

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摘要

在经历数十年的体制改革后，意大利广域市在 2014 年进入了最后的设立阶段。事实上，早在 1990 年颁布第 142 号法令（地区自治改革）时，意大利便已打算设立广域市，将其作为行政机构顺理成章地实施国际一流的管理和战略发展计划。本文提议在 2014 年第 56 号法令颁布三年后，对意大利广域市各属地政府部门开展的首批活动进行分析。分析重点包括形成两项规划（战略规划和广域市规划）的管辖区以及两项规划之间应该存在必要和严格的统一关系的合理假设。

本文的第一部分分析了广域市具备的一些特征，以及法律为区域政府部门的新机构分配的职能。第二部分概述了有关区域形成的最新情况（战略规划、国土规划和相似区域）。第三部分抽样分析了三座大都市（米兰、热那亚和博洛尼亚）的进展情况，并在大体上与一些意大利南部城市进行了对比。在最后一部分，本文针对所提出的一些问题指明了要注意的事项，特别是在工具创新以及行动实施的时间表方面。

关键词：
广域市；战略规划；国土规划

1 INTRODUCTION

The last stage of the process of establishment of the Italian Metropolitan Cities, which took place in 2014, follows of a few decades the start of this institutional reform. In 1990, in fact, the Act 142 (Local Autonomies Reform) had planned metropolitan areas as the administrative organization more suitable to provide these territories of structures for the management and the strategic development alike the best international models. The paper proposes to analyse the first activities taken by the Italian Metropolitan Cities in the sector of territorial government, three years after the enactment in 2014 of Act nr. 56.

Focal point of the analysis is the jurisdiction in the formation of two plans (the Strategic Plan and the Metropolitan Territorial Plan) and the following relationships among them, in the logical assumption that between them a necessary and strict consistency there should be. Other interesting elements are the connections of the new institution with the previous institutional subject (the Province), especially with regard to the experience of the Provincial Territorial Plans (PTCP) and their use as metropolitan planning tool.

The deepening of this relationship is interesting, given the existence of a continuity of the administrative processes. Nevertheless, it is clear the need that the new metropolitan authority is a promoter of a strong innovation in the planning tools, enough to mark a substantial advance over the experience of the Provinces. In the first part, the paper analyses some factors characterizing the metropolitan areas and the functions that the law assigns to the new institution in the territorial government sector. The second part outlines the updated situation with regard to the formation of the sectoral tools (Strategic Plan, Territorial Plan and homogeneous zones). The third part analyses the progresses in three Metropolitan Cities taken as sample (Milan, Genoa and Bologna) and, in general, to those of Southern Italy. In the last part, the paper exposes some considerations regarding the issues raised in the article, particularly about the innovativeness of the tools and the timeline for the implementation of the act.

2 GOVERNANCE OF METROPOLITAN AREAS

Urban systems are increasingly at the centre of global development processes (Sassen, 2001; EEA, 2014). Cities are constantly developing in all continents; they are the place where the majority of the Earth's inhabitants lives, with a growing tendency that the forecasts believe certain (UN, 2015; Mazzeo, 2016). For this reason, «cities in the (Weberian) sense of integrated socio-economic entities no longer exist. The urban phenomenon is better described by the notion of metropolitan areas that is multi-centred urban regions which develop mainly along functional networks, cutting across institutionally defined territorial boundaries» (Kubler & Heinelt, 2002, 2).

In Europe, in particular, the urbanization's phenomena have a specific importance, both in terms of population (about 80% of the total is an urban population), and in economic terms. Urban areas, in fact, concentrate a large share of the national budget's transfers and of local investments (Spadaro, 2015; Ciapetti, 2014). Within this continental space (but the same argument can also be made for the urban situations of other continents) metropolitan areas present more specificity in terms of concentration of assets, innovation and produced wealth (BBSR, 2011).

The metropolitan systems are typically an interdisciplinary topic in which several research's areas are involved with a wide variety of approaches. Generally, if the physical size and the number of inhabitants are the main factors linked to a city assuming the name of "metropolis", the definition of "metropolitan area" is associated with the functional relationships created at the local level, the level of infrastructure and the size of activities' system, especially the highly specialized (Salet et alia, 2003).

For this reason, metropolitan areas are territorial systems affected by particular attention at international level,

up to reach to the constitution of ad hoc administrative structures, provided with operational capabilities both managerial and strategic.

Within these processes, special attention is paid to the relational aspects that occur in the game role between administrative subjects. For Hamilton et alia (2004), also if metropolitan administration is the key of the reasoning, its probability of success depends on the vertical relations established by central and local level (just think to financial flows from the centre) and on the horizontal relations between the municipalities belonging to a metropolitan region.

3 THE NEW ITALIAN REGULATORY FRAMEWORK

The reform process of the Italian administrative system, started in 2014 but dropped into a state of uncertainty following the outcome of the constitutional referendum of December 2016, based their fundamental motivations in the thematic of the simplification. The achievement of this aim seemed to be necessary both to increase the efficiency of the State's structures than to reduce its overall weight on the economic and productive system. Acts such as deleting of the provinces or transformation of the Senate into unelected parliament were intended for this purpose.

The formation of Metropolitan Cities falls within this process.

The normative sources on which this administrative body is founded are the Constitution and the Act nr. 56 of April 7, 2014, named "Arrangements on metropolitan cities, provinces, unions and mergers of municipalities". The first describes the Metropolitan City as an intermediate institution and assigns to it generic statutory, regulative, administrative and financial authorities (article 114 and followings). The second, by paragraph 2 to 50, defines the structure of the new institution and assigns to it either specific functions than functions transferred from the provinces, as part of the reorganization process foreseen by paragraphs 85 to 97 of the same act, as well as in accordance with Article 117 of the Constitution.

The new institution represents a governance's answer to complex urban areas (Mazzeo, 2015a). The territorial extension, one of the main obstacles encountered by previous reform's acts on the local autonomies enacted since 1990, it is imposed as coincident with that of the deleted provinces.

New Metropolitan Cities replace provinces in the management of their territory, and also in the coordination of the activities of the inner Municipalities.

One consideration is that the law does not give any indication of the modes in which the relationships between Metropolitan Cities and inner Municipalities must be realized, nor on the action's freedom of the Metropolitan City respect to Municipalities.

This situation puts the Municipalities in a strong position founded on the continuity of the management of their functions. This is irrational in a complex reality that needs strength in the strategic activities rather than in basic ones. Among the potential consequences is to underline the weakening of the action's capacity and of image of the new authority, due to potential conflicts that cannot be excluded given the current legislation.

In this regard it is to remember that political scientists identify two different positions. The first underlines the need of a strong administrative subject because «the existence of a large number of independent public jurisdictions within a metropolitan area [is] the main obstacle for efficient and equitable urban service delivery» (Kubler & Heinelt, 2002, 3); the latter highlights the aspects of democracy and participation associated with the presence of more administrative entities between which no one seems to have enough force to impose its position. Two positions have to do, ultimately, with a further version of the democratic dilemma between system's efficiency and citizen's participation.

With regard to the aspects connected with planning, Act nr. 56, paragraph 44, foresees two different tools. The first is the Strategic Plan of the Metropolitan City (PST), setting guidelines for the performance of their functions, also with regard to the implementation of delegated or assigned functions by the Regions on the

basis of specific acts that must regulate the passage of functions of their competence to the Metropolitan cities. The PST has a life of three years and may include an annual review.

The second is the General Territorial Plan (PTG), a plan that specifically deals with:

- communication facilities;
- service networks;
- infrastructures under the jurisdiction of the metropolitan community;
- constraints and aims to activity and function's practice of the Municipalities included in the metropolitan territory.

Territorial plans of the Provinces (PTCP) put beside that functions, as well as the protection and enhancement of the environment, which descends from the provincial functions.

Territorial planning of metropolitan areas can be considered as a coordination tool connecting territorial assignments that are part of the Metropolitan Cities with the needs of the communities that belong to. In fact, we should not forget that Metropolitan Cities does not delete the inner Municipalities, nor their competencies, which remain untouched. For this reason we can conjecture that general planning could «to refer to the possibility of prescriptive and mandatory predictions selecting relevant large-scale projects and action, thus leaving to the "traditional" urban tools regulatory tasks for the municipal and local level» (Gastaldi & Zarino, 2015).

In this regulative framework the Metropolitan Territorial Plan will have to perform strategic, coordination and prescriptive tasks in relation to a number of areas and themes, looking for forms of sharing and collaboration with the Municipalities.

Act nr. 56 foresees other key functions that, for their inherent characteristics, can fit into a planning process of metropolitan dimension. We refer, in particular to:

- mobility and road system;
- compatibility and consistency of the urban planning of the Municipalities located in the metropolitan area;
- promotion and coordination of economic and social development with the support to economic and research innovative activities that are consistent with the vocations of the Metropolitan City, as outlined in the Strategic Plan of its territory;
- sponsorship and coordination of computerization and digitization's environments in metropolitan areas.

Another area not directly owned by PTG's competence which, for its specific characteristics, can be involved is the organization of coordinated systems of management of public services presenting a general interest and a metropolitan dimension (Mazzeo, 2015b).

The act does not precisely define the contents and the aims of the General Territorial Plan of the Metropolitan City. It requires, however, that the Regions adapt their legislation with the provisions of the Act nr. 56.

Despite this requirement, the Regions are not working with enthusiasm to promote the process of strengthening of the Metropolitan Cities, despite the fact that some of them have approved acts for adaptation and reorganization of functions to be delivered to the Metropolitan Cities¹. In this way the competencies, resources, and organizational structures necessary to complex settlement's systems cannot be completed, as it is not possible to outline the final overview of the planning competencies and the relationship between metropolitan planning and regional planning.

Finally, national law assigns an important role to the homogeneous zones, a kind of association of Municipalities representing an intermediate level between the municipalities and the Metropolitan City. Just consider that the Assembly of the Mayors of the homogenous zones expresses mandatory opinion in the procedure for approval of the Territorial Plan.

¹ For example, Piedmont Region has issued a regional act in 2015 (nr. 23), later amended several times.

4 SOME CHARACTERISTICS OF THE METROPOLITAN CITIES

Act nr. 56 of 2015 represents a point of arrival of twenty years of attempts made to resolve a long-standing question as that of the government of metropolitan regions in Italy. The urgency of a strong innovation comes from the need to provide of innovative management structures this specific area of territorial government, so that they are able to act effectively both on internal front (territorial redevelopment and higher quality of services) that on outside front (national and international competition between metropolitan areas).

Moreover Metropolitan Cities are not a limited territorial sample both for territorial area, population, and total added value at current price. Table 1 presents the data as regards three basic indicators. It points out that they occupy an area equal to 16.54% of the national territory hosting 36.37% of the population and producing 41.17% of national income.

METROPOLITAN CITY	TERRITORIAL AREA (Sq Km, 2014)	POPULATION (Nr., 2014)	TOTAL ADDED VALUE AT CURRENT PRICES (Million Euros, 2014)
Milan	1,575.65	3,196,825	150,723.72
Turin	6,827.01	2,291,719	62,304.50
Venice	2,472.91	858,198	23,342.27
Genoa	1,833.79	862,175	25,578.78
Bologna	3,702.32	1,004,323	34,275.72
Florence	3,513.69	1,012,180	31,906.04
Rome	5,363.28	4,342,046	137,724.55
Neaples	1,178.93	3,118,149	50,230.73
Bari	3,862.88	1,266,379	21,670.74
Reggio Calabria	3,210.37	557,993	6,946.39
Cagliari	4,570.41	561,925	10,945.65
Palermo	5,009.28	1,276,525	19,222.49
Catania	3,573.68	1,116,917	16,553.93
Messina	3,266.12	645,296	9,619.03
<i>Overall MC</i>	<i>49,960.32</i>	<i>22,110,650</i>	<i>601,044.54</i>
Italy	302,072.84	60,795,612	1,459,881.00
<i>% MC respect Italy</i>	<i>16.54</i>	<i>36.37</i>	<i>41.17</i>

Tab.1 Territorial area, population and total added value of the Metropolitan Cities. Data are relates to 2014. Source: Italian Government, <http://dati.italiainitalia.it/opendata.aspx>

These basic data highlight the weight of these systems and their relevance in economic terms (Papa et alia, 2014). This importance is confirmed even if more specific data are used. Table 2 presents the export data per type of productive sectors grouped according to Pavitt's classification (1984). These data confirms what was stated above, in particular for "science-based" and for "specialized productions" sectors, that is for the most innovative sectors of the productive system.

To prejudice of this data, institutions created to manage Metropolitan Cities seem to be enough indifferent to the territorial potential present and therefore do not appear to be conscious of the need to put in place direct and strong actions in areas greatly affected by the national and international competition.

METROPOLITAN CITY	TRADITIONAL SECTORS	SPECIALIZED SECTORS	SCALE-INTENSIVE SECTORS	SCIENCE-BASED SECTORS
Milan	10,440,037	10,676,028	11,000,884	5,257,130
Turin	2,620,024	5,479,944	10,526,294	1,974,077
Venice	1,883,551	911,960	1,058,570	299,576
Genoa	730,155	1,936,813	1,539,638	179,157
Bologna	2,578,114	5,980,258	2,961,741	512,413
Florence	5,850,881	2,419,011	899,148	839,878
Rome	1,271,881	838,964	3,508,948	2,109,265
Neaples	1,816,279	591,953	674,083	1,939,278
Bari	1,446,475	520,009	763,165	1,210,552
Reggio Calabria	61,127	6,574	64,918	628
Cagliari	123,797	59,074	4,050,770	28,159
Palermo	127,932	89,093	41,600	15,459
Catania	41,600	59,931	103,028	599,774
Messina	188,636	74,782	863,553	5,306
<i>Overall MC</i>	<i>29,180,489</i>	<i>29,644,394</i>	<i>38,056,340</i>	<i>14,970,652</i>
Italy	129,853,352	96,171,688	133,549,888	38,421,460
<i>% MC respect Italy</i>	<i>22.47</i>	<i>30.82</i>	<i>28.50</i>	<i>38.96</i>

Tab.2 Export in the sectors defined by Pavitt Classification. Data in Euro x 1000. Year 2014. Source: Italian Government, <http://dati.italiainformazioni.it/opendata.aspx>

METROPOLITAN CITY	TERRITORIAL AREA (ha)	CONSUMED SOIL (ha)	NOT CONSUMED SOIL (ha)	CONSUMED SOIL (%)	NOT CONSUMED SOIL (%)
Milan	157,565	50,043.71	107,626.50	31.74	68.26
Turin	682,700	67,405.66	615,526.97	9.87	90.13
Venice	247,291	35,819.80	211,196.12	14.50	85.50
Genoa	183,379	15,516.84	167,974.18	8.46	91.54
Bologna	370,232	33,221.68	336,980.46	8.97	91.03
Florence	351,358	28,954.73	322,402.95	8.24	91.76
Rome	536,328	70,803.98	464,764.56	13.22	86.78
Naples	117,893	39,618.17	77,745.13	33.76	66.24
Bari	386,288	37,185.72	345,329.79	9.72	90.28
Reggio Calabria	321,037	18,125.24	300,161.95	5.69	94.31
Cagliari	457,041	18,809.84	438,541.08	4.11	95.89
Palermo	500,928	28,249.87	466,358.73	5.71	94.29
Catania	357,368	27,941.96	327,373.38	7.86	92.14
Messina	326,612	19,938.77	303,953.13	6.16	93.84
<i>Overall MC</i>	<i>4,996,020</i>	<i>491,635.97</i>	<i>4,485,934.93</i>	<i>9.84</i>	<i>89.79</i>
Italy	302,072,840	2,287,799.22	27,788,915.00	7.61	92.39
<i>% MC respect Italy</i>	<i>16.54</i>	<i>21.49</i>	<i>16.14</i>	<i>=</i>	<i>=</i>

Tab.3 Soil consumption in the Metropolitan cities. Territorial area by ISTAT (<http://dati.istat.it/>). Other data by ISPRA (2016)

This happens despite their territories have the tools to increase their performance. One consequence of this is found in the development's and competition's activities that the most active subjects provide on their own because they do not yet recognize to the Metropolitan Cities no willingness to become an active player in the construction of strategic development views.

Economical elements are not the unique interpretation's key of the Metropolitan Cities territories. An aspect that can assume critical meanings is linked to the way by which in the recent past have been made the processes of urban expansion. Using the words of Sbeti (2016, 28) we can affirm that in the last years «the process of metropolisation of Italian settlement systems has been extended by assuming different forms, often post-urban, with a significant worsening of the problems related to quality of life, to the development process, and to the social integration». Without to forget environmental aspects.

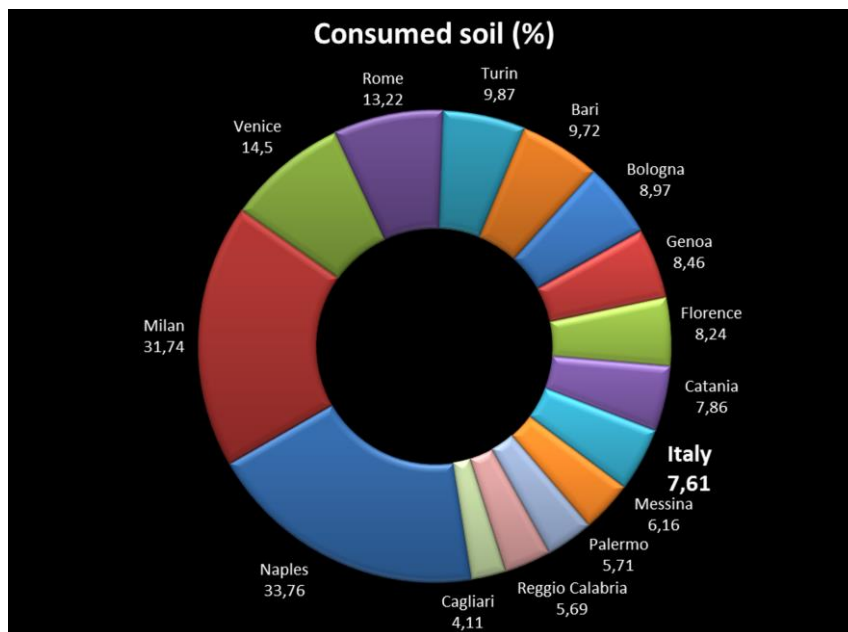


Fig. 1 Percentage of soil consumption for the Metropolitan Cities compared with national datum. See Consumed soil (%) in Table 3 Data by ISPRA (2016)

Among the indicators showing this phenomenon we use the soil consumption occurring in metropolitan areas. Table 3 highlights that in Metropolitan Cities the consumed soil is 9.84% of entire territorial area, whereas this datum is 7.61% at national level. Furthermore, respect a territory equal to 16.54% of national one, the consumed soil is 21.49% of the whole.

This testifies that the territory of the Metropolitan Cities presents a concentration of soil consumption's phenomenon, due, most probably, to the pressure carried out on these areas by the settlement's systems and by the production's systems.

5 STATE OF THE ART IN METROPOLITAN PLANNING

The analysis of the activities that Metropolitan Cities are carrying out makes it possible to outline a precise overview of the state of implementation of the legislation that has led to the establishment of these new institutions.

This analysis is important not so much in relation to the formation of the bureaucratic structure of the institutions, as for their capability to equip with the operational and planning tools that the law provides them. This phase is very sensitive and, at the same time, very important. It should have been carried out with a

good speed so as to put the Metropolitan Cities under the conditions to become fully operational and, above all, to work having a large action's capacity.

For the aims of the present paper, the 14 Metropolitan Cities that shape the national metropolitan system (including those belonging to the Special Statute Regions of Sardinia and Sicily), have been analyzed in relation to the state of formation of the three tools inherent in the planning sector, namely the strategic planning, the territorial planning and, more specific element, the establishment of homogeneous zones in which the Metropolitan City can be divided.

