Saveria Boulanger

Smarter and Greener

A Technological Path for Urban Complexity

Ricerche di tecnologia dell'architettura
FRANCOANGELI

Informazioni per il lettore

Questo file PDF è una versione gratuita di sole 20 pagine ed è leggibile con

La versione completa dell'e-book (a pagamento) è leggibile con Adobe Digital Editions. Per tutte le informazioni sulle condizioni dei nostri e-book (con quali dispositivi leggerli e quali funzioni sono consentite) consulta cliccando qui le nostre F.A.Q.

RICERCHE DI TECNOLOGIA DELL'ARCHITETTURA

diretta da Giovanni Zannoni (Università di Ferrara)

La collana *Ricerche di tecnologia dell'architettura* tratta prevalentemente i temi della progettazione tecnologica dell'architettura e del design con particolare attenzione alla costruibilità del progetto. In particolare gli strumenti, i metodi e le tecniche per il progetto di architettura alle scale esecutive e quindi le modalità di realizzazione, trasformazione, manutenzione, gestione e recupero dell'ambiente costruito.
I contenuti scientifici comprendono la storia e la cultura tecnologica della progettazione e della costruzione; lo studio delle tecnologie edilizie e dei sistemi costruttivi; lo studio dei materiali naturali e artificiali; la progettazione e la sperimentazione di materiali, elementi, componenti e sistemi costruttivi.
Nel campo del design i contenuti riguardano le teorie, i metodi, le tecniche e gli strumenti del progetto di artefatti e i caratteri produttivi-costruttivi propri dei sistemi industriali.
I settori nei quali attingere per le pubblicazioni sono quelli dei progetti di ricerca nazionali e internazionali specie di tipo sperimentale, le tesi di dottorato di ricerca, le analisi sul costruito e le possibilità di intervento, la progettazione architettonica cosciente del processo costruttivo.
In questi ambiti la collana pubblica progetti che abbiano finalità di divulgazione scientifica e pratica manualistica e quindi ricchi di spunti operativi per la professione di architetto.

La collana nasce sotto la direzione di Raffaella Crespi e Guido Nardi nel 1974.
I numerosi volumi pubblicati in questi anni delineano un efficace panorama dello stato e dell'evoluzione della ricerca nel settore della Tecnologia dell'architettura con alcuni testi che sono diventati delle basi fondative della disciplina.
A partire dal 2012 la valutazione delle proposte è stata affidata a un Comitato scientifico, diretto da Giovanni Zannoni, con lo scopo di individuare e selezionare i contributi più interessanti nell'ambito della Tecnologia dell'architettura e proseguire l'importante opera di divulgazione iniziata quarant'anni prima.

Saveria Boulanger

Smarter and Greener

A Technological Path for Urban Complexity

Ricerche di tecnologia dell'architettura
FRANCOANGELI

In copertina: A roof garden in Osterbro district, Copenhagen (Author's photo).

Table of contents

Foreword

by Marco Marcatili, NOMISMA

According with UN, in 2050 more than three quarters of the Italian population will live in urban areas. However, the future of our country doesn't rely in Megalopolis, as Italy can become an European laboratory for a new protagonist of development: the "micropolitan city". This is a reality that can be synthesized in its ability to extend policies of developments to territorial and administrative contexts having "variable geometries". The "micropolitan city" can recognize itself not only for its good life quality but also as context of production and finally in its ability to experience the processes of innovative infrastructure at the service of sustainability, accessibility and mobility, going beyond the logic of technology without humans.

In recent years, both internal and metropolitan areas have become the main protagonists of urban scenarios in our country. In the case of internal areas, which often coincide with high grounds, Fabrizio Barca's works must be credited for having identified an open-air "mine" for thinking tailor-made policies and for avoiding the vicious circle through which differences become inequalities.

The national strategy on the internal areas has then proved to be very difficult and not really capable to trigger real processes of social innovation. However from 2020 the ambitious Alpe Project of the Italian Environment Fund will call the new generations to rebuild a destiny of centrality also to the Italian internal areas.

At the same time, a particular attention continues to be given to metropolitan areas through a path that, in the Italian spirit, identifies fourteen urban realities that sometimes require an effort to be defined metropolitan areas in the European sense. Here again, there is still no trace of authentic successful experiences and metropolitan cities have remained trapped in the governance of the administrative boundaries of municipalities.

In this precious work of Saveria Boulanger, the concept of the smart city leads micropolitan cities towards a senseable city perspective.

In the micropolitan city, in fact, the real life of people forces the boundaries of city walls (administrative boundaries) and it redraws a new map that requires new forms of regulation and institutionalization: the centroid municipality acts as a catalyst for a network of neighboring municipalities and it configures a "city in nuce" (A. Calafati).

Through the interaction between different actors having different powers, resources and visions, each community builds its own future in different ways: by starting from its own specificities (smart specialisation), by transforming what they have through innovation; by building plans for the development of the city within credible visions; by recognizing a vocation with an approach of urban acupuncture; by recognizing that city users (residents, students, tourists, new citizens, etc.) are not only users of services for the city, but co-producers of cultural, urban and social renewal of the city.

In this key of co-creating values, the gaze of the micropolitan city looks at the perspective of this new idea described by a new term, coined by the homonymous laboratory of the MIT in Boston: the senseable city. A city capable of "sense", which reflects more the human component, as Carlo Ratti describes: «*in a senseable city it is important to focus on citizens. Technologies are just a means, but a means to do the things as we, the citizens, want to do. And these things deal with the quality of life, with losing less time in traffic, with how to better use resources and eventually how to find new ways to meet, work and live better. The debate on smart cities is really wide these days, but I think it is important to note the impact that these new structures will have on individuals, how they will change our lives*» .

To build new smart, senseable and micropolitan strategies, the tools used for urban transformation in an expanding context are no longer adequate. The proposals of the "Circular Smarter and Greener Circle and Matrix" are a first important attempt by Saveria Boulanger to accompany and accelerate the transition to the