The picture that comes out is summarized in the Table 4.

METROPOLITAN CITY	STRATEGICAL METROPOLITAN PLAN	TERRITORIAL METROPOLITAN PLAN	HOMOGENEOUS ZONES
Milan	Under way	Under way	Yes
Turin	Under way	Formally under way	Yes
Venice	Under way	PTCP	No
Genoa	Under way	Under way	Yes
Bologna	Under way	PTCP	Yes (1)
Florence	Under way	PTCP	No
Rome	No	PTCP	No
Neaples	No	PTCP (2)	No
Bari	No (3)	PTCP	No
Reggio Calabria	Under way	PTCP	No
Cagliari	No (4)	PTC	No
Palermo	No (5)	PTCP	No
Catania	No (6)	PTCPct	No
Messina	No	PTP	No

Tab.4 State of the art for the three tools belonging to the planning function of Italian Metropolitan Cities. Update: 08/03/2017

Notes: (1) The homogenous zones are the associative forms of the Municipalities as the territorial plan of Province of Bologna (PTCP). (2) PTCP of the Province of Naples is not yet in force. (3) In 2010 a strategic plan called "Piano Metropoli Terra di Bari" was published. (4) In 2012 a strategic plan called "Piano Strategico Intercomunale dell'Area Vasta di Cagliari" was published. (5) On the institutional site there is a page dedicated to the strategic planning. (6) In PTCPct is present a "Propositional Framework with Strategic Value".

Starting from this overall picture we analyse below some of the Metropolitan Cities – namely Milan, Genoa and Bologna; they are in a more advanced phase in the drafting process of the territorial governance tools required by law.

Indeed, while the general situation is not positive, some local situations can be considered more advanced and go in the direction of the enhancement of the new administrative structure and deepening of the potentialities existing in it.

A brief analysis is also performed on the state of planning in Metropolitan Cities of Southern Italy.

6 METROPOLITAN CITY OF MILAN

6.1 STRATEGIC METROPOLITAN PLAN

On May 12, 2016, the Metropolitan City of Milan has definitively approved the Strategic Plan. With this tool it wants to become a strong player in the process of sustainable revitalization of the local economy and wants to cooperate in the resolution of the needs of Municipalities, citizens and enterprises.

The Strategic Plan is the result of a path lasted about a year, which has seen a continuous interaction with Municipalities, organized for homogeneous areas, with the economic and social organizations of the territory, gathered in the "Metropolitan Table for Development", and with many other actors.

The construction of the Strategic Plan is based on two different and related visions: a short-term vision interpreting the current situation and outlining actions in the near period, and a long-term vision, forecasting a "fully operational" Metropolitan City. These two visions are condensed in the slogan "Milan. Real metropolis, possible metropolis".

Particularly interesting is the opening of the Strategic Plan to a long-term vision, which exceeds that of the short period required by law. In this regard a number of areas to develop in the future metropolitan policies are identified. In this regard a number of areas to develop in the future metropolitan policies are identified. Reference is to the characteristics of the metropolis of the future in relation to the knowledge needed to maintain an international dimension and to act in the process of competition; to the development of spatial planning processes for the metropolitan area of North West of Italy; to the policies for a free mobility; to the green and metropolitan parks; to the environmental sustainability of the metropolitan area after the signing of COP21; to the development of large network services (Nobili, 2016).

The Strategic Plan has represented the first important opportunity to realize the change outlined by the act of reform of the local autonomies, ie the transition from the former Province to Metropolitan City.

It is significant that Milan has been the first Italian Metropolitan City to develop its strategic plan, confirming as one of the most dynamic Italian realities among metropolitan systems and one of the main places for incubation of political and institutional changes at the national level.

6.2 TERRITORIAL PLAN

The Metropolitan City of Milan is oriented towards an adaptation of the existing Territorial Coordination Plan. The new plan will be structured so as to include information in key areas for the organization of the territory. It will centralize its attention particularly:

- on infrastructure networks. They are under the responsibility of the Metropolitan City and are a characterizing element of the PTCP. The new plan will strengthen the connections of the networks with the territory and settlements, focusing on interchanges and logistics;
- on the localization of excellence and metropolitan rank functions. The settled functions considered of excellence should be identified and strengthened. For this purpose, the plan will have to think in terms of service areas, of accessibility conditions, of effects and impacts of large area. Characterizing element of this forecast will be the establishment of effective embodiments, which use the territorial equalization;
- on the organization of general interest public services in metropolitan areas. The Provincial Territorial Plan (PTCP) had already addressed this issue in relation to the presence of poles of attraction and to their utilization for increasing the compactness of the settlements. The new plan will add new informations about services' forecasts meeting a supra-local dimension demand, as well as to satisfy certain accessibility requirements in relation to the hierarchical characteristics of public transport nodes. In this area lies also the possibility of forming supra-municipal services plans, coordinated with the policies of the Metropolitan City;
- on the territorial equalization. The aim is to make more effective the activation and implementation of territorial policies related to some types of interventions through the use of a balanced system of costs and benefits allocation between the different municipal administrations involved by large area scale urban and/or infrastructural transformations. On the other hand, the plan will have to confirm the urban equalization, instrument of municipal plan competence, regulated by Regional Act nr. 12 of 2005;

- Magentino e Abbiatense (29 Municipalities; 213,745 inhabitants; 360.44 sq Km);
- Nord Milano (7 Municipalities; 315,494 inhabitants; 57.88 sq Km);
- Nord Ovest (16 Municipalities; 315,749 inhabitants; 135.82 sq Km);
- Sud Est (15 Municipalities; 173,267 inhabitants; 179.72 sq Km);
- Sud Ovest (16 Municipalities; 238,729 inhabitants; 179.94 sq Km).

7 METROPOLITAN CITY OF GENOA

7.1 STRATEGIC METROPOLITAN PLAN

Intention of the Strategic Plan of the Metropolitan City of Genoa is to realize a renewed relationship with the territory. To achieve this goal the topics that it wants to tackle are the new functions of the Metropolitan City, the renewed attention to the traditional functions of the previous Province (in particular schools and roads, to assign new characters and new meanings), the age-old issue of hydrogeological risks to deal with a specific attention to the resilience of the territory, and, finally, the promotion of the environment.

Specifically, it wants to give operational skills related to coordinated management systems of metropolitan public interest, in particular water cycle, public transport, and waste cycle. With regard to this last function the Metropolitan City of Genoa has already adopted the metropolitan plan of wastes; in a strategic vision of circular economy it aims to exceed 65% of separate collection and recycling by 2020.

One of the new institution's responsibilities is the economic development. The strategic plan of Genoa wants to face this task in an innovative and sustainable way, giving strong support to the creation of new activities in leading production sectors. For this purpose it foresees the realization of incubators, the development of activities dedicated to the most innovative companies and to those offering greater youth and female employment, and new types of tax breaks able to attract companies and resources. In this way, the plan aims to enhance the excellence of the territory (by means of territorial marketing), to promote sustainable tourism, to clear up the advantages of soft and green mobility.

Most relevant aims from the point of view of territorial impact are the rebalancing of the relationships between coast and hinterland, the support for the activities of the Genoa's Harbour, and the construction of specific infrastructure such as the railway corridor Genoa - Rotterdam.

The increase of the territorial resilience aims to effectively respond to the risks of hydrogeological instability. This means to increase the environmental protection with specific actions such as the networking of parks, the creation of the Pelagos Cetacean Sanctuary, the release of the Internet portal #fuorigenova, with news, informations on environment, services of the territory, the project E.L.EN.A. (European Local Energy Assistance), aiming to increase the energy efficiency and the development of renewable sources.

Within the Strategic Plan there are also details related to new projects in the field of the metropolitan governance, particularly with regard to the involvement of local communities in the implementation of metropolitan functions and services. This applies, in particular, for the participation of Genoa to the development of the network of European metropolitan cities committed to implementing the Europe 2020 strategy of the European Community.

7.2 TERRITORIAL PLAN

At the time of the formation of the Metropolitan City the Province of Genoa was equipped with the Territorial Coordination Plan and had begun the procedures for its review. The new plan project, identified by the acronym "PTCP20", has become the basis for the construction of the General Territorial Plan of the Metropolitan City (Pasetti, 2016). On April 22, 2015, with a resolution of Metropolitan Council, were

identified ten "guidelines" for its formation. The path of the new plan foresees the organization of territorial meetings for their deepening. The guidelines are the following:

- Genoa metropolitan area can be regarded as a door for Europe. The plan should aim at strengthening the role of the Metropolitan City of Genoa in the network of Italian Metropolitan Cities and of greater European cities;
- the plan should be seen as a uniform and commonly shared "territorial project", reinforcing the sense of belonging to the metropolitan community through the use of simple and consistent rules;
- homogenous territorial areas are tools for representing individual or associated municipalities; they realize the necessary coordination between Municipalities and Metropolitan City;
- the plan identifies a number of "strategic systems", that is to say areas characterized by complex and cross-sector problems to deal with "integrated projects". Complex systems are a priority in the process of relaunching and positioning of the metropolitan area;
- soil is a valuable and irreproducible resource to enhance and transmit to future generations. Consequently, the plan must act primarily on the existing city, reinforcing it by means of urban regeneration actions;
- territorial safety and hydrogeological instability prevention are preconditions for the plan decisions. Specific guidelines for urban planning must promote the integration of the morphological, natural, and hydrogeological elements with the man-made elements distributed on territory;
- the economy of the future must be sustainable and must be present on territory with widespread productive activities; the logic should be the public-private partnership, involving institutions, entrepreneurs, universities and third sector;
- the building and strengthening of infrastructure networks, both physical and virtual ones, are determining factors for developing economy, relations and social cohesion of the area;
- the territorial networks (particularly the metropolitan ecological, the public service, and the cultural, historical, landscape and environmental networks) are essential facilities to improve quality of life and attractiveness of the metropolitan territory;
- the homogeneous zones are the tools to organize and to manage in an efficient way the territorial services.



Fig. 3 Metropolitan City of Genoa. Homogeneous areas

7.3 HOMOGENEOUS AREAS

The proposal of the Metropolitan Territorial Plan articulates a system of homogeneous areas already defined by previous planning tools. The areas identified are Riviera Ponente, Stura, Genoa Central Area, Scrivia, Trebbia, Paradiso, Tagullio's Riviera, Fontanabuona, Aveto-Graveglia-Sturla. As mentioned, they were in an advanced formation in the draft revision of the territorial plan of Province of Genoa (PTCP2020), plan with strong characters of metropolitan planning.

The considerations that led to the bounding of the homogeneous areas were the maximization of the territorial characteristics within the urban planning, the effectiveness of the functions and activities of large area, the coordination of local planning, the improvement of services to citizens and businesses, the co-operation in the protection and enhancement of the territory.

8 METROPOLITAN CITY OF BOLOGNA

8.1 STRATEGIC METROPOLITAN PLAN

The Metropolitan Council approved the Address lines of the Metropolitan Strategic Plan of Bologna in May 2016 (PSM2.0). They represent an evolution of the process started in 2013, when the Covenant for the Metropolitan Strategic Plan had been signed (PSM2013).

This plan represented «the first experience of strategic planning in Bologna and the first national experience of plan with a metropolitan dimension» (Conticelli *et alia*, 2016, 42).

Address lines of PSM2.0 sets out five strategic lines and seven goals within which the upcoming strategic planning instruments will operate. It also outlines the priorities of the metropolitan politics in order to organize, guide and select the projects and concrete actions that will compose the PSM2.0.

The goal is to provide a strong identity to the new local authority so that it can work to coordinate the economic development of the territory and to become an active subject in the direct confrontation with national and international partners.

Within the territory the Strategic Plan will identify priority areas and will define action's systems without fixing settled geographies. Apennines with hilly areas and great axes are two of these geographical realities of the territory with a strong outside recognisability; for this reason the plan will not be limited to the Metropolitan City area but will have a broader view extending its gaze to a vast territorial space.

Metropolitan City and Emilia-Romagna Region have defined together the action areas of the Strategic Plan, namely:

- economic and social development, business promotion and innovation policies, training, and employment services;
- territorial planning, mobility, and infrastructures;
- policies for the attractiveness;
- welfare systems;
- creation of coordinated systems of public services management and their organization in metropolitan area;
- policies of simplification, computerization, and digitization.

The confrontation with the territory has led to the formulation of five strategic lines, or working areas, representing a synthesis of the more strongly positions come out in the confrontation; their realization will lead to a more connected, more open to the world, and more attractive territory. The strategic lines are:

- quality of life of the citizens, in all their aspects;
- connection among education, research, and manufacture;

- strengthening of a speedy and sustainable mobility;
- new meaning of the urban regeneration theme;
- culture as identity and attractive element.

These lines must also be empowered to work using a number of cross factors, defined as elements that must characterize and qualify the entire metropolitan action. Reference is the attention to the genders and generations, the implementation of digital technologies and an easier and open relationships with the public institutions.

On the basis of these premises the address lines of the Metropolitan Strategic Plan identify seven following tasks:

- territorial marketing addressed to make more attractive the Metropolitan City of Bologna;
- urban and environmental regeneration for a more beautiful, sure, and healthy city;
- smart mobility for cutting traffic and pollution;
- enterprise and industry promotion in connection with school and research;
- sustain to offer and demand of culture;
- equal and fair educational system from babyhood to university;
- strengthening of the welfare system.

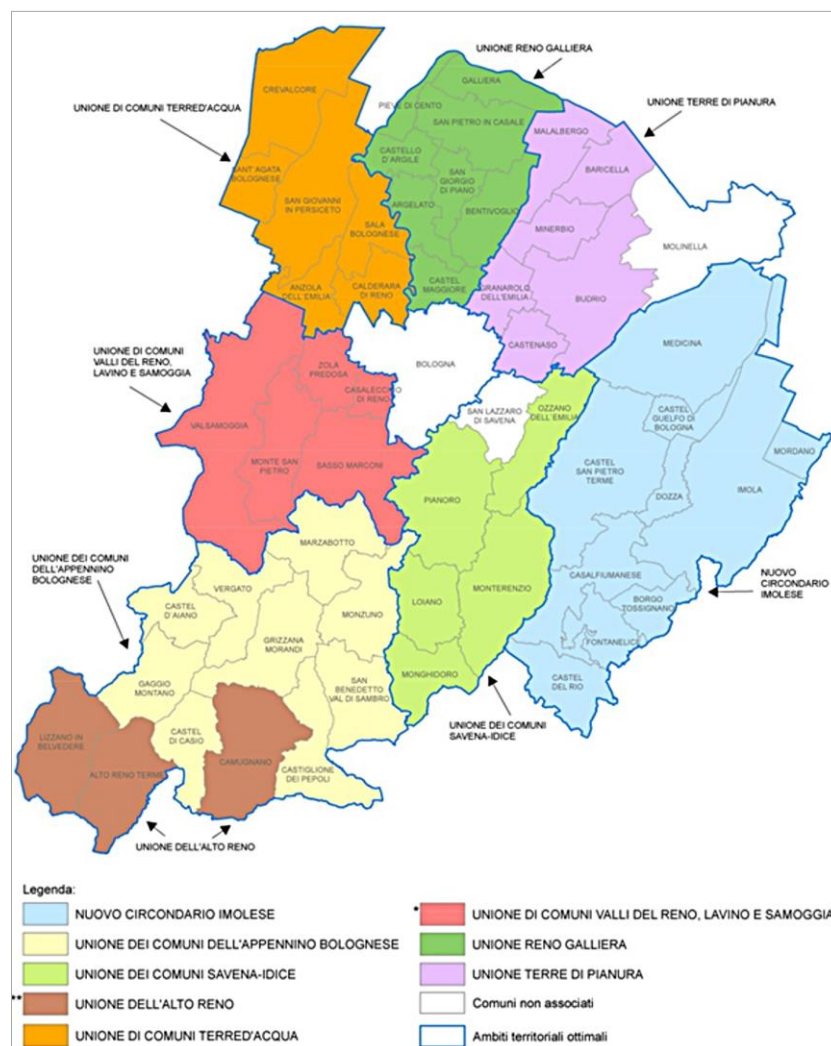


Fig. 4 Associations of Municipalities. Metropolitan City of Bologna.

8.2 HOMOGENEOUS AREAS

Metropolitan city of Bologna contains in its territory 55 Municipalities, grouped in 8 homogeneous zones.

The making of this territorial composition precedes the institution of Metropolitan cities and results from the provisions within the PTCP of Province of Bologna. Associative choices have been confirmed by the Metropolitan City of Bologna, given the fact that they had already led to specific results in terms of organization of services and management of some administrative functions. To the areas listed below must be added the city of Bologna.

- Nuovo Circondario Imolese, including the Municipalities of Borgo Tossignano, Casalfiumanese, Castel del Rio, Fontanelice, Castel Guelfo di Bologna, Castel San Pietro Terme, Dozza, Medicina, Mordano, Imola;
- Unione dei Comuni dell'Appennino Bolognese, including the Municipalities of Castel d'Aiano, Castel di Casio, Castiglione dei Pepoli, Gaggio Montano, Grizzana Morandi, Marzabotto, Monzuno, San Benedetto Val di Sambro, Vergato;
- Unione dei Comuni Savena-Idice, including the Municipalities of Loiano, Monghidoro, Monterenzio, Ozzano dell'Emilia, Pianoro;
- Unione dei Comuni Valli del Reno, Lavino e Samoggia, including the Municipalities of Valsamoggia (fusione dei Comuni di Bazzano, Castello di Serravalle, Crespellano, Monteveglio, Savigno), Monte San Pietro, Sasso Marconi, Casalecchio di Reno, Zola Predosa;
- Unione dell'Alto Reno, including the Municipalities of Alto Reno Terme (fusione dei comuni di Granaglione e Porretta Terme), Camugnano, Lizzano in Belvedere;
- Unione Reno Galliera, including the Municipalities of Argelato, Bentivoglio, Castel Maggiore, Castello d'Argile, Galliera, Pieve di Cento, San Giorgio di Piano, San Pietro in Casale;
- Unione Terre di Pianura, including the Municipalities of Baricella, Budrio, Castenaso, Granarolo dell'Emilia, Malalbergo, Minerbio;
- Unione Terre d'Acqua, including the Municipalities of Anzola dell'Emilia, Calderara di Reno, Crevalcore, Sala Bolognese, San Giovanni in Persiceto, Sant'Agata Bolognese.

9 METROPOLITAN CITIES OF SOUTHERN ITALY

Southern Italy is present in the system of Metropolitan Cities with 3 continental cities (Naples, Bari, and Reggio Calabria) and 4 insular cities (Cagliari, Palermo, Catania, and Messina). In all these cases, the activation's process of the new institutions presents significant delays.

At the present days none of these has seriously started procedures in the direction of the formation of strategic and territorial plans. We can state that in these territories there is a clear trend to use the plans bequeathed by deceased provinces, postponing the necessary adjustments to a date to be determined.

This situation is clear both as regards the formation of strategic plans that with regard to territorial plans.

Table 4 shows that only two Metropolitan Cities (Reggio Calabria and Palermo) have on the agenda the topic of the strategic planning, even if the informations available show that they are in a more than early stage and that they have not taken any steps to concretely undertake the process of formation of the plan.

As for the other cities there is no trace, on corporate websites, of strategic plans.

In the cases of Bari and Cagliari there is mention of the existence of strategic plans formed before the dissolution of the provinces. Aims and purposes of these plans are to be evaluated carefully in the light of the need for a strategic plan that wants to call itself "metropolitan". In the case of Catania the situation is still different because inside the territorial plan of the province (PTCPct) is present a "Propositional Framework with Strategic Value".

As regards the territorial planning the situation, as said, sees the presence in all cases of provincial territorial

plans. Of these only one (Naples) is still not fully in force.

In all cases, therefore, the provincial plans serve as a planning tool and, although it is evident the need for a their deep review – necessary to adapt them to the new institutional reality –, seem to be no many possibilities to start this new planning season.

Finally, no information was found in relation to the formation of homogeneous zones.

10 DISCUSSION ITEMS

International experiences in the field of metropolitan agglomerations highlight the need to treat these urban systems as specific cases, clearly differentiated from the traditional urban systems. The metropolitan areas represent specific situations from the agglomerative point of view, and their management requires specific administrative structures.

The reason lies in the fact that they represent areas of economic, cultural and social strength that must be developed and made stronger by having as theme not the daily administrative practice but innovative strategies able to compete at national and international level and to act for increasing the attractiveness of their territories both in the economic field and in the development processes based on innovation.

In the situation created since the second half of 2016, we find on the one hand the lack of advanced planning by the Metropolitan Cities, on the other a climate of latent demobilization of the institutional reforms put in place in the three years from 2012 to 2016.

The institutional restructuring process that led to the constitution of Italian Metropolitan Cities had specific potentialities in itself, recognizable in curtailing of the territorial government. They represent «a perspective in which it is possible (or must be) to develop and to practice a consistent innovation in urban and regional planning, a definition of new local development policies, and a greater administrative efficiency and simplicity (for citizens, for economic activities and for services). Thus can also enhance competitiveness, thereby contributing to necessary actions to restart Italian sustainable growth processes just starting from the metropolitan Cities» (Barbieri, 2015, 9).

But if we analyse the activities of the new institutions and the steps which they have operated (Table 4), we see that the attention has focused primarily on actions that don't seem to have the required breathing. In particular, we notice an overall delay state in the planning field.

As a first step the new local authorities seem to have concentrated their attention on the formation of the strategic plan, although in three cases there is no trace of this either. The sensation is that the construction of this type of plan seems to have become a minimum target in the programs of the new institutions, almost like a simple task to be drawn up to show that they have done something.

On the other hand, if we take into account the contents and forecasts of the documented plans we can note that the formalized instruments seem, generally, without personality and do not contain any element of innovation in the methodologies, nor particularly courageous territorial visions.

We also highlight the question of the timing related to the formation of such instruments. Because the plans are lasting three years, it was reasonable to assume quickest paths of genesis and approving of the strategic plans. If the times are those hitherto applied it could get to the paradox that the period of time necessary to build the plan is comparable, if not greater, than that of validity of the same. Without considering the fact that the law provides for an annual update that, under current conditions, would have formation times equally long, unless it does not turn into a meager document attached to some deliberation.

The right combination, in the case of strategic planning, would be the construction of a document by the innovative and disruptive contents, with rapid procedures for genesis and approval.

Even worse is the situation with regard to the territorial plan, the formation of which has been started only in two of the Metropolitan Cities. Furthermore, all Metropolitan Cities use uncritically the territorial planning

outlined by previous provincial coordination plans which, in the best case, should only be a starting point to outline completely innovative tools.

The analysis of the case studies can be referred to local areas that historically have had different attitudes to planning, ranging from situations with a sedimented tradition of planning, to realities in which the plans are poorly tolerated. It shows how Metropolitan Cities, whose management structure is derived from that of the previous provinces, are almost reluctant to abandon their territorial coordination plans, as if they had not understood that the real meaning of a metropolitan planning have a distinctly different breath than that applied in the provinces. Even in the territories where the PTCP have had an interesting story resists the binding to solid but less flexible planning drawings, however not equipped with an extended view of the processes taking place in metropolitan areas at European level, at least.

This factor also connects to another not secondary aspect, namely the existence of metropolitan functional systems that often don't overlap with the statutory territorial systems. It is sufficient to consider the realities of Milan or Naples to understand how it is necessary to rethink the relationships that will be created when the Metropolitan City presents functional relationships with areas administratively external (Mazzeo, 2009). Clearly, in some way, they must fall in the metropolitan planning processes.

This aspect is confirmed also by the lack of inter-institutional collaboration processes between Metropolitan City and regional systems, whose general objectives should be convergent. The situation inevitably impacts on the overall importance of the Italian system compared to other national systems.

Same negative situation meets in the formation of the homogeneous zones, for which only four Metropolitan Cities have provided, asking for help, in the case of Bologna, to the areas already established in the previous PTCP. The delay related to this forecast is due probably to the fact that it is not compulsory, even if the homogeneous areas are considered an attractive tool to transfer at the level of the Municipalities the policies of the Metropolitan Cities. Furthermore, the establishment of homogeneous zones, allowing to rebalance the weights between Metropolitan Cities and Municipalities, particularly if the first develops in full measure its potential and seeks to assume a relevance of national and international level.

The survey carried out allows to state that the application of the reform establishing the Metropolitan Cities cannot take off.

This situation results from the lack of an effective driving force in the implementation of the reform. The enactment of the law would have to trigger a virtuous emulative process highlighting the advantages of the new administrative shape compared to the previous administrative situation. This trigger has not occurred, making it once again clear the distance between theoretical research in urban planning (for which metropolitan cities are key tools of government of large cities), and administrative practice.

Furthermore, the reform, albeit necessary and even if arising from the need to reduce public administration costs, was perceived, wrongly or rightly, as ineffective.

A not secondary element, finally, it is to emphasize: the apparent gap between the Metropolitan Cities of the Center-North of Italy and those of the South. The first show more attention to the strategic issues that may result by the creation of Metropolitan Cities, although critical aspects do not lack even in these (De Luca, 2016). The latter continue in the unconcealed aversion to all forms of planning and confirm a persistent inaction of the ruling classes, whose only strategy seems to be the preservation of their constituencies, compared to a clear lack of long term development vision.

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Cover photo and Fig. 1: by author

Fig. 2: http://www.cittametropolitana.mi.it/portale/territorio/zone_omogenee/

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SHORTCOMINGS TO SMART CITY PLANNING AND DEVELOPMENT

EXPLORING PATTERNS AND RELATIONSHIPS

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ABSTRACT

Smart city criticism concentrates on conceptual and methodological ambiguity, corporate driven utopian visions, overlooking citizen and other stakeholder potential, 'splintering urbanism', and lack of long term vision for sustainable urban development adapted to local needs. Inspired by this critical discourse, this paper aims to present smart city planning and development shortcomings on the basis of applied experience and, further, use this experience to create a new theoretical construct about shortcomings to smart city planning and development. Nine individual smart city cases (Barcelona, Stockholm, Chicago, Rio de Janeiro, PlanIT Valley, Cyberjaya, Masdar, Songdo International Business District, Konza) are explored on the basis of selected published material and in-depth case studies, highlighting the challenges and shortcomings that appeared during their development and implementation. Subsequently, the identified shortcomings are synthesized and assessed critically across contextual and strategic levels, uncovering underlying causal relationships. The findings are used to create a new theoretical construct, comprising two paths to shortcomings towards smart city planning and development.

KEYWORDS:

smart city; urban development; strategy; challenge; causes and effects

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智慧城市规划与发展的缺陷

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摘要

本文对智慧城市规划与发展的缺陷进行了探讨。具体而言，它对 11 座智慧城市的发展战略以及在规划和实施阶段所发现的缺陷展开了调查。这 11 座智慧城市分别是：巴塞罗那智慧城市 (Barcelona Smart City)、生态城市普兰尼特谷 (PlanIT Valley)、斯德哥尔摩智慧城市 (Stockholm Smart City)、网路之城赛城 (Cyberjaya)、阿布杜拉国王经济城 (King Abdullah Economic City)、马斯达尔城 (Masdar City)、斯科尔科沃 (Skolkovo)、松岛国际商务区 (Songdo International Business District)、芝加哥智慧城市 (Chicago Smart City)、里约热内卢智慧城市 (Rio de Janeiro Smart City) 和孔扎科技城 (Konza Technology City)。本文对相关调查结果进行了综述并提出了中肯的评价。具体缺陷体现在以下方面：资金和预算不足、官僚主义和组织挑战、数字服务发展和布局挑战、实体规划较差、难以吸引投资和支持新商业的发展、在用户吸引方面表现不佳以及利益相关者的阻力。接下来，本文将这些缺陷分成了两大类，并逐一分析了原因和影响。本文最后通过将过往的经验与新颖的方法相结合，提出了缓解提议。

关键词：

智慧城市；缺陷；挑战；问题；缓解

1 INTRODUCTION

Urban futures have attracted the interest of urban planners for over one century now (Papa et al., 2013); but the recent leaps in ICT and knowledge and innovation economy have created an extraordinary technology push for smart city solutions and a demand pull on the side of cities which, on one hand has made the smart city conception very popular, but on the other hand hinders the development of common understanding about what it means for a city to be 'smart' (Angelidou, 2015). Smart city plans, strategies, initiatives and solutions of all sorts and sizes are now being developed by hundreds in cities all over the world. Solutions abound; open knowledge, open government, and open source applications have enabled the development of an ecosystem of solutions, platforms and tools that cities can choose from to create their smart city agenda.

But what about shortcomings to smart city planning and development? From practical experience we know that perfectly successful strategic planning initiatives do not exist in any domain. Every project faces its own challenges, and is characterized by its own objectives and specifications.

Although critical literature towards the smart city abounds, until recently it had not dealt substantially with the practical challenging aspects of strategic planning for smart city development. Purportedly "good" practices abounded while "pitfalls" and "challenges" were downplayed - and still are, in many cases. This is largely due to the 'self-congratulatory' nature of smart cities (Hollands, 2008), which assumes that the smart city is *a priori* a successful paradigm of urban development. As many smart city projects from around the world are now entering their maturity phase, however, the volume of published in-depth smart city case study research has been growing. This valuable source of knowledge can be used to build theory from cases (Eisenhardt, 1989) with the purpose of mapping practical shortcomings in the smart city planning and development process. The results can be used in policy making towards anticipating and mitigating pitfalls in technology-led development, increasing the chance of smart city initiatives to succeed.

Starting from the previous reflections, the purpose of this paper is to present smart city planning and development shortcomings on the basis of applied experience and, further, use this experience to create a new theoretical construct about shortcomings to smart city planning and development.

The following section (2) presents the basic critical arguments towards smart cities. Section 3 explores nine individual smart city cases and the challenges that appeared during their development and implementation on the basis of selected published material and in-depth case studies. Subsequently, the identified shortcomings are synthesized and assessed critically by uncovering causal relationships among them (section 4). Section 5 presents the conclusions of this paper.

2 REVIEW OF LITERATURE ON SMART CITY PLANNING AND DEVELOPMENT SHORTCOMINGS

2.1 CRITICAL LITERATURE TOWARDS THE SMART CITY

In the course of the past decade, along with the increasing popularization of the smart city idea, a growing number of smart city scholars and practitioners engaged in addressing the smart city through a critical lens. This section aims to highlight the most important points emerging from this discourse by citing the most influential academic publications in this regard. It clusters smart city criticism across five levels: (i) conceptual and methodological ambiguity, (ii) ICT and corporate driven utopian visions (iii) overlooking citizen and other stakeholder potential, (iv) 'splintering urbanism', unequal representation, privacy and security concerns and (v) lack of long term vision for sustainable urban development adapted to local needs. These points are analytically described in the following paragraphs.

Hollands (2008), in his widely cited seminal paper, *'Will the real smart city please stand up?'*, essentially launched the smart city criticism discourse by pointing out underlying issues of conceptual and ideological ambiguity, observing the 'self-congratulatory' nature of so-called 'smart cities'. Seven years later, Hollands (2015) returned with his paper *'Critical interventions into the corporate smart city'* whereby, among others, he notes that current conceptions about smart cities bring together so many disparate theories, city systems and functions, that it is essentially impossible to embed all smart city aspects in a single ideological framework (Hollands, 2015). The contribution of smart cities to sustainable development remains vague (Salvati et al., 2013). Arguably, smart cities are shaped by diverging conceptual variations, fragmentary thoughts and conflicting ideological and conceptual roots (Fernández-Vázquez & López-Forniés, 2017; Kitchin, 2015; Meijer & Bolívar, 2016; Pierce & Andersson, 2017; Van den Bergh & Viaene, 2015). Further, the lack of documentation and established performance metrics hinders an assessment of the efficiency of 'smart' interventions that can be justified towards replication (Glasmeier & Nebiolo, 2016). Hollands (2008), Van den Bergh and Viaene (2015) and Glasmeier and Nebiolo (2016), note the use of the smart city idea as a *label* and *means of promotion* used by city administrators and politicians. Smart technologies, they observe, are put forward as marketable, off-the-shelf products, instead of serving purposes of public benefit and common good.

Furthermore, smart cities put forward business-led urban development as one of their foremost priorities (Hollands, 2008), with concepts of technology-led smart city development originating not only from the business sector (technology vendors and consultants), but also government (the European Commission, for example) and academia (computer sciences) (Fernández-Vázquez & López-Forniés, 2017). As a result, smart city initiatives and technologies are increasingly driven by business imperatives, with smart city planning and control being handed over to private organizations, creating a risk of lock-in around proprietary technologies and raising issues about the management of these systems after the departure of the corporates (Buck & While, 2015; Datta, 2015a; Glasmeier & Nebiolo, 2016; Greenfield, 2013; Kitchin, 2015; Marvin & Luque-Ayala, 2013; Pierce & Andersson, 2017). Due to their nature, corporate smart city initiatives tackle a limited range of social and environmental priorities and fail to develop the capacity of a city's people to actually learn and deeply engage in the smart city discourse (Marvin & Luque-Ayala, 2013). In addition, an efficiency and reflexivity gap between vendor led, fixed smart city solutions and solutions-driven, promptly available smart city technologies is observed (Glasmeier & Nebiolo, 2016).

Stakeholder engagement is broadly cited as a fundamental pillar of the smart city in many wordings (for example grassroots engagement, bottom-up engagement) and is associated with related the conception of 'smart communities' (Bencardino & Greco, 2014; Komninos, 2011; Mosannenzadeh & Vettorato, 2014). Cities are 'messy' places (Greenfield, 2013), and regardless of the approach, the essence is that stakeholder empowerment is an enabling ingredient of the smart city: citizens, businesses and civil servants should act as empowered data and knowledge generators and contributors, agents, implementers and assessors of smart city policy. Behavioral changes are required towards the sustainable smart city development (Salvati et al, 2013). Although integrated stakeholder segmentation efforts in a smart city context have taken place in the past (Mosannenzadeh & Vettorato, 2014), existing smart city models frequently fail to identify stakeholders and describe their roles (Harrison, 2017; Pierce & Andersson, 2017; Vanolo, 2016). This is a common situation across smart city initiatives, driven by the dominance of supply-driven smart city solutions and the aforementioned different ideological stances across academic, corporate and government literature (Angelidou, 2015; Kitchin, 2015; Marvin & Luque-Ayala, 2013). It results to a loss of the opportunity to experiment with innovative solutions, tailor smart cities to user needs, capitalize on the problem solving capacity of the populace, provide new insights and obtain buy-in from stakeholders. Some smart city critics have proposed 'smart urbanism' as an alternative conceptual fundament towards integrated and participative urban growth driven by bottom-up innovation and creativity (Kitchin, 2014; Luque-Ayala & Marvin, 2015).

Furthermore, weak stakeholder participation in the smart city and the diffusion of entrepreneurially led smart cities raise questions regarding democratic representation and citizenship (Angelidou, 2014; Datta, 2015b; Greenfield, 2013; Hollands, 2015; A. Townsend, 2013), in turn posing negative implications about public space privatization, social polarization and gentrification (Hollands, 2008; Hollands, 2015). Smart cities also raise concerns about security, privacy and panoptic surveillance on different levels (Elmaghraby & Losavio, 2014; Kitchin, 2015; van Zoonen, 2016). Failing to account for the implications of smart city technology and 'networked urbanism' on urban life and urban citizens (Kitchin, 2015), technologically mediated urban living inevitably contributes to the creation of the phenomena of 'splintering urbanism' (Graham & Marvin, 2001) and 'urban digital divides' (Crang et al., 2006), with urban infrastructures enhancing spatial inequality instead of contributing to the creation of inclusive communities. Public policy is shifting away from its principal scope, which is to serve social objectives, such as provision and accessibility to quality infrastructure, education and other amenities. It is not clear who the main beneficiary of the smart city is, and furthermore to whom the smart city services will be accessible to. Smart cities, as costly, privileged, all-encompassing places, eventually risk becoming a commodity of the elite (Glasmeier & Nebiolo, 2016).

Finally, smart cities often omit accounting for a long term vision for long term, sustainable urban development, despite the efforts undertaken so far (Papa et al., 2013) as well as its potential contribution to urban resilience (Papa et al., 2015). They suffer from the dominance of one-size-fits-all smart city narratives, which do not consider the history, culture and social, economic, political and other features of cities (Kitchin, 2015). Solutions often focus only on one city system (Glasmeier & Nebiolo, 2016). Zubizarreta et al. (2015), after an analysis of more than 60 smart city applications in 33 cities, actually confirmed that smart city applications are in most cases designed as isolated tools, without contributing to the development of a broader ecosystem and failing to position themselves within a vision that promotes integrated and sustainable development. As a result, many smart city initiatives do not consider how urban systems and development areas (e.g. energy and urban living) can work together in order to achieve efficiencies.

Arguably, the criticism points mentioned above are inherently interrelated – for example, conceptual ambiguity is partly driven by the diffusion of corporate driven smart city visions, and weak stakeholder engagement posits 'splintering' pressure on the urban fabric.

Furthermore, in parallel to this ideological and theoretical criticism towards the smart city, the smart city criticism discourse is becoming stronger of the basis of evidence-supported arguments.

2.2 PREVIOUS EFFORTS TO IDENTIFY AND EXPLORE SMART CITY CHALLENGES

As many smart city initiatives from all over the world are now entering their maturity phase, we are beginning to have an increasing amount of evidence-based information about their priorities, characteristics and results. As a result, there has been a growing volume of scientific literature focusing on specific, in-depth case studies about smart city strategies, describing –among others- smart city strategy shortcomings¹. In parallel, a limited number of efforts to analyze smart city cases comparatively has also been undertaken, as described in the followings.

More particularly, Pierce and Andersson (2017), in a research conducted across 10 mid-sized European cities², identified and grouped smart city development and implementation challenges in two domains: technical and non-technical. The technical domain includes challenges with regards to interoperability and privacy, while the non-technical domain includes challenges related to collaboration, financing, governance and awareness

¹ Although background work was undertaken in this area for the purpose of selecting the case studies and sourcing material for this research, it is out of the purpose of this paper to list all the available literature with this respect.

² Aarhus (Denmark), Bristol (UK), Dublin (Ireland), Eindhoven (Netherlands), Helsingborg (Sweden), Lund (Sweden), Malmö (Sweden), Rotterdam (Netherlands), Santander (Spain)

raising. They found that the most pressing challenges lie with cross-departmental and outward collaboration and coordination of recourses, closely followed by the challenge of securing the necessary financial recourses. Fernández-Vázquez and López-Forniés (2017), in analyzing and comparing smart city initiatives while focusing on the role of citizens in the smart city, examined 200 scholarly papers to identify the characteristics of ICT based smart cities versus the characteristics of citizen based smart cities³. Among others, as weaknesses in ICT based smart cities they identify i. poor citizen participation, ii. fuzzy goals and iii. private benefits. In citizen driven smart cities they identify i. lack of funds, ii. poor communication power and iii. need for new tools/methods.

Ojo et al. (2014) studied comparatively ten smart city programmes⁴, creating a framework for smart city initiative design addressed to policy makers, practitioners and smart city stakeholders. Their findings deal, among others, with the challenges (technical, management, governance) encountered by policy makers into implementing the initiatives. These are related with attracting and sustaining stakeholder interest from the civil and private sector, including marginal communities and financing difficulties.

Neirotti et al. (2014), analyzing comparatively 70 smart city programmes around the world⁵ on the basis of secondary sources, identify smart city application domains and further examine their relationship with contextual factors (geography, demography, economy, development policies). Among others, they note that smart city initiatives are variably affected by contextual political, economic and cultural factors which present different obstacles, depending on the case. The authors highlight the need to adopt bottom-up engagement approaches in cities that are currently not very advanced in technological and economic terms.

Heo et al. (2014) explore the requirements and challenges in smart systems' integration through use cases. Their approach is purely technical, focusing on areas of i. smart power grids, ii. structural and surveillance applications, iii. transport and traffic management, iv. food, water quality and environmental monitoring and v. ubiquitous healthcare applications. The identified technical challenges with respect to the integration of the previous systems are related with interoperability, scalability, infrastructure management, data privacy and security.

This paper diversifies its positioning from the previous research efforts in that it engages in a investigation into the shortcomings of each smart city initiative, sourcing and processing material from published case study research, rather than settling with material from smart city project websites. It also differs substantially in that it seeks to create theoretical constructs from observation (Eisenhardt, 1989), rather than vice-versa, which is the standard approach followed in previous work.

3 RESEARCH APPROACH

The research approach used is "theory building from cases" (Eisenhardt, 1989), whereby a number of case studies are analyzed internally and comparatively in order to create a theoretical construct in an inductive way. The emerging theoretical constructs reflect relationship patterns within and across the cases and can be used, among others, to provide description. Following the recommendations of Eisenhardt (1989), the selection of the case studies aimed at the selection of polar types, i.e. cases that are very different and represent extreme situations. Other important factors that drove the selection of the cases is the maturity of the initiatives, which is a precondition for being able to identify shortcomings, and the availability of information through scholarly publications (academic journal and conference papers, theses and research reports) -particularly in-depth case studies into smart city cases and their shortcomings. The collected data were arranged in a tabular display,

³ the authors do not mention the exact smart city initiatives

⁴ Smart Amsterdam (Netherlands), Climate Smart Malmo (Sweden), Smart City Malta (Malta), Masdar Smart City (United Arab Emirates), PlanIT Valley (Portugal), Smart City Singapore, (Singapore), Smart Curitiba (Brazil), Smart Songdo (South Korea), Tianjin Eco-City (China), Yokohama Smart City (Japan).

⁵ the authors do not mention the exact smart city initiatives

which features shortcomings pertaining to the context of the smart city strategy and the strategy itself (Section 4, Table 1). Using this display, the collected information was scanned vertically and horizontally multiple times to uncover underlying patterns and hidden relationships. The patterns that appeared more frequently were in turn used to create two new constructs which describe relationships across smart city planning and development shortcomings.

4 RESEARCH FINDINGS AND SYNTHESIS OF RESULTS

4.1 THE SMART CITY CASES AND THEIR SHORTCOMINGS

This section presents the nine smart city cases of this paper and the shortcomings that appeared during their development and implementation.

Barcelona's Smart City strategy (Spain) is built around 'international promotion', 'international collaboration' and 'local projects'. The strategy establishes collaboration channels among government, industry, academia and citizens (Angelidou, 2016; Bakici et al., 2012; Barcelona Smart City official website, 2016). Harrison (2017) notes a misalignment of the city's strategy with the reality and needs of Barcelona's urban population –actually, the initiative faced opposition from specific neighborhood associations and raised 'splintering urbanism' concerns (March & Ribera-Fumaz, 2016). However, Barcelona's smart city initiative is currently in the process of transitioning from a more of top-down to a bottom-up one (Calzada, 2017), using tools and methodologies such as smart districts, open collaborative spaces, infrastructures and open data. To implement the strategy, a major organizational reform took place, resulting in the creation of the 'Urban Habitat Department' (the 'smart city' department). The City of Barcelona faced challenges in securing the necessary funds, providing exact and appropriate infrastructure and in the deployment and management of wireless networks. Cross-departmental cooperation has also been challenging, due to the difficulty to clearly define the roles and responsibilities of each person and authority (Bakici et al., 2012). In addition, the massive restructuring of services and budgets that took place for the creation of the Urban Habitat department faced opposition from some citizen groups.

In the smart city strategy of Stockholm (Sweden), environmental and information technology is tested and used extensively throughout the city's infrastructure, with the purpose of creating an innovation ecosystem that involves the city's inhabitants, industry and the public sector (Buscher & Doody, 2013; Stockholm smart city official website, 2014). One of the key challenges to the implementation of the strategy has been financing; the need to have funds available upfront in order to make investments is one of the constant issues to be tackled. Furthermore, as every change risks raising society's resistance, city employees and the city council need to be constantly informed and convinced about the importance of the smart city project (Buscher & Doody, 2013).

The city of Chicago (USA), driven by a vision towards more transparent, accountable and democratic governance, pursued a data driven smart city strategy for leveraging technology in order to promote inclusion, engagement and innovation. The project foresees the collaboration of the public, the private and the third (social) sector to develop the city's infrastructure, 'smart' communities, civic innovation and technology companies (Buscher & Doody, 2013; City of Chicago, 2013; Goldstein, 2013; O'Neil, 2013; Smart Chicago official webpage, 2014). The smart city of Chicago had to address a host of issues normally associated with open data, including privacy, interoperability, scalability, consistent and automatic updating of data, and creating user friendly interfaces (Goldstein, 2013). Also, building an ecosystem of open government, vibrant user communities, potential investors and meaningful datasets required a continuous and concerted effort on the side of the city (O'Neil, 2013). That said, acquiring the necessary financial capital and technical expertise for the project was one of the strategy's key challenges, as an array of private and public foundations were

required to contribute knowledge and other resources for the realization of the initiative (Buscher & Doody, 2013; O'Neil, 2013). Another key issue was re-tooling the Chicago City's IT department to meet the new requirements of the smart city strategy (Buscher & Doody, 2013).



Fig. 1 - 2 Rio Operations Center

The smart city of Rio de Janeiro (Brazil) is a collaboration of the city with technology vendor IBM to become a 'smarter city', created in the prospect of the 2016 Olympics and the 2014 World Cup. Rio is now equipped with a citywide Emergency Response System that collects sensor-and-camera-generated data that enable informed decision making in policing, traffic and energy management (Buscher & Doody, 2013; Goodspeed, 2015; Rio de Janeiro Centre of Operations official website, 2014). Rio de Janeiro's smart city initiative, however, focuses on anticipating and mitigating urgent situations across the city, rather than addressing 'wicked' problems of the urban environment, such as social inclusion and the provision of appropriate infrastructure (Goodspeed, 2015). Progress has been slow to fulfill the set goals, especially regarding user engagement and open data. Bureaucratic issues have also been raised.



Fig. 3 - 4 Images of PlanIT Valley

Cyberjaya (Malaysia) is a planned smart city which is part of the broader government policy for advancing the country's innovation and knowledge economy. The city is expected to become a global ICT hub by attracting world-class multimedia companies, professionals and students (Brooker, 2008; Cyberjaya official website, 2011; Nordin, 2012). The project has suffered bureaucratic challenges and political conflicts, as the city's development is shared among a federal authority, a private company and a government-owned company (Brooker, 2008). The initially foreseen development cost for Cyberjaya has more than doubled up to date, with 17 property developers involved in Cyberjaya's development so far (Nordin, 2012). On the physical level, the city has been criticized as overly labor-focused, suffering from lack of social amenities and neglecting the

need for social life (Brooker, 2008). Many workers of the city choose not to live there, but commute there only for their work (Nordin, 2012). Many companies have registered their address in Cyberjaya for tax benefit reasons, but did not actually move their major operations there (Brooker, 2008). Therefore, the city is practically empty; public spaces are empty; the city's streets -apart from working hours- are empty, too; the city is culturally destitute (Brooker, 2008) and socially dead (Yusof, 2008).

Masdar City (Abu Dhabi, United Arab Emirates) is another well-known planned smart city, designed on the principles of environmental sustainability. Its economy revolves around cleantech research and development, pilot projects, technology and materials testing (Crot, 2013; Cugurullo, 2013; Günel, 2014; Masdar City official website, 2013). Masdar is living proof of the challenges in achieving integrated, self-regulated urban development across different functional domains of the city (Glasmeier & Nebiolo, 2016). With the onset of the global economic crisis, the government of Abu Dhabi decreased its financial backing of the project (Cugurullo, 2013). What is more, Masdar faced difficulties in attracting investment and startups (Kingsley, 2013). *'There's limited indigenous talent and local markets are too small to justify localizing a lot of Research and Development'*, according to S. Geiger, Masdar's co-founder and director in the period 2006-2009 (Kingsley, 2013). In 2010, the project's leaders had to make a major review of the project and scale down and even shelve some of its parts (Alusi et al., 2010; Crot, 2013; Cugurullo, 2013). In 2013 only 100 people were living on the site (Cugurullo, 2013) and life there *'cannot be described as urban'* (Kingsley, 2013).

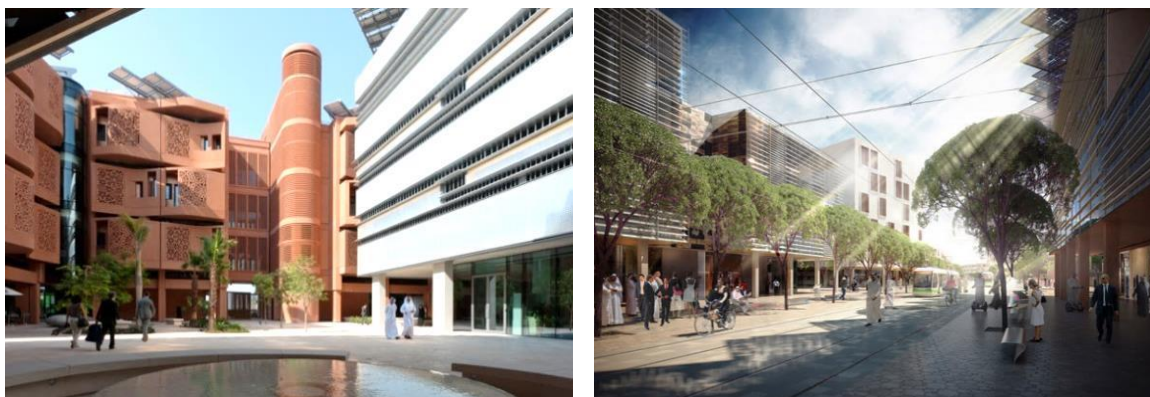


Fig. 5 - 6 Central Courtyard of the Masdar Institute Campus (left) and Central Spine Showing Light Rail Transit and Retails -artist impression (right)

Songdo International Business District (South Korea) is a planned city which is a model of sustainable, city-scale development and innovation and aims to become a central business hub in Northeast Asia (Alusi et al., 2010; Lee & Oh, 2008; Shwayri, 2013; Songdo IBD official website, 2013; Yigitcanlar & Ho Lee, 2014). The city faced strong opposition by local stakeholders and environmentalist groups, as the reclaimed land upon which Songdo was built was formerly an area of important wetlands and fishing grounds (Shwayri, 2013). It is a city which combines green and smart urbanism in an environment of entrepreneurial urbanization which is socially segregated and presents limited learning, knowledge exchange and societal embedding opportunities (Benedikt, 2016; Carvalho, 2015). Songdo's history has been repeatedly shaped by governmental policies with periods of support and periods of neglect. Budget shortages have also been a major problem (Shwayri, 2013); the need for more funding has almost doubled the cost of the venture (Lee & Oh, 2008). There have been significant delays in permits and in construction (Lee & Oh, 2008) -actually the development and implementation plan was revised 10 times only in the period 2008-2010 (Shwayri, 2013).

The last city, Konza (Kenya), is a planned smart city to be developed close to Nairobi, designed on the basis of sustainable design principles and expected to advance technology growth in Kenya. Its economy will focus on four sectors: education, life sciences, telecom and information technology and business process outsourcing

(Konza City official website, 2014; Watson, 2013). The project has suffered major delays (Mutegi, 2014). Although some funds have already been allocated for Konza, they were not spent due to strict procurement laws or because they are dispersed across various government agencies (Mutegi, 2014). Konza has also been subject to criticism for social and spatial gentrification. There has been concern that Konza's properties and lifestyle will be financially unaffordable for locals (Watson, 2013).



Fig. 7 Aerial view of Songdo

4.2 SYNTHESIS OF FINDINGS

Arguably, some of the above smart city shortcomings stem from contextual factors, such as the broader political environment and related policy priorities, as well as the broader characteristics, structure and culture of the implementing authority. Other smart city shortcomings are related to the smart city strategy itself, and particularly how it has been designed and implemented. Table 1 arranges the research findings into these broad categories (context and strategy) and serves as the basis for a further analysis into the causal relationships among the identified shortcomings. After a thorough horizontal and vertical analysis of these findings, a series of insights emerged, as described in the followings.

Across all cases, it appears that the economic aspects of smart city strategies are the foremost issue of concern and source of problems both for planned and existing cities. Bureaucracy is also among the top challenges hindering the advancement of smart city strategies. It discourages investment and slows down financing procedures, resulting to delays in the implementation or downsizing of the smart city project. The main causes of bureaucracy in smart city strategies are complex legal frameworks, diverging political priorities, dissidence among stakeholders and the prevalence of political interests. Another significant challenge is ICT weaknesses, namely systems integration, software/hardware updates, lack of trained staff and a creativity gap. Stakeholder skepticism is more of an occasional challenge, which might be overcome by consultation and meaningful engagement in the smart city design and implementation process. The main causes of stakeholder resistance are accessibility and representation concerns, environmental, economic and real estate interests and a climate of resistance to a possible change of the status quo.

SMART CITY PLANNING AND DEVELOPMENT SHORTCOMINGS

CITY / LEVEL	CONTEXTUAL		STRATEGIC				
	POLICY	ORGANISATION	PHYSICAL PLANNING	TECHNOLOGY	FINANCING	TIMING	STAKEHOLDER RESONANCE
Barcelona (existing)		Organisational restructuring, cross departmental collaboration, roles' definition	Splintering urbanism' concerns	Infrastructure selection, deployment and management	Financing challenges		Stakeholder skepticism, resistance on the side of society
Stockholm (existing)		Organisational stakeholder scepticism			Financing challenges		
Chicago (existing)		Re-tooling organisation to meet requirements		ICT infrastructure challenges, Open Data challenges	Creative ways to increase funds, contribution for private and non-profit sector		Creating engaged, vibrant communities of developers and users
Rio de Janeiro (existing)		Bureaucratic legal framework & administrative structures	Splintering urbanism' concerns	Technologically determined, too ambitious		Schedule delays	Low citizen uptake
PlanIT Valley (planned)			Too ambitious	Technologically determined, too ambitious	Budget shortages	Schedule delays	
Cyberjaya (planned)	Changing officials, change in policy direction, diverging policies	Bureaucratic legal framework & administrative structures. Unclear organisational / leadership roles.	Poor urban design, too fragmented development, too ambitious, several plan reviews	Technologically determined, too ambitious, infrastructure challenges, services only partially implemented, surveillance and censorship	Cost more than doubled	Schedule delays	Low citizen uptake due to lack of social life, low investment attraction, inability to pass as international business hub
Masdar (planned)	Changing officials, change in policy direction	Bureaucratic challenges. Agency to facilitate bureaucratic processes	Poor urban design, too fragmented development, too ambitious, several plan reviews	Technologically determined, too ambitious	Authority reduced budget	Schedule delays	Low citizen uptake due to lack of social life, insufficient indigenous talent, small market potential, global financial crisis
Songdo (planned)	Changing officials, diverging policies	Bureaucratic legal framework & administrative structures	Too ambitious, plan reviews, real estate speculation, privatisation of public space	Technologically determined, too ambitious	Cost more than doubled	Schedule delays	Stakeholder skepticism, a socially segregated place. Inability to pass as international business hub
Konza (planned)		Bureaucratic legal framework, weak cross departmental collaboration, too many stakeholders		Technologically determined		Schedule delays	Low citizen uptake due to high cost of living

Tab. 1 Smart city planning and development shortcomings. Categorization of research findings

Brownfield (existing cities) initiatives usually face shortcomings related to organizational issues, such as securing cross departmental collaboration, aligning internal stakeholders, defining clear roles and workforce upskilling. Technological challenges are mostly related with issues of privacy, security and interoperability. While there are frequent financing challenges, as well, these are usually mitigated through the application of innovative or creative business models which establish alternative collaboration routes and bring in external stakeholders. Citizen uptake and stakeholder resonance is critical in smart city initiatives implemented in existing cities, as citizens need not only to be informed, but actively engaged in the co-design of the smart city solution.

Greenfield (new/planned) smart cities, on the other hand, face more massive challenges, typically associated with financing and timing. The research shows that greenfield developments, being massive and ambitious projects, usually face multiple challenges in terms of funding and investment attraction, which makes their advancement slow and sluggish within the current globally restrained real estate market and preference for low risk investment. In terms of physical and ICT infrastructure, many of them are too ambitious to realize, resulting in financing problems, slow advancement rate, and partial cancellation. Other smart city plans are characterized by poor urban design (too strict zoning regulations, inadequate social amenities, architectural repetition, spatial fragmentation etc.), which in hindsight discourage resident and investment attraction.

4.3 BUILDING THEORY FROM RESEARCH

What emerges is that most of the previous shortcomings are interconnected; some complications may be the outcome of the very same cause, while one complication may trigger the appearance of another. We can actually identify two principal path dependencies of co-existing shortcomings (Figure 10).

The first causal path begins with contextual shortcomings (top left box in Figure 10). The pattern is more or less the same in all the cases: the state does not adequately support and facilitate the smart city venture, while lingering bureaucratic problems and changes of key persons in the organizational structure render the venture slow, sluggish and costly. Implementing organizations fail to align stakeholders and establish internal and external collaboration channels. As bureaucratic, administrative and managerial problems accumulate, the interest on the side of investors fades away, and so does its uptake/embrace by citizens. The smart city project stagnates by being unable to secure funds due to the low uptake and low stakeholder resonance, resulting to schedule delays, which in turn enhance stakeholder disengagement and create a self-feeding cycle of entrapment.

The second causal path of shortcomings begins with poor or too ambitious planning, either or both in physical and digital terms (bottom left box in Figure 10). Physical plans of smart cities are characterized by poor and outmoded urban design (too strict zoning regulations, inadequate social amenities, architectural repetition, spatial fragmentation etc.). In other cases, the digital services of smart cities fail to live up to the set standards, rendering the city anything else but 'smart' and creating concerns of privacy, security and panoptic surveillance. Technically speaking, such smart city initiatives are partly or fully unrealizable, resulting to financing deficits, slow advancement, and in many cases cancellation of parts of the project. At the same time, this situation discourages the involvement of residents and the attraction of investment on the side of businesses. Failing to attract international and well educated citizens hinders the development of dynamic local economies that appeal to international businesses. Failing to engage and attract the interest of service users leads to a low uptake of the smart city services. The abovementioned self-feeding cycle of entrapment appears again. Complications backlog and become hard to overcome.

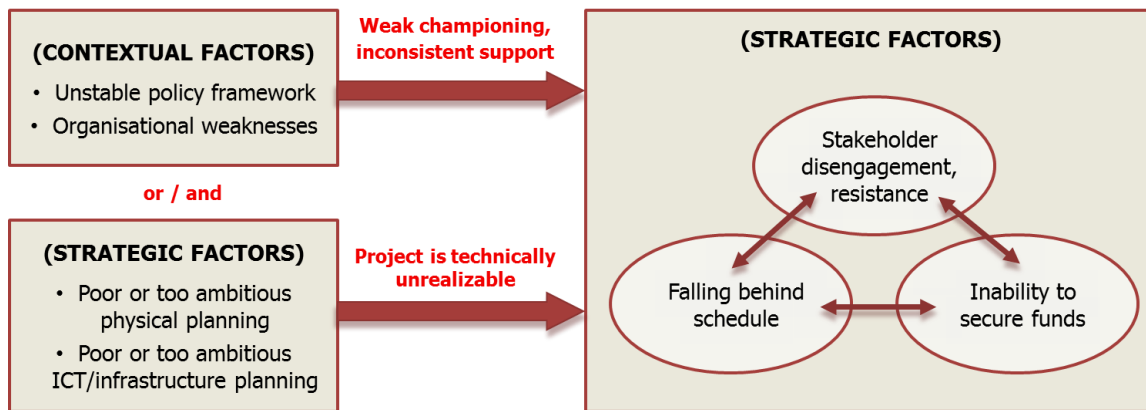


Fig. 8 Theoretical construct: two smart city challenges path dependencies

5 CONCLUSIONS

The smart city strategy discourse is full of smart city strategies that commence with very ambitious plans, only to soon confront detrimental challenges stemming from their context or their own design. In many cases, smart city initiatives were forced to downsize their scope, cancel or alter parts of their plans and revert to creative and alternative ways for securing funds. Based upon this general observation, it is suggested to maintain a more realistic grounding of how far a smart city strategy can go.

Becoming a smart city usually involves large investments in infrastructure and organizational change. Furthermore, smart cities capitalize both on physical and digital assets, meaning that a big number of stakeholders and possible partnership schemes may arise, as well as that highly complex procedural and financing processes are included. Therefore smart cities should be developed upon a clear and simple strategy and plan, capitalizing on thoroughly defined business and governance models.

In an ideal world, smart cities would be developed by solid administrative structures, free from bureaucratic shortcomings on all government levels and with funds allocated and secured in advance, guiding the smart city project firmly and efficiently towards its goals. The reality, however, is very different, and as with any urban development strategy, smart city shortcomings should be anticipated and planned for. By doing so, cities can both avoid their appearance and identify and mitigate them as they emerge.

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IMAGE SOURCES

Cover: author's elaboration

Fig. 1 - 2: <http://www-03.ibm.com/press/us/en/pressrelease/33303.wss>

Fig. 3 - 4: <http://www.living-planit.com>

Fig. 5 - 6: <http://masdarcity.ae/en/>

Fig. 7: <http://www.songdo.com/>

Fig. 8: author's elaboration

Tab. 1: author's elaboration

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Senior researcher at URENIO Research, Aristotle University of Thessaloniki, Greece, since 2004. As a researcher, she has worked in many European and national research projects related with urban, socio-economic, technological/digital growth. Since 2009 she has been also providing teaching support at the School of Architectural Engineering of the same university, lecturing in courses about Urban Planning and Development, as well as Smart Cities and technology-led urban growth. By education she is an architect and urban planner with a focus on urban, digital and social innovation (BSc, MSc, MBA, PhD). She has a PhD in Smart City Planning and Development and she is a post-doc research fellow of the Institute of the Greek State Scholarships Foundation in the field of Urban Digital Social Innovation. She has received numerous fellowships and outstanding performance awards. Her research interests revolve around urban planning and development policy, as well as digital platforms and tools for addressing urban problems, urban and social innovation and the knowledge society.

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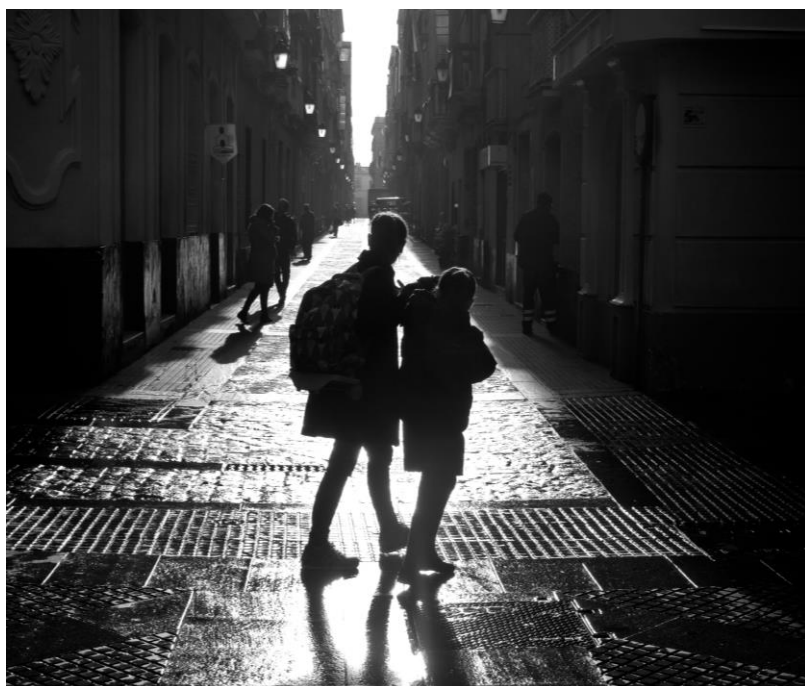
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ACTIVE TRANSPORT TO SCHOOL AND CHILDREN'S BODY WEIGHT

A SYSTEMATIC REVIEW

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ABSTRACT

Because of decreasing physical activity of children, they are becoming more obese. Moreover, commuting to school has become more passive during the past decades. The objective was to update the previous systematic reviews by narrowing down the topic to body mass index of children (3-12 years) as a representative of body composition. Applying search terms such as active transport to school, body mass index, childhood obesity, and so on in four online databases: PubMed, ScienceDirect, WorldCat, and Google Scholar. Peer-reviewed English journal papers published between 2005 and 2015 presenting empirical quantitative studies were eligible studies to be reviewed. 310 journal papers were screened, 27 of which were reviewed by studying the full text. The final 13 papers were limited to those that focused only on active commuting to school and body mass index of children and adolescents. Out of 13 final studies, 3 found conclusive associations, three indicate partial associations in subgroups or societal or geographical limitations, and seven show no correlations. The existing literature are still inconsistent, so this study suggests conducting surveys with larger samples on less-studied contexts and applying more complex statistical methods for adjusting some of the variables. It is also argued that this topic can be culturally and contextually specific.

KEYWORDS:

Active transport to school, body mass index, childhood obesity, overweight, children.

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主动学校通勤与儿童体重： 系统评价

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摘要

由于儿童的身体运动量在不断减少，他们也因此而变得越来越肥胖。而且，在过去的几十年里，被动方式的学校通勤已成为一种常态。本文的目的是为了通过详述反映儿童（3-12岁）身体结构的体重指数来更新以前的系统评价。在以下四个在线数据库中使用主动学校通勤、体重指数、儿童肥胖等搜索术语：PubMed、ScienceDirect、WorldCat 和 Google Scholar。2005 和 2015 年间发表的同行评审英文期刊论文对实证定量研究进行了介绍，符合审查资格。对 310 篇期刊论文进行了筛选，并对其中 27 篇进行了通篇研究审查。最后的 13 篇论文仅限于那些只关注主动学校通勤以及儿童和青少年的体重指数的研究。在最后 13 项研究中，有 3 项研究发现了存在明确的联系，3 项研究表示在群体或社会或地域限制方面存在部分联系，而另外 7 项研究没有联系。现有的文献仍然存在不一致，因此本研究建议对大量较少研究的情况进行调查，并应用更复杂的统计方法来调整一些变量。也可以针对具体的文化和内容来开展这类研究。

关键词：

主动学校通勤，体重指数，儿童肥胖，超重，儿童

1 INTRODUCTION

With continuous increase in body weight of the youth in several regions of the world, researchers and practitioners have recently sought for passive ways for prevention of obesity as a driver of a handful of diseases. The Active Transport to School (ATS)- Body Mass Index (BMI) studies as a part of research on ATS and children's body composition has been noted to be inconsistent in a couple of studies (Ford et al. 2007; Landsberg et al. 2008; Pabayo et al. 2010; Mendoza et al. 2011; Drake et al. 2012; Saksvig et al. 2012; Heelan et al. 2013). The objective of this study is to update our knowledge using the most up-to-date observations conducted recently and to check if the knowledge produced by the scholars of this topic has become consistent. It is meant to refer to a similar study done by Lubans et al. and update their work after six years, though that study targeted both children and adolescents and also investigated not only BMI but a broader range of health-related fitness. Although this review attempts to complete the previous ones, it is new because it narrows down childhood age and only to BMI as a body composition measure.

Respecting the fast-growing field of children's active commuting and their body weight, it would be appealing to test the inclusiveness of the results of the recent empirical studies. After six year of the previous systematic study, it would be relevant to update the feedback using the new quantitative investigations. The field is very much progressive, so it is logical to refresh the systematic reviews occasionally by means of the results of several research groups actively publishing their findings. The studies related to active transportation to school and the effects on children's body weight is currently being developed in several developing countries, thus the new findings may show contextual disparities.

Apart from the clear connections of the research theme to urban transportation planning and urban land use, there are direct connection between the subject and infrastructure planning and indirect but considerable associations with urban environment. The more sustainable transport modes children and their parents take for school commuting, the cleaner will the urban environment be; there are less air and sound pollution. The infrastructure side will be related to development of the sidewalks, bike routes and tracks, infrastructure customized for safety of children, safer and secure playgrounds, customized routes from populated areas to school, and the like. In addition to the benefits for the public health of the society, increasing suitability of the urban environment for walking and biking of children to school can lead to other outcomes in mobility and environment; our understanding about the relationship between the behavior of children and their parents show that changing the travel behavior of children can be associated in change in their parents' travels. Hence, undertaking fundamental research on the commute trips of children can help providing more sustainable mobility for several age groups. These interrelations between sub-topics form a multifaceted subject resulting in healthier, safer, and more livable urban environment for children and their parents.

For such an updating, systematic review without meta-analysis is applied in this paper. Few systematic reviews have been done on the theme of this paper for children and adolescents. Systematic review is considered to be suitable for concluding the results of quantitative studies during the past years since they "Systematic reviews are not only instrumental for implementing evidence-based practice but also for taking stock relative to a particular question (or set of questions) and for the shaping of future research. For development, the primary role of systematic reviews rests with the creation of data-based rationales for newly proposed development activities." (Schlosser, 2006).

2 BACKGROUND

Urban planning has gained importance in promoting public health during the past years (Hoehner et al. 2003). Built environment has been recently addressed by scholars as a determinant of public health (Frumkin, 2003; Jackson, 2003). The role of planners in enhancing public health has been highlighted in academic research

(Bors et al. 2009; Bors & Lee, 2012; Silver, 2012). Urban planning efforts such as interventions in form of community design, housing development, community organizing, greenspace planning, etc. are applied as Active Living by Design provide environments that support active living of residents (i.e. Miller & Scofield, 2009). During the past years, scholars have tried to draw attentions to the potentials of public policy approaches to urban transportation and land development to provide better conditions of public health (Frank & Engelke, 2001). Certain approaches to urban planning or the related shortcomings may be considered as sustainable forms suitable for promotion of public health, while others may be named as unhealthy urban development, i.e. urban sprawl is considered as unhealthy by some researchers: "among those with chronic conditions, including hypertension, diabetes, and lung disease, those who live in areas with more highly connected street networks have higher rated health." (Kelly-Schwartz, 2004).

The existing literature depicts a holistic image of the influences of the physical environment on physical activity (PA) as an important aspect of public health (Sallis et al. 2006; Aytur et al. 2008; Timmermans et al. 2016). Sustainable urban form is associated with forms of PA, when urban planning targets the concept of smart growth principles including housing opportunities, walkable neighborhoods, community and stakeholder collaborations, attractive communities with sense of place, mixed land use, diverse transport mode choices, preserved open spaces, etc.

The role of physical activity in obesity and overweight of children (Goran et al. 1999; Steinbeck, 2001; Hills, et al. 2012; Corder et al. 2016). The linkage between the physical environment and physical activity is built by active transportation, bicycling, and particularly walking as elements of sustainable urban transportation planning (Craig et al. 2002, Handy et al. 2002; van Dyck et al. 2010a & van Holle et al. 2014). Walkability is not the only essence of urban form that can increase PA; some other qualities such as regional accessibility, sidewalks, bike facilities and recreation facility access are also associated with physical activity and concludingly body weight and high blood pressure (Ulmer et al. 2014). This correlation may affect body weight of all age groups (Smith et al. 2008). Neighborhood walkability can be decisive for children's PA (D'Haese et al. 2014). Walkability of the local space around residential places as well as the way to school can be of importance regarding physical activity of the youth. Researchers have majorly suggested to adopt policy to make the surrounding of schools more walkable. The examples are providing safer environment for children to promote their walking to and from school (Shbeeb & Awad, 2013) and selection of school site according to street connectivity (Giles-Corti et al. 2011). In general, 14 different interventions were identified by Chillón et al. (2011) for promotion of active commuting to school in the United States, the United Kingdom, and Australia. The physical activity of children has decreased compared to previous decades (Tanter & Doyle, 1996; Karsten, 2005; Hillman, 2006). The reasons can lay in very different aspects of modern life such as built environment, lifestyles, socio-economics, objective and subjective safety and security, etc. Outdoor physical activities and organized sport practice of US children has been significantly reduced between 1981 and 1997. Lack of PA in children may come together with hypertension, insulin resistance, dyslipidemia, cardiometabolic risk, and finally obesity (Ekelund et al. 2006; Ness et al. 2007; Leary et al. 2008; Owen et al. 2010).

The literature attempting to analyze the circumstances of diminishing PA of children and its correlates are have discussed many aspects including the urban form and neighborhood, socio-economics and social interactions, safety, and security. In many cases, the results of the empirical studies are consistent and reliable. A newer topic that has drawn attention of scholars is the concept of ATS. During the past decades, children's walking and biking to and from school has been weakened. Children are chauffeured to school much more than previous decades in several countries (Department of Transport, 2001, 2009; Sturm, 2004; Karsten, 2005; Salmon et al. 2005; McDonald, 2007; van der Ploeg et al. 2008; Garrard, 2011). There is also evidence that childhood outdoor PA is decreasing (e.g. Sturm, 2004; McDonald et al. 2009) and their body weight is continuously increasing in several countries. The findings related to this topic clearly describe the advantages

of ATS and its contributions to PA. Nevertheless, when it comes to the associations of ATS with children's body weight, obesity, and BMI, the study results are not clear.

3 METHODOLOGY

The present paper presents a systematic review of literature dealing with ATS, BMI, and their associations. The objective is to clarify if the inconsistency in the results addressed in a couple of studies mentioned above still exists. The question that is to be answered by this study is are there significant associations between ATS and children's BMI? This study focuses only on children and avoids to broaden the age to adolescents; the age criterion of this study is thus limited to 3 to 12 years. It is clear that three to six-year old children do not go to school, but in this paper, ATS refers to a wider meaning than only attending elementary school. Here, both elementary school and kindergarten are addressed. The topic is studied in an international context using all the literature from high-income and emerging economies.

ATS and similar terms as well as BMI, "body weight", and obesity were searched for online. Nine different combinations were searched for as illustrated in Table 1. English peer-reviewed journal papers were searched and the results were arranged in Citavi citation management software. Location of published papers played no role in the search. As a result, 310 citations were collected.

CHILDREN'S MOBILITY PATTERNS		WEIGHT
Active Transport to School		BMI
Active Commuting to School	+	Body Weight
Active School Transportation		Obesity

Tab. 1 Search Parameters

Searches in four databases (PubMed, ScienceDirect, WorldCat, and Google Scholar) identified 310 citations published in 2005 and later. Fig. 1 depicts the inclusion/exclusion procedure.

The criteria employed for quality assessment of the final bibliography based on an adaptation of Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement, which is also taken by Lubans et al. (2011). The six assessment criteria of Elm et al. were slightly changed to fit within the topic of this study. For making this study consistent with that of Lubans et al. (2011), the three common studies are assessed according to Lubans et al. These three studies are Heelan et al. (2005), Rosenberg et al. (2006), and Owen et al. (2010).

4 RESULTS

The number of studies on the target topic conducted in the recent years is increasing; four studies have been published in 2015. Nine studies (less than 70 percent) were published between 2010 and 2015, while between 2005 and 2010 only four were out. Five out of 13 studies (38.5%) were conducted in the US. Two studies (15.4%) were done in Canada. Australia, Norway, Sweden, Spain, and China had each one, and one study was international (Table 3). Four studies are longitudinal (Rosenberg et al. 2006; Pabayo et al. 2010; Chillón et al. 2012; Mendoza et al. 2014), which provides a higher quality in discussing causation than the existing evidence back in 2011 by Lubans et al. (2 out of 27 which equals 7.4%). Except Fulton et al. (2005) and DeWees & Ohri-Vachaspati (2015), who applied random-digit dial survey, others took self-reported questionnaires for collecting ATS and other data. Body composition data were measured by research staff, or by other equipment, or were self-reported. Sample sizes differ from 262 in Sweden (Chillón et al. 2012) to 21596 in China (Sun et al. 2015). Samples of one thousand or more have mostly been taken between 2013

and 2015. The widest age range has been 3-18 years (DeWees & Ohri-Vachaspati, 2015), while the narrowest ranges was 10.2 ± 0.7 years (Heelan et al. 2005). All 13 studies examined both sexes. Walking and biking were the essential modes of ATS of the selected studies. Only Yeung et al. (2008) did not observe bicycle trips. ATS ranged from 8.67% (Mendoza et al. 2014) to 69% (Gutiérrez-Zornoza et al. 2015) within the children of the samples, both conducted in the US.

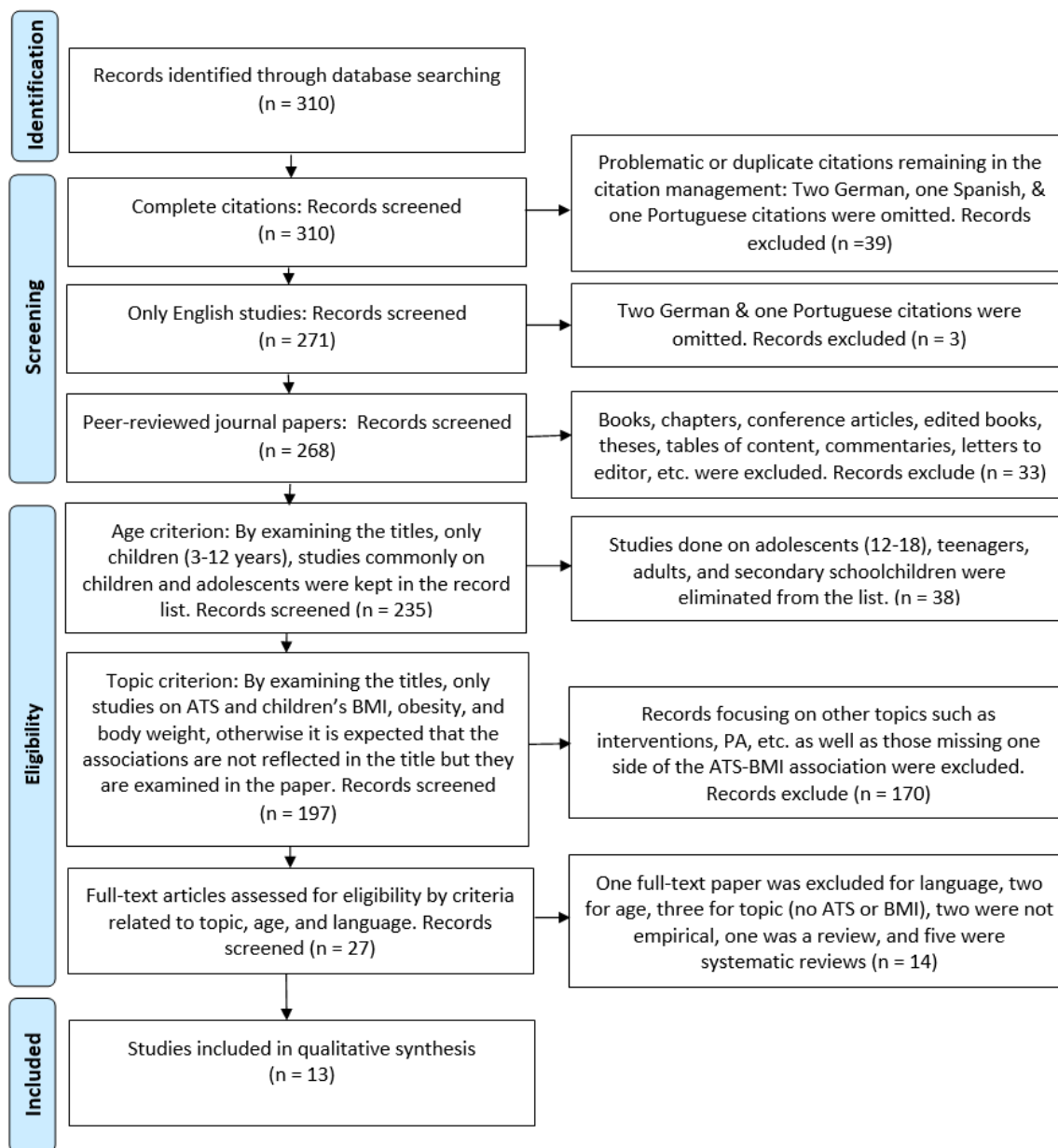


Fig. 1 Flow diagram of study selection. Note: ATS = Active Transport to School

As illustrated in Table 2, six out of 13 studies (46.2%) scored ≥ 4 , which is almost comparable with the quality of 27 studies analyzed in 2011 (Lubans et al.). Only five studies succeeded to provide convincing information concerning random selection of participants/schools (Fulton et al. 2005; Pabayo et al. 2010; Østergaard et al. 2013; Gutierrez-Zornoza et al. 2015; DeWeese and Ohri-Vachaspati, 2015). Reporting the sources and details of BMI was the strength of 10 studies. Most of the studies failed to fulfill the requirement of the last question regarding the number of respondents who completed each of the different measures, and if they succeeded to do so, they did not catch the 80% threshold.

Out of 13 studies, three conclusively confirmed existence of associations between ATS and BMI (Larouche et al. 2011; Sarmiento et al. 2015; Sun et al. 2015), three partially confirm such associations in certain conditions (Rosenberg et al. 2006; Mendoza et al. 2014; DeWeese and Ohri-Vachaspati, 2015), and seven reject any association (Fulton et al. 2005; Heelan et al. 2005; Yeung et al. 2008; Pabayo et al. 2010; Chillón et al. 2012; Østergaard et al. 2013; Gutiérrez-Zornoza et al. 2015). The example of the studies that found associations in specific conditions is Rosenberg et al. (2006) that found significant associations only for boys. The significant associations found by Mendoza et al. (2014) were limited to less safe neighborhoods. Finally, DeWees & Ohri-Vachaspati, (2015) reported inverse associations only for children who walk, bike, or skateboard to school beyond half a mile. The average sample size of the three conclusively confirming studies is 9569, while those of the three studies that found associations in subgroups and some of the measures and seven studies finding no correlations are 4784 and 2769 respectively (Table 3). Table 3 also depicts that more recent studies have found associations more than older ones; three fourth of studies published in 2015 found general or partial relations, four studies out of five conducted between 2005 and 2010 did not report any associations. Except Larouche et al. who found an association from a sample of 315 students, all the other five studies that reported correlations were based on larger samples of around one thousand students or more. Two out of three studies that reported general correlations (Sarmiento et al. 2015; Sun et al. 2015) were done in less-studied contexts or internationally. Both cross-sectional and longitudinal studies found correlations. Except Larouche et al. that did not report clearly about the modes of active transport to school in their study, only Yeung et al. (2008) took a one-mode ATS (walking). This only study found no relations with BMI.

STUDIES	(I)	(II)	(III)	(IV)	(V)	(VI)	QUALITYSCORE TOTAL/6
DeWees & Ohri-Vachaspati, (2015)	1	1	1	0	0	0	3
Sun et al. (2015)	1	0	1	1	1	1	5
Sarmiento et al. (2015)	0	0	1	1	1	0	3
Gutiérrez-Zornoza et al. (2015)	1	1	1	1	0	0	4
Mendoza et al. (2014)	1	0	1	1	1	0	4
Østergaard et al. (2013)	1	1	1	1	1	0	5
Chillón et al. (2012)	1	0	0	1	0	0	2
Larouche et al. (2011)	1	0	0	1	1	0	3
Pabayo et al. (2010)	1	1	1	1	1	0	5
Yeung et al. (2008)	1	0	0	0	0	1	2
Rosenberg et al. (2006)	1	0	0	1	0	1	3
Heelan et al. (2005)	1	0	1	1	1	0	4
Fulton et al. (2005)	0	1	0	0	0	1	2

Tab. 2 Assessment of study quality

- (I) Did the study describe the participant eligibility criteria?
- (II) Were the study schools/ participants randomly selected (or representative of the study population)?
- (III) Did the study report the sources and details of ATS measurement and did the methods have acceptable reliability for the specific age group?
- (IV) Did the study report the sources and details of body weight assessment and did the all of the methods have acceptable reliability for the specific age group?
- (V) Did the study report a power calculation and was the study adequately powered to detect hypothesized relationships?
- (VI) Did the study report the numbers of individuals who completed each of the different measures and did participants complete at least 80% of measure

Author, Year	Observation Location and Time	Study Design / Analysis Method	Data Collection Method	Sample Size	Participants' Age and Sex	ATS Type	Percent of Children Classified as Active Commuters	Result
DeWees & Ohri-Vachaspati, 2015	4 low-income cities in New Jersey (Camden, Newark, New Brunswick, and Trenton) / 2009-2010	Cross-sectional, T-Test and Chi-square tests with some demographic, food consumption and PA variables as covariates.	Random digit-dial household survey: An adult in the household (often parents) talked on phone and did the measurements.	1408 households: 1 randomly selected school-going student per household	3-18 / Both	walking, biking, or skateboarding	47.2%	Without fixing distance, no association were reported. Inverse associations between ATS and overweight/ obesity were found among students who commute beyond half a mile.
Sun et al. 2015	8 cities in different parts of China (Shenyang, Shanghai, Hefei, Wuhan, hengzhou, Chongqing, Kunming, Guangzhou) / 2010	Cross-sectional, multivariate linear regression	Questionnaires administered by research staff in classrooms. Measurements were done by staff.	21596 children and adolescents (9445 boys and 12151 girls), 21280 of whom had BMI information.	Students of grade 1 to 12 / Both	Walking, biking	Not reported	ATS is associated with lower body weight represented by BMI, percentage of body fat, and waist circumference. Children who walked to school were significantly less likely to be obese.
Sarmiento et al. 2015	15 cities in 12 countries (Australia, Brazil, Canada, China, Colombia, Finland, India, Kenya, Portugal, South Africa, UK, and USA) / 2011-2013	Cross-sectional / linear mixed model	Questionnaires. Measurements were done by staff.	6797 children	Students of age 9 to 11 years / Both	walking, biking, roller blades and scooter	37.2% walking and 4.9% bicycling, roller-blade, skateboard, scooter	ATS is associated with lower BMI.
Gutiérrez-Zornoza et al. 2015	Cuenca, Spain / May and June 2006	Cross-sectional / T-Test and Pearson's Chi-square test	Cluster randomized trial	956 participants (472 boys and 484 girls), who join 18 public schools in rural areas.	Students of age 10 to 12 in Grades 5 and 6 / Both	Walking, biking	69% (boys: 68.4%, girls: 69.5%)	No associations.

Mendoza et al. 2014	USA / 1998-2004	Longitudinal / ANCOVA	Questionnaires. Research staff did the measurements using a Shorr board and weight using a Seca digital scale.	12022	Kindergarten to fifth grade / Both	Walking, biking	8.67%	Children from less safe neighborhoods who did ACS had lower fifth-grade BMI z-scores than their peers who did not do ACS, and there was no difference in fifth grade BMI z-scores among children from more-safe neighborhoods.
Østergaard et al. 2013	Norway / 2005-2006	Cross-sectional / multiple linear regression	Questionnaires. Measurements were done by research staff.	2299	Children of age 9-15 from 40 elementary schools and 23 high schools /Both	Walking, biking	48.7% walking, 3.6% bicycling.	No association were found between transport to school and BMI after adjusting for age, gender and leisure time physical activity.
Chillón et al. 2012	Sweden / 1998-2005	Longitudinal / ANCOVA	Computerized self-reported questionnaire	262	9-15 / Both	Walking, biking	Walkers decreased from 54% to 35% during the study time, while bikers increased from 12% to 31%.	No associations were found between ATS and fatness (BMI, waist circumference, and sum of 5 skinfolds)
Larouche et al. 2011	Eastern Ontario, Canada / 2009-2010	Cross-sectional / T-Test, ANCOVA	Self-reported questionnaires. Measurements were done using a portable stadiometer (SECA: Hamburg, Germany)	315	Grades 4 to 6 /Both	Not reported.	21.0% and 30.9% in the Fall/Winter and Spring/Summer seasons	Children who use ATS had lower BMI values, and were less likely to be overweight and obese.
Pabayo et al. 2010	Quebec, Canada / 1997-1998	Longitudinal / growth curve analyses was applied to examine the relationship between sustained ATS and BMI Z-scores.	Questionnaires. Measurements were done by research staff.	1170	From kindergarten to grade 2 /Both	Walking, biking	ATS at age 6: 14.4%.	No association was found between ATS and being overweight (between 75% and 85% percentiles) or obese (>95% percentile).

Yeung et al. 2008	Brisbane, Australia / ?	Cross-sectional / Mann-Whitney U test	Self-administered parental questionnaire	318 participants (46.9% boys and 53.1% girls)	4-12 / Both	Walking	33.6%	No association
								Boys who actively commuted to school had lower BMI ($p < 0.01$). No such association was found for girls. Active commuting to school over 2 years was not associated with BMI change or overweight status.
Rosenberg et al. 2006	Southern California, USA / 1990-1992	Longitudinal / ANOVA	Supervised questionnaire in the classroom. Caltrac accelerometers.	924 participants in 5 th grade at the end of the study period (53.2% boys; 46.8% girls)	4 th and 5 th grade students in 7 suburban elementary schools / Both	walking, biking, skateboarding	20%	
								36% of the children who lived between 0.8 and 1.6 km from their school actively commuted at least 50% of the time. 9% actively commuted more than 75% of the time each week.
Heelan et al. 2005	Nebraska, USA /	Cross-sectional / multiple regression	Questionnaires sent to children's houses. Research staff did the measurements in schools using Seca Platform Scale, model 707.	320 participants (44% boys and 56% girls) in 8 rural schools	Age 10.2 ± 0.7 years /Both	Walking, biking, skateboarding / scooter		Significant positive associations were found between active commuting to school index (number of active commutes by distance to school) and BMI. No results were reported indicating ability of ATS in attenuating BMI.
								No associations: compared to obese/overweight participants, those with normal BMI have 0.8 (0.5-1.1) times the odds of using ATS.
Fulton et al. 2005	USA / 1996	Cross-sectional / multivariate logistic regression analysis	Random digit-dial household survey, Computer-assisted telephone interviews	1458 parent-child pairs	Students of grades 4 to 12 / Both	Walking, biking	Walk: 11.4%, bike: 2.6%.	

Tab. 3 Review results

5 DISCUSSION AND CONCLUSION

The results of this systematic review shows that after an increase in the number of studies on ATS and BMI of children, the results are still not consistent. No conclusive result is thus to be derived from the studies published after 2005. However, the partial conclusion can be active transport to school may lead to lower BMIs in children, particularly for longer walking/cycling distances, for boys, and in less safe neighborhoods. Despite conduction of several interesting studies during the past five years, the finding of this review is still in line with five older systematic reviews that did not find the international findings consistent and compelling (Lee et al. 2008; Faulkner et al. 2009; Lubans et al. 2011; Schoeppe et al. 2013; Larouche et al. 2014).

It is noteworthy that this study has been narrowed down to only children and BMI in hope of better quality of research, while most of the abovementioned systematic reviews have much wider topics; i.e. the associations of ATS with children's PA and weight (Lee et al. 2008; Schoeppe et al. 2013), the same associations in children and the youth (Faulkner et al. 2009), ATS with health-related fitness in children (Lubans et al. 2011), and finally ATS with PA, body composition, and cardiovascular fitness in children and adolescents (Larouche et al. 2014). For undertaking this study, it is assumed that narrowing down the effective factors of the associations as well as the age limit may promote the quality of the review.

Based on the results of this review, more studies are needed to clarify the possible associations. Two points are necessary to be cared about in the future research: (1) larger sample sizes; (2) less-studied contexts. The results of this review reveals that most of studies that found significant correlations were carried out enjoying at least one of the above conditions.

The findings of this study confirms the comment of Bere and Anderson (2009) who believe higher sample sizes may provide higher statistical power for finding associations of ATS and BMI. The literature studied in this paper suggest that in case seeking universal and conclusive associations may fail, investigating subgroups, geographical and contextual settings, or different socio-economics can lead to identifying relationships, e.g. some studies address the ATS-BMI relationship stronger in boys, or the associations may be stronger for cycling rather than walking. More complex statistical methods for controlling for some of the variables may help identify relative relationships.

Two recent studies published in 2015 focused on less-studied contexts like China (Sun et al. 2015) and an international group of countries mostly among emerging economies (Sarmiento et al. 2015) found conclusive correlations. This suggests that if the future studies are directed towards these regions, a better understanding of different ATS-BMI relationships are provided and more significant outputs maybe resulted. This idea is supported by limited number of a recent research that show the correlated of ATS may be context-specific (Larouche et al. 2015) and that in a multi-ethnic society like England, the ATS habits are different among ethnicities: "white European children were more likely to walk/cycle, black African Caribbeans to travel by public transport and South Asian children to travel by car" (Owen et al. 2012). If ATS behaviors are different inside a single country, then it can be hypothesized that habits like the speed and intensity of walking or biking to school may be various in different geographies and cultures. This may cause changes on the effectiveness of ATS on children's body weight. While in some cultures children may have interest to walk or bike faster than some other contexts, PA may be affected differently, and consequently BMI may be attenuated in a higher level. We have very little evidence about the culturally and contextually specificity of ATS-BMI correlations. Thus, this topic deserves more observations and analyses.

To sum up, this systematic review of recent literature indicates inconsistency in ATS-BMI relationship research results. Further research by means of larger samples in less-studied contexts and cultures may be useful for shaping the overall structure of the subject.

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IMAGE SOURCES

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TeMA

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REVIEWS PAGES

METHODS, TOOLS AND BEST PRACTICES TO INCREASE THE CAPACITY OF URBAN SYSTEMS TO ADAPT TO NATURAL AND MAN-MADE CHANGES 1(2017)

Starting from the relationship between urban planning and mobility management, TeMA has gradually expanded the view of the covered topics, always remaining in the groove of rigorous scientific in-depth analysis. During the last two years a particular attention has been paid on the Smart Cities theme and on the different meanings that come with it. The last section of the journal is formed by the Review Pages. They have different aims: to inform on the problems, trends and evolutionary processes; to investigate on the paths by highlighting the advanced relationships among apparently distant disciplinary fields; to explore the interaction's areas, experiences and potential applications; to underline interactions, disciplinary developments but also, if present, defeats and setbacks.

Inside the journal the Review Pages have the task of stimulating as much as possible the circulation of ideas and the discovery of new points of view. For this reason the section is founded on a series of basic's references, required for the identification of new and more advanced interactions. These references are the research, the planning acts, the actions and the applications, analysed and investigated both for their ability to give a systematic response to questions concerning the urban and territorial planning, and for their attention to aspects such as the environmental sustainability and the innovation in the practices. For this purpose the Review Pages are formed by five sections (Web Resources; Books; Laws; Urban Practices; News and Events), each of which examines a specific aspect of the broader information storage of interest for TeMA.

01_WEB RESOURCES

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

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02_BOOKS

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

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03_LAWS

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

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04_URBAN PRACTICES

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

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05_NEWS 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开，并始终保持科学严谨的态度进行深入分析。在过去两年中，智能城市（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。

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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

城市的实践描述了期刊主题在实践中最具创新性的应用。

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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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METHODS, TOOLS AND BEST PRACTICES TO INCREASE THE CAPACITY OF URBAN SYSTEMS TO ADAPT TO NATURAL AND MAN-MADE CHANGES 1(2017)

REVIEW PAGES: WEB RESOURCES

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In this number

IDEAS AND APPROACHES TO FACE CLIMATE CHANGE IN CITIES

Climate change is a systemic challenge for cities (EEA, 2016). It is influenced by environmental and socio-economic factors of urban contexts. While lifestyle, consumption and production affect the amount of GHG emissions, hence the mitigation challenge, the spread presence of cities in risk areas reduces the capacity of urban systems to respond effectively to climate change impacts (i.e. heatwaves, extreme rainfalls, sea level rise, etc.). Therefore, cities have started to implement different measures of urban adaptation.

Considering that urban areas can be seen as melting pots for human activities and often hit by several climate change impacts simultaneously, adaptation measures need to cover a broad range of issues, including technological, informational, organizational, etc., at various governance levels, as well as sectoral and cross-sectoral levels (Biesbroek et al., 2010; Papa et al., 2015). Indeed, climate impacts vary significantly from country to country. Therefore, different adaptation measures are defined considering the specific urban context. Many of those actions are part of long-term strategy, but the majority of them are low-cost and soft measures, such as emergency plans, institutional procedures and behavioral advice. Today, although the definition of climate change adaptation promoted by IPCC (2014) is largely shared, different approaches are adopted in order to face climate change and to build up resilient cities. Moreover, in the last years, many efforts have been oriented toward a definition of a methodology to develop adaptation strategies in different urban contexts (Carter et al., 2015).

In this number, three websites are presented in order to describe different methodological approaches aimed at improving the capacity of urban systems to face future changes associated with climate change. The first one is the website of research project TURAS, which has developed a twinning approach bringing together decision makers in local authorities with SMEs and researchers to improve and fulfill urban resilient strategies and measures; the second website is FRC – FloodResilientCity, an EU-funded project for implementing urban resilience in eight cities of North West Europe to the increasing likelihood of floodings due to sea-level rise and increased flood flows on rivers, streams or due to extreme rain (pluvial flooding). Finally, the third website is the one developed by ISET-International, a non-profit research, training and technical support organization, which supports sustainable solutions to improve the resilient capacity of local communities and urban areas, in particular in the cities of developing countries of Asia.



TURAS (Transition towards Urban Resilience and Sustainability) is the website of an EU funded project, started in October 2011 and finished in September 2016. The project aimed to bring together urban communities, researchers, local authorities and firms for a total of 26 project partners (specifically, 11 local authorities, 9 leading academic research institutions and 6 SMEs) to develop, realize and disseminate strategies and measures in order to improve the resilience capacity of European cities. The specific challenges addressed in TURAS included: climate change adaptation and mitigation; natural resource shortage and unprecedented urban growth. Therefore, TURAS has developed a framework and a process for collecting data at neighborhood scale through a geospatial ICT infrastructure. Such data were used to develop and test new approaches to increase urban resilience and reduce the urban ecological footprint of each participating city to the project.

The main results are articulated in six work packages:

- geospatial ICT – Support Infrastructure for Urban Resilience;
- greening Public and Private Green Infrastructure;
- urban/Industrial Regeneration, Land Use Planning and Creative Design;
- climate Change Resilient City Planning and Climate-Neutral Infrastructure;
- limiting Urban Sprawl;
- short-Circuit Economies.

The TURAS website presents four sections: *About TURAS*, *Results*, *Resources* and *Contact us*. The *About TURAS* section is composed by the homepage of the website with general information about the projects, a list of project partners and a useful sitemap for website users. The second section, *Results*, contains 85 TURAS solutions, divided into four categories:

- *TURAS tools*: such tools consist in analytical toolkits, process methodology, community engagement tools and implementation guidelines to help cities respond to a broad range of urban challenges from climate change adaptation. For instance, the *Space-Engagers* is a tool made of guidelines and online platform to identify the underused urban spaces in order to improve the strategic urban planning to “address multiple challenges and facilitate the transformation of social and ecological systems in the city”;
- *Integrated Transition projects*: these projects combine the above-mentioned TURAS tools in an integrated cross-disciplinary approach to dealing with large scale urban challenges;
- *TURAS Pilots*: TURAS Pilot projects are implemented by TURAS participants. In total, there are 33 Pilots and each project reports obstacles and resources limitations faced by stakeholder for implementing the solutions;
- *Place-based Strategies*: Place-based Strategies presents the experience and lessons learned from TURAS cities through combination, adaptation, implementation and check.

Instead, the *Resources* section is articulated in eight pages which collect a wide variety of materials which are related both to the TURAS project itself and to the related topics. *Videos* page contains several interviews to project partners related to different initiatives’ topics. *Blog* and *News* report information about TURAS activities. In *TURAS Events* there is a list of events organised by TURAS or to which has taken part and the *Images* page collects several photos of such events. In *Documents* and *Deliverables* pages more than hundred documents and research reports can be freely downloaded. Finally, about the *Contact us* section for each project outcome there is a nominated contact person for further information, even if the project is finished.



The FRC project (acronym of FloodResilienCity) is a project funded within the INTERREG NEW – the EU Programme aimed at promoting the economic, environmental, social and territorial future of the North-West Europe. The main aim of the FRC project is to enable public authorities in eight cities across North West Europe region to better cope with floods in urban areas, also thanks to a combination of transnational cooperation and regional investments. What it is worth to note is that the project brings together experts (e.g. water engineers and flood managers) and public authorities, but it also involves “*people who have interests in other aspects of water management such as for supporting ecosystems*”. The purpose and the main structure of the website are described in the page *Using this Website*. Indeed, this website has been developed with a twofold goal:

- to communicate and disseminate the detailed results of the FRC project for people involved in urban design and water management, as well as university researchers and the people in the FRC partner organisations. The specific section *FRC Output* includes these results and it is can be seen directly from the home page;
- to represent an on-line resource for introducing of the flood management topic “*to all the people affected by or interested in flooding and whose jobs and roles may make them stakeholders in flood management*”. In order to reach this goal the section *Adaptation in the built, natural and water environments* has been added to the homepage.

Specifically, the user interested to FRC results can access the *FRC Output* where contents are grouped into 4 sub-sections:

- the *Our end conference*, where the final presentations can be downloaded;
- the *Sharing learning and experience* pages, which share the knowledge and experience developed into the project framework;
- the *Flood resilient actions in FRC*, where the actions to improve resilience to different types of flooding taken by the eight case studies are described,
- the *Training* part that collect material to understand flooding concepts, flood management and resilience for towns and cities as well as the FRC project framework and results.

However, if the user prefers to investigate the FRC topics in accordance with the project framework, he can click on the *Adaptation in the built, natural and water environments* tab from the homepage. Then, the user can access the topics in three different ways: depending on the topics by means of the navigation tools *Themes*, depending on the type of water (e.g. water supply and drought) thanks to the navigation tool *Water types* or typing the terms directly in the *Search website*, available on the top of the above mentioned navigation tools. In addition to this, the website provides the users with the *Glossary* section where technical contents are explained in order to increase awareness about the flooding in urban context using simple language.

Since one of the aims of the FRC project is to provide as many people as possible with useful information and materials, there is also a section about the *Links* section where related projects are briefly explained, as well as the possibility to translate the site in other five languages, which are the ones of the project partners. The importance of dissemination and communication is also highlighted by the presence of links to two image hosting and video hosting websites (i.e. YouTube and Flickr channels). Finally, on the bottom part of the website, there is a sliding bar that allows users to visualise the logos of the partners involved in the project. In detail, project's partners are equally constituted by research institutes and public administrators.



ISET-International – namely Institute for Social and Environmental Transition – is involved in the development of strategies to improve the resilience and the adaptation capability of the cities (mainly Asiatic ones) towards natural resource, climatic, environmental and social challenges. It is important to note that this foundation has some core principles (e.g. Partnership, strategic thinking, communication, and commitment) as the basis for its research, training and implementation activities.

The website is subdivided into 4 main sections, and an additional section with the contact form. The four sections are the followings:

- Projects: in this section, the projects where ISET has been involved are collected year by year, since 2006. The projects are related to the topics of urban resilience, the resilience assessment, disaster risks, resource management, etc...
- Resources: within this section, there are several materials such as reports, case-studies, discussion papers, journal articles and resources and training materials to support the needs and approaches of different groups, as well as videos and conference presentations.
- Network Capacities: as already introduced, the partnership and communication are strategic principles for ISET. In order to foster the collaboration between partners, a presentation of ISET core activities is shown. Moreover, also the members and the collaborators are listed in order to provide information about possible contact persons.
- Blog and news: thanks to the contributions of the partners and the collaborators, this section includes information and news about their research from all over the world. In detail, the section leads to another website (blog.i-s-e-t.org) where information and news are subdivided into specific categories.

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IMAGE SOURCES

The images are from: <http://www.turas-cities.org/about>; <http://www.floodresiliency.eu/>; <http://i-s-e-t.org/welcome.html>

METHODS, TOOLS AND BEST PRACTICES TO INCREASE THE CAPACITY OF URBAN SYSTEMS TO ADAPT TO NATURAL AND MAN-MADE CHANGES 1(2017)

REVIEW PAGES: BOOKS

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In this number
THE URBAN ADAPTATION TO CHANGES

The urban areas and especially the cities have become the most desired place to live. In fact, the population living in cities is greater than the rural population. In recent years this has caused significant migratory movements that have no comparisons in human history. This urbanization process is which will significantly influence the economic, political and social transformation of societies and their spatial impacts. It is evaluated that up to 70% of the global population will be living in cities by 2050. So, spatial and functional interrelations between cities, settlements and their surrounding rural areas are increasing and the metropolitan scale is gaining more and more relevance for integrated urban and city-regional planning, governance, financing, and implementation. The urban areas are becoming spatially, functionally and economically interdependent with their surrounding areas constituting metropolitan regions. The need for holistic approaches to govern these urban agglomerations becomes ever more pressing. Local authorities, planners, decision makers as well as the international development community consequently need to look beyond traditional administrative and jurisdictional boundaries. This is why there is now an increasing focus on metropolitan governance as an essential mechanism for cooperation beyond city boundaries, achieving efficiency gains for cost effectiveness, improving delivery of basic services for all, ensuring equitable distribution of resources, promoting balanced territorial development, and many other needs.

An additional challenge, that the cities are facing, concern the evident and worrisome effects of climate change. So for the urban areas it is necessary to forecast some long term adaptation strategies to reduce the negativeness. In fact, climate change seems to currently represent the main threat to urban development in the near future: cities are indeed the main contributors to energy consumption and GHG emissions paying, at the same time, the highest price for increasing climate impacts (Papa et al., 2015). There are many challenges to cope especially for the local authority. The financial crisis has reduced the municipality and metropolitan budget and public and private investors are hard to find.

According to these themes, this section suggests three books and reports that help to better understand the issue of this number: Metropolitan Governance: A Framework for Capacity Assessment, The lightweight city. Smart city and operative planning and Smart Governance Successful Initiatives and Financing urban adaptation to climate change.



Title: **Metropolitan Governance: A Framework for Capacity Assessment**

Author/editor: Jenny Pear son

Publisher: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Publication year: 2016

ISBN code: -

The Sector Project “Sustainable Development of Metropolitan Regions”, implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), develops action-oriented advisory services on the role of metropolitan regions as drivers for sustainable development. This Framework for Metropolitan Governance Assessment – Guidance Notes and Toolbox forms part of the publication series “Sustainable Development of Metropolitan Regions” that gives conceptual guidance and recommendations for hands-on approaches for development organizations as well as partner countries in the field of sustainable development of metropolitan regions.

The Metropolitan Capacity Assessment Methodology (MetroCAM) presented here has been developed to offer a set of tools for actors in metropolitan regions who want to initiate change, and for the agencies planning to support them do so. It is a generic methodology that provides guidance about what needs to be covered when assessing the governance capacity of a metropolitan region, starting with existing capacity, future needs, and potential trigger points and then identifying what else is needed to deal with a particular need or challenge (e.g. mobility, resilience, social inclusion).

The MetroCAM presented here has been developed to offer a framework and accompanying tools for any actors in metropolitan regions who want to initiate change, and for the agencies planning to support them do so. It is a generic methodology that provides guidance about what needs to be covered when assessing governance capacity of a metropolitan region. The approach stresses the need to start with understanding existing capacity as the first step and then to identify what else is needed to deal with a particular need or challenge. As important as the capacity assessment itself, the MetroCAM is also a process to build consensus. The whole assessment process is a way to foster dialogue and get political buy-in to initiate or deepen a reform.

The Part A provide guidance and a structure to lead decision making about: start up activities; how to conduct the assessment process - through steps such as stakeholder mapping, gathering core data, conducting consultative workshops, and so on; a framework for assessment and analysis; and using the analysis to identify recommendations and next steps for action. There is also guidance on issues such as resources considerations and working on a theme. Part B is a selection of useful tools for conducting the relevant activity steps.

The ultimate aim of the MetroCAM is to lead to an informative analysis of key issues, capacities and needs, that in turn result in recommendations for initiatives that would contribute to solving problems, creating innovations, or improving existing services and conditions.

In conclusion the tool is useful for two purposes:

- (i) as a workshop exercise, to get participants engaged in a discussion about the current state of services and the priorities for change or improvements in the specific sector;
- (ii) it can be used as part of the decision making process at the end of the assessment, when reviewing key findings and recommendations, to help decide which challenges or initiatives should be addressed first.



Title: Financing urban adaptation to climate change

Author/editor: European Environment Agency

Publisher: European Commission

Publication year: 2017

ISBN code: 978-92-9213-845-5

This report was written through a collaboration between European Environment Agency (EEA) and European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation (ETC CCA).

Notwithstanding the global, European and national efforts to unlock climate change finance, this is a major challenge for relevant authorities and private stakeholders. To advance adaptation measures in municipalities, it is important to improve the capacity to find these sources, apply for funding and negotiate the various financing streams. The report supports the public and private stockholders who wants to make use of the experience of a specific case study to get in direct contact with the relevant municipality, and eventually to set up a peer-to-peer learning process. In the first part of report, the authors list and describe some main local adaptation financing measures, that are: Governmental sources - mostly grants, including international and EU funding instruments, national, regional and local municipality budgets; Banks and other financial institutions provide loans or guarantees, either directly or in partnership with local retail banks; Private stakeholders, including foundations, real estate developers, companies, house owners and individuals, that invest in measures directly or via crowdfunding and green bonds; Free/low-cost solutions exist through early integration of adaptation needs into urban planning and design, mainstreaming of adaptation measures into other municipal areas such as water management, health, nature, etc., or through supporting regulations such as building standards. In the second part, the report proposes short and schematic descriptions of eleven European case studies that have adopted some financial models for implementing adaptation measure, so to provide an insight into the different ways to finance urban adaptation actions. The cases featured in the report can inspire and share valuable practical experience but require creative handling and adjustment to specific local conditions to make them work elsewhere.

After the analysis of the case studies the report proposed a summary of interesting lessons can already be learned from this limited set of studies, that are collect in three different paragraph listed below:

- Wise use of financial sources. Many successful instances of financing adaptation measures, European cities and municipalities combine different types of financing from various sources in different sectors and from different governmental levels;
- Essential capacities are needed in or for cities. Some of key factors for advancing adaptation action in municipalities is to establish the capacity to identify, apply for and negotiate various financing streams. This requires an expert staff, which is a problem in particular for smaller municipalities, where adaptation is often only an office with one staff member;
- Communication, reasoning, convincing. Implementing measures successfully requires more than financial resources. It also requires sufficient awareness and support among decision-makers in the public and private domain, and among citizens and other stakeholders. An adaptation strategy or plan often helps to raise such awareness.

In conclusion, financing of the adaptation measures, that change the way a city is built and organised, can be easy or difficult to implement. Because the measures often fall under the responsibility of many different sectors. However, taking the comprehensive perspective of integrated and long-term urban development, and considering the municipality as a whole, can result in lower overall costs and many additional benefits.



Title: The lightweight city. Smart city and operative planning

Author/editor: Giuseppe Mazzeo

Publisher: Fedoa Press

Publication year: 2016

ISBN code: 978-88-6887-005-8

This book has been published on the open access platform FedOABooks of the University of Napoli Federico II, in the series Smart City, Urban Planning for a Sustainable Future. This research work is a further advancement of the SEM project - Smart Energy Master to development a model of governance for energy saving and efficiency of the territory with reference to both the urban areas. The project was financed within the Smart Cities and Communities PON projects and ended in January 2016.

The aim of this book is to analyse urban structures and knowing what features could have to contrast the two opposing forces acting on the same scene: on the one hand the unabated urbanization process, on the other the ever growing demand for real sustainability. So, the author proposes an urban planning response focused on the transformations of urban sectors to be achieved using innovative operative tools. The goal is to include in the cities innovative actions that can provoke a domino effect with repercussions on the entire urban structure. The book is divided in five sections, that are briefly described below: the first one addresses the issue of urbanization and the development of the urban systems, with the related implications in terms of resource consumption and concentration of people and functions; the second part discusses some models that explain the mechanisms of urban sprawl and the derived scenarios; the third part deals with one of the key nodes of the relationship between urban systems and environmental resources, namely the energy; the fourth part analysis some international and European case studies to extrapolate recurring characteristics that can affect the operative planning in terms of sustainable and smartness; the fifth part, finally, it deepens the structure and elements that must be part of this new type of plan, with the aim to start in the cities localized innovative actions such as to involve the entire urban structure.

In conclusion, this book seeks to start the development of scientific debate and good practice of implementing urbanism that are weak of theoretical bases and lack of interest in the management level. One of the ways, in which it is possible to give consistency and coherence to the study of urban systems is to steer the growth and development of the cities fairly and sustainably. So that the interaction between technology and man is able to make the city balanced in consumption and efficient of energy.

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METHODS, TOOLS AND BEST PRACTICES TO INCREASE THE CAPACITY OF URBAN SYSTEMS TO ADAPT TO NATURAL AND MAN-MADE CHANGES 1(2017)

REVIEW PAGES: LAWS

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URBAN PLANNING AND GOVERNANCE IN EUROPEAN METROPOLITAN AREAS

European cities have been facing very serious economic, environmental, social and demographic challenges during recent years, especially in urban areas. If, on one hand, economic growth has driven the fast spatial expansion of urban areas in the last decades, on the other hand, European local governments have not updated their territorial architecture, which has remained unaltered for decades in most countries. Therefore, in many cases *"the 'economic city' has become much larger than the 'administrative city'. With the outdated institutional and territorial structures, public interests are poorly represented and remain a long way behind the dynamism of private actors"* (Tosics, 2011).

In this context, as globalization moves forward, European countries have been trying to modernize their government structure and their spatial organization in order to promote growth and innovation. Hence, new governance models on functional spatial levels have emerged for integrating urban planning strategies and decision-making processes (Barresi & Pultrone, 2013).

The conceptual idea of metropolitan cities (or regions) was born based on these considerations. In particular, *"the hypothesis at the basis of Metropolitan cities concern the idea that, within metropolitan areas, the main city and the smaller edge towns are characterized by close economic and social interdependences, which are, however, beyond the jurisdiction of individual municipal governments"* (Crivello & Staricco, 2017). In this light, different European States have promoted territorial reforms and, according to a study by the Thomas More Institute (2009), *"encouraged by the European Union, regions will become the frame of reference for European regional politics, aiming to promote the development of competitive territories whilst maintaining their cohesion"*. Therefore, this issue of TeMA focuses on the different territorial organization and governance models of three European countries:

- Italy, which recently changed its administrative structure introducing fourteen metropolitan cities;
- France, which reorganized its territorial architecture reducing the number of regions from twenty-two to thirteen, strengthening the role of metropolitan cities;
- Germany, with its eleven metropolitan regions assigned by the Ministerial Conference on Regional Planning between 1997 and 2005.

Three different names for similar urban conurbation, which have been created for similar reasons, such as better managing economic and social growth, reduce public costs and promote more equality across territories.



URBAN PLANNING & GOVERNANCE IN ITALY

Italian Metropolitan Cities were first introduced by the Law 142/1990, which identified nine urban areas – Torino, Milano, Venice, Genoa, Bologna, Firenze, Rome, Bari, and Naples – that should have become metropolitan cities. However, the legislative provisions have been only on paper for over twenty years because of bureaucracy and political impasse (Piolette, Soriani). Only in 2014, with Law 56/2014 (also called Delrio Law) the nine metropolitan cities became effective, and by January 2016, they become operative. In addition to the nine metropolitan cities defined by the Delrio Law, five new metropolitan cities have been instituted between 2016 and 2017: Reggio Calabria, Catania, Palermo, Messina and Cagliari. Therefore, up to now, Italy has fourteen metropolitan cities, whose administrative boundaries correspond to those of the former Provinces. Crivello and Staricco (2017) argue that the Delrio reform had three main objectives: (1) *"first, it aimed at cost containments and savings, as the newly appointed councillors of the remaining Provinces and Metropolitan cities do not receive a salary"*; (2) *"second, the law tried to promote inter-municipal cooperation as the main governance approach at the intermediate level between Municipalities and Regions"*; (3) *"third, the law conferred to Metropolitan cities not only functions originally held by Provinces but also new ones concerning infrastructures, services and national and international relations"*.

Nevertheless, several issues have emerged since the law has been approved, especially with regard to the third goal identified by Crivello and Staricco (2017). In particular, there is still lack of transparency involved in the distribution of competences among regions, metropolitan cities and municipalities. Indeed, the different roles often overlap, thus slowing down the empowerment of metropolitan cities.

A clear example of this ambiguity in the division of roles concerns the adoption of the *metropolitan general spatial plan*. According to the Law 56/2014, metropolitan cities should develop and adopt this new urban planning tool, but the content of this plan is not specified in the Law, which gives this responsibility to the twenty Italian regions, according to their specific planning regulations. This type of administrative organization inevitably reduces the power of metropolitan cities and their functions.

Another critical issue about the role of metropolitan cities is funding streams. By replacing former provinces, indeed, metropolitan cities have access to provinces' budget, which has been severely cut during the last years; at the same time, the number of the strategic competencies of metropolitan cities has increased, thus bringing to light the need for additional funds. This issue has been substantially addressed by the European Commission in 2015 with the adoption of the National Operational Programme (PON) "Metropolitan cities 2014/2020". The total budget of the program for the fourteen Italian metropolitan cities amounts to about 893 million. The program was born in the framework of the European Urban Agenda and aims at strengthening the role of big urban areas by investing in the modernization of public services as well as in improving social inclusion, especially in disadvantaged territories. The program focuses on four priority axes: (1) digital metropolitan agenda; (2) sustainability of services and of urban mobility; (3) public services for social inclusion; (4) infrastructure for social inclusion. Based on these four main areas, the program identifies three groups of expected results that include the following: (1) regarding the digital agenda, one of the goal is providing 70% of metropolitan citizens with digital interactive services; (2) regarding urban sustainability, the PON aims to modernize lighting systems, reducing electricity consumption for public lighting by 8.8%, increase cycling and the number of passengers of public transport systems; (3) regarding social inclusion, one objective is to create and renovate over two thousand apartments for disadvantaged families.



URBAN PLANNING & GOVERNANCE IN FRANCE

A new map of France reorganized its internal administration, reducing the number of regions from twenty-two down to thirteen. After months of debate, resistance, changes, and much reshuffling of cartography, the 13-region version was adopted by the *Assemblée Nationale* – the lower house of the bicameral Parliament of France – with effect in January 2016 with the aim to simplify bureaucracy and save costs.

The French state is decentralised territorially in order to coordinate and deliver state functions more effectively. While French regions do not hold legislative authority – they do not write their own laws – they do indeed have considerable discretionary power over infrastructure and operational spending in education, tourism, public transit, universities and research, unemployment, and assistance to businesses.

The new map ratifies the merging of the following regions:

- Alsace, Lorraine and Champagne-Ardenne;
- Nord-Pas-de-Calais and Picardy;
- Burgundy and Franche-Comté;
- Upper Normandy and Lower Normandy;
- Rhône-Alpes and Auvergne;
- Midi-Pyrénées and Languedoc-Roussillon;
- Aquitaine, Limousin and Poitou-Charentes.

And six unchanged regions:

- Brittany;
- Corsica;
- Ile-de-France;
- Centre;
- Pays de la Loire;
- Provence-Alpes-Côte d'Azur.

There are two main principles behind the French reform: (a) simplify the administrative organization by strengthening the couple region/inter-municipal grouping at the expense of the historic couple (inherited from the French Revolution), department/municipality (these two levels do not disappear); (b) clarify the competences between levels of local governments with specific roles, avoiding duplication and rationalizing public spending.

Furthermore, The French government wanted to give its regions a "European size" in order to compete with its European neighbors. The redrawing, indeed, has increased the size of French regions, which were generally smaller than regions in other EU member states. Four French regions are part of the 50 most-populated regions in Europe, including Champagne-Picardie, Normandy, Alsace-Lorraine and the Centre-Poitou-Limousin.

Lastly, the territorial reform aims *"to give new impetus to economic development and to address the challenges of sustainable and inclusive growth, relying on the metropolitan cities and the regions as the two main levers. The metropolitan reform could have a significant impact on long-term GDP growth if it is implemented effectively without recreating intermediate layers that could diminish its impact"* (OECD, 2014).



URBAN PLANNING & GOVERNANCE IN GERMANY

Germany has eleven metropolitan regions, seven of which were identified by the Standing Conference of Federal and State Ministers Responsible for Spatial Planning in 1997 – Berlin/Brandenburg, Hamburg, Munich, Rhine-Ruhr, Rhine-Main, Stuttgart and Halle/Leipzig-Saxon Triangle – and four of which were added in 2005 – Nuremberg, Hanover, Bremen and the Rhine-Neckar Triangle. According to the German Federal Office for Building and Regional Planning (BBR) and the German Federal Ministry of Transport, Building and Urban Affairs (2006), metropolitan regions are *"primarily high-density urban agglomerations with at least 1 million inhabitants. They are spatial and functional locations whose prominent functions extend beyond international borders and are the main driving forces behind societal, economic, social and cultural development"*.

As presented in the document "Concepts and Strategies for Spatial Development in Germany" (BBR, 2006), four main factors are crucial for the functional sphere of influence and cooperative activities of the eleven German metropolitan regions:

- the concentration of political and economic centres of power and the control of international flows of capital and information;
- a high density of scientific and research establishments and the presence of high-quality cultural facilities and creative environments;
- good international accessibility provided by high-quality transport infrastructure and many and varied options for the exchange of goods, knowledge and information;
- a high degree of significance in historical, political, cultural and urban development terms and a corresponding international reputation.

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IMAGE SOURCES

Fig. 1 https://commons.wikimedia.org/wiki/File:Flag_of_Europe.svg; Fig. 2 <https://pixabay.com/it/photos/italy%20flag/>; Fig. 3 https://it.wikipedia.org/wiki/File:Flag_of_France.svg; Fig. 4 https://it.wikipedia.org/wiki/File:Flag_of_Germany.svg

METHODS, TOOLS AND BEST PRACTICES TO INCREASE THE CAPACITY OF URBAN SYSTEMS TO ADAPT TO NATURAL AND MAN-MADE CHANGES 1(2017)

REVIEW PAGES: URBAN PRACTICES

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In this number

PLANNING FOR BIKE SHARING: TWO CASE STUDIES IN THE U.S.

Sustainable mobility planning, as a relatively new approach in transport planning, requires the implementation of policy measures that produce a modal shift towards non-motorized form of transport such as walking and cycling (Banister, 2008; Morelli et al., 2013). Cycling, in particular, offers a number of environmental and health benefits, and represent a fast and cheap transportation option for short-distance trips in urban areas (Fraser and Lock, 2011). Accordingly, in recent years, transport planners and policy makers have focused much of their attention in promoting the use of bicycles in urban areas as an alternative to intensive car use (Pirlone e Candia, 2015).

One way in which cities can seek to capitalize the benefits associated with an increase in the use of bicycle is by implementing bike sharing schemes (BSS) to facilitate short term bicycle rental in urban areas. Typically a BSS involves the provision of a pool of bicycles across a network of strategically positioned bike sharing stations, which can be accessed by different types of users for short-term use, allowing point-to-point journeys (Meddin, 2015). By addressing the storage, maintenance, and secure parking aspects of bicycle ownership, BSS can encourage cycling among users who may not otherwise use bicycles. Additionally, the availability of a large number of bicycles in multiple dense, nearby locations frequently can creates a “network-effect,” further encouraging cycling and, more specifically, the use of public bike-sharing for regular trips (Parker et al., 2013). BSS have existed for almost fifty years but only in the last decade they have significantly grown in prevalence and popularity to include over 800 cities across the world and a global fleet exceeding 900,000 bicycles (Meddin, 2015). Technological advances, such as bike tracking, solar powering, telecommunicating and on-line shopping, have helped transform bike-sharing from an aspiration to reality.

In the United States, bike sharing has steadily increased year-over-year, from four systems in 2010 to 55 systems in 2016. In addition, 80% of systems that have been in operation for more than a year have expanded since they launched (NACTO, 2016). A number of U.S. cities, such as Detroit, New Haven, and New Orleans, have either selected vendors or are planning to launch systems, and many existing systems are also rolling out major expansions. The expansion and densification of bike sharing systems across the United States has helped many cities in moving bike share towards realizing its potential as an integrated, low-cost part of city transportation systems. This contribution presents two relevant U.S. case studies where BSS have been successfully implemented in recent years: i) Los Angeles and ii) Philadelphia.



LOS ANGELES

The County of Los Angeles is the most populous county in both the United States and the state of California. With over 10 million inhabitants, the county is home to more than one-quarter of California residents and is one of the most ethnically diverse counties in the U.S.. Despite its reputation as a car-oriented city, Los Angeles (and its county) has made huge investments in recent decades to improve its once-nonexistent public transportation system. This city now has a network of nearly 200 bus lines and six rail lines, as well as an extensive regional commuter rail system, mainly operated by the Los Angeles County Metropolitan Transportation Authority, also known as Metro.

In 2016, Metro launched the *Metro Bike Share*, the first regional bike share program that establishes the business model to bring bike share to more cities within L.A. County. In particular, the planning document “*Regional Bikeshare Implementation Plan*” envisions a bike share system that is accessible to Los Angeles County residents, students, workers and visitors, and that integrates with existing Metro services to improve the reliability, efficiency and usefulness of Metro’s transportation system. The Plan envisions a pilot bike share system of 99 stations in downtown L.A., implemented in two phases, and three future expansion phases, comprising 155 stations in eight communities.

Four interesting features make the *Metro Bike Share* a particularly interesting case study:

- *Integration with the public transport system.* Not only unique for its regional administrative plan, *Metro Bike Share* is also purpose built for regional accessibility. Indeed, it is the first U.S. large regional bike share program to offer transit fare integration, introducing bike share as a component of, rather than a compliment to, transit. At the *Metro Bike Share* website, customers can register their transit fare card to ride Metro bikes, using the same card to also ride Metro buses and trains. Integration is also accomplished by shared branding, service area and fare media.
- *Equity considerations.* A transportation equity perspective illuminates the plan. For the stations located in Downtown Los Angeles, Metro performed an analysis of the share of minority population within a quarter-mile and half-mile radius of the bike share stations, ensuring that stations are placed near neighborhoods and transit lines that low-income riders use in order to increase the likelihood that they can integrate the system into their regular travel.
- *Public engagement.* Metro and the city of Los Angeles worked closely with downtown L.A. community stakeholders, taking into consideration crowdsourced public input to select initial station locations that will better connect people to key neighborhood destinations. Special consideration was given to locations that created better access to museums, libraries, schools, retail, employment, residential areas and transit hubs.
- *The development of a Bikeshare Suitability Index.* In order to identify the most efficient locations for bicycle stations, Fehr & Peers, the transportation consultant that supported Metro in the development of the plan, developed a Regional Bikeshare Suitability Index. The index is based on a combination of basic variables associated with high bikeshare ridership. Integrating this index with other criteria for financial, political and community support resulted in a ranked list of potential expansion communities. Fehr & Peers then analyzed the effect of the demographic and built environment characteristics on ridership levels in four established bikeshare systems and applied the resulting regression models to estimate

ridership for the network of stations proposed for Downtown Los Angeles, Pasadena, and Santa Monica. Comparing the resulting ridership level estimates with the operating characteristics of other established bikeshare systems informed recommendations for the needed number of bikes and docks to support bikeshare demand.



PHILADELPHIA

Philadelphia is the largest city in the Commonwealth of Pennsylvania and the fifth-most populous city in the United States, with an estimated population of 1,567,442 and more than 6 million in the seventh-largest metropolitan statistical area, as of 2015. Philadelphia is considered to be one of the most bike-friendly cities in the U.S. with dedicated bike lanes on city streets, hundreds of miles of trails and a growing number of bicycle commuters.

In the spring of 2015, Philadelphia launched *Indego*, the first city's bike sharing programme. Based on the findings of a 2009 bike share feasibility study, the City of Philadelphia has worked to build support and funding for a bike sharing system. A *Bike Share Working Group* was formed to evaluate business models and develop a feasible business plan. The Working Group includes the City of Philadelphia Mayor's Office of Transportation and Utilities, the Bicycle Coalition of Greater Philadelphia, the Delaware Valley Regional Planning Commission and the Pennsylvania Environmental Council.

In 2013, the Working Group developed the *Bike Share Business Plan*. The plan examines the potential for success of a proposed bike share program in Philadelphia. It includes a comprehensive planning-level analysis of the bike share concept while also exploring key ancillary issues—such as bike-lane infrastructure and interoperability with public transit—that are likely to influence the potential success of the system. The program envisioned for Philadelphia entails an initial deployment of approximately 1,750 bicycles in a defined “core” area that will be further developed in a flexible way, according to the result of the first phase.

Key features of the Philadelphia bike sharing programme can be summarized as follows:

- *A clear definition of goals and objectives.* According to the business plan, Philadelphia's bike share system will establish a new form of public transportation for Philadelphia, one that is healthy and safe, is environmentally friendly, affordable for users, and financially sustainable to operate. Bike share will be an important part of the city's integrated public transportation network, connecting communities to more destinations across the city.
- *The definition of key performance measures.* The purpose of the performance measurements is to provide stakeholders and the public a clear and concise way to measure the effectiveness of the Philadelphia bike share program. A set of measures have been developed that fit within the overall framework of the program's vision, goals, and objectives. Each objective has one or more performance measurements that can be tracked over time. These measures can be grouped in four main domains: i) Personal Mobility; ii) Livability & Economic Competitiveness; iii) Health & Safety and iv) Finances & Transparency.
- *The development of a solid business plan.* Philadelphia's bike share system has been developed to be a financially self-sufficient system that requires neither operating subsidy nor additional capital funding from the City of Philadelphia. For this reason, the plan identifies the necessary actions to raise operating

revenue through three main channels: memberships, usage fees, and station advertising. In order to project revenue from memberships and usage fees, a revenue model was created and a market analysis was performed in order to assess as best as possible the potential level of bike share usage in Philadelphia. In order to achieve this, it was also critical to acknowledge both the experiences of other bike share cities as well as specific travel demand patterns in Philadelphia. In addition, it was important to identify local factors likely to influence the outcome of the Philadelphia bike share program, including climate, topography, demographics (populations of user groups), mode split, and infrastructure.

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IMAGE SOURCES

The image shown in the first page is from <http://dribbble.com/>; the image shown in the second page is from: <http://architecturaldigest.com/>; the image shown in the third page is from <http://visitphilly.com>.

METHODS, TOOLS AND BEST PRACTICES TO INCREASE THE CAPACITY OF
URBAN SYSTEMS TO ADAPT TO NATURAL AND MAN-MADE CHANGES 1(2017)

REVIEW PAGES: NEWS AND EVENTS

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In this number

GREEN INFRASTRUCTURE AS DUAL-USE SYSTEM FOR ADAPTIVE PLANNING

Rapid urbanization and rapid growth of urban centers have been accompanied by the rapid growth of highly vulnerable communities, many of which settle on land at high risk from extreme weather. This rising complexity of urban structure, together with the expecting negative impacts of climate change, has brought a great deal of attention to the seductive theory of resilience through its capacity to evoke systemic adaptation before and after disasters. It is in fact increasingly shared the awareness that the possibility to support climate change adaptation via effective city governments goes through the thorough understanding of the complex inter-dependent system of city. Nevertheless, one of the main limits of this theory consists in the practical and economic difficulty for local governments of investing in preventive actions for adequately addressing the security and emergency response needs without a clear economic and political return.

In their paper *Toward Inherently Secure and Resilient Societies* Allenby & Fink (2005) offered an interesting perspective on this issue proposing the concept of dual-use systems. In their vision the urban systems should be redesigned by "implementing dual-use technologies that offer societal benefits even if anticipated disasters never occur".

In this perspective green infrastructure could represent an efficient dual-use system for adaptive planning. In fact, on the one hand, the implementation of green infrastructure represents one of the main key strategies to moderate the expected increases in extreme precipitation (Zellner et al., 2016) or temperature (Gargiulo et al., 2016; Salata & Yiannakou 2016); while on the other, it represents an important contributor for improving human health and air quality, lowering energy demand, expanding wildlife habitat and recreational space, and even increasing land-values (Foster et al., 2011).

Therefore, green infrastructure approaches help to achieve different goals over a range of outcomes, in addition to climate adaptation.

In this perspective, the value of green infrastructure can be calculated in terms of benefits, by comparing the costs of green practices to "hard" infrastructure alternatives, the value of avoided damages, or market preferences that enhance value, like property value.

Green infrastructure benefits generally can be divided into five categories of environmental protection:

- land-value;
- quality of life;

- public health;
- hazard mitigation;
- regulatory compliance;

For these reasons, green technologies and infrastructure solutions should be implemented by considering a comprehensive accounting of their multiple benefits.

The selected conferences represent a fertile level playing field of the latest methods to address the issue of green infrastructure and its multiple-use role in the increasingly pressing challenges that cities have to face.



GRAY TO GREEN CONFERENCE

Where: Toronto, Canada

When: 8-10 May 2017

<https://greytogreenconference.org/>

The main conference topic is “quantifying green infrastructure performance”; it aims at analyzing and quantifying the many benefits of investing in living green infrastructure such as urban forests, green roofs and walls by exploring the latest in performance, economic valuation, design, policy, and technology.

Grey to Green conference also includes different activities, like workshops, tours of outstanding networking events, and presentations of Toronto projects such as the Toronto's new Green Streets Guideline and the Province of Ontario's new Stormwater Design Guidelines.

The core of the conference will be the six unique workshops organized in the following tracks:

- green Roof Professional Exam;
- green Wall 101: Systems Overview & Design;
- how to Properly Construct Low Impact Development Stormwater Management Practices;
- integrated Water Management for Buildings & Sites;
- introduction to Rooftop Urban Agriculture;
- lighting for Indoor Vegetable and Medicinal Crop Production and Living Walls.

Another interesting initiative is the Green Infrastructure Charrette: A one-day Green Infrastructure Design Charrette where multi-disciplinary volunteers are tasked to redesign specific neighborhoods in need, with 15 generic types of green infrastructure as their tools.



RESILIENCE 2017: RESILIENCE FRONTIERS FOR GLOBAL SUSTAINABILITY

Where: Stockholm, Sweden

When: 20-23 August 2017

<http://resilience2017.org/>

The Anthropocene is a proposed epoch dating from the beginning of significant human impact on the Earth's geology. Based on this, the Resilience 2017 conference intends to discuss resilience as a key lens for biosphere-based sustainability science, aiming to set out future directions for research. A main focus will be on global sustainability, which today is influenced by the speed, scale and connectivity of the Anthropocene. A resilience thinking approach tries to investigate how the interacting systems of people and nature – or social-ecological systems – can best be managed to ensure a sustainable and resilient supply of the essential ecosystem services on which humanity depends.

Under this thread the conference will be articulated in four major themes:

- social-ecological transformations for sustainability;
- connectivity and cross-scale dynamics in the Anthropocene;
- multi-level governance and biosphere stewardship;
- approaches and methods for understanding social-ecological system dynamics.



EUGIC 2017

Where: Budapest, Hungary

When: 29-30 November 2017

<http://eugic.events/>

EUGIC 2017 conference provides a forum for the coming together of research, policy and practice in urban green infrastructure to share nature-based solutions for resilient cities. It will explore how urban centers are addressing climate change and biodiversity loss, managing water, air quality and energy, and designing for health and wellbeing by working with nature.

The conference is organized in different sessions. Session 3, called “Key Urban Green Infrastructure Discussions”, represents the core of the conference and it will be articulated in the following main tracks:

- the Green Infrastructure Fabric of Europe: the EUGIC Vision;
- implemented Green Infrastructure Projects;
- how do we evaluate Green Infrastructure in the urban realm?;
- what can we learn from each other?.



ICUGSPHEJ 2017: 19TH INTERNATIONAL CONFERENCE ON URBAN GREEN SPACE, PUBLIC HEALTH, AND ENVIRONMENTAL JUSTICE

Where: Istanbul, Turkey

When: 21-22 December 2017

<https://www.waset.org/conference/2017/12/istanbul/ICUGSPHEJ/call-for-papers>

The conference will bring together leading academic scientists, researchers and scholars from around the world, focusing the debate on the main topics of Urban Green Space, Public Health, and Environmental Justice. The conference proposes a huge list of more specific topics for submission; in particular the focus on the roles of green infrastructure in the urban planning is declined in many aspects, thus underlining the multiple functions of urban green areas and their different relationships with other urban system elements especially connected with urban risk topics. The following are just few example of this very rich list:

- green Infrastructure and Renewable Energy;
- green Infrastructure and Urban Flooding;
- green Infrastructure and Water Management;
- green Infrastructure for the City;
- green Infrastructure for Urban Climate Adaptation;
- green Infrastructure in Urban Land Use;
- green Infrastructure: Planning for Sustainable and Resilient Urban Environment.



ICGIUR 2018 : 20TH INTERNATIONAL CONFERENCE ON GREEN INFRASTRUCTURE FOR URBAN RESILIENCY

Where: London, UK

When: 24-25 April 2018

<https://www.waset.org/conference/2018/04/london/ICGIUR/home>

Green Infrastructure is considered one of the most widely applicable, economically viable and effective tools to combat the impacts of climate change and help people adapt to or mitigate the adverse effects of climate change. Is not a case that *The Land Use, Land Use Change and Forestry* (LULUCF) as defined under the UNFCCC's Bali Action Plan of the Kyoto Protocol, encourages Green Infrastructure initiatives in the agriculture and forestry sectors that have a positive effect on carbon stocks and the greenhouse gas balances in Member States, thus helping to put EU climate policies into practice. Therefore green infrastructure solutions that boost disaster resilience, against climate change related risks, are an integral part of EU policy on disaster risk management.

Based on these premises the conference provides a premier interdisciplinary platform for researchers, practitioners and educators to present and discuss the most recent innovations, trends, and concerns as well as practical challenges encountered and solutions adopted in the fields of Green Infrastructure for Urban Resiliency.

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IMAGE SOURCES

The image shown in the first page is taken from:

<http://rym.fi/results/ecosystem-services-approach-in-urban-forest-planning/>

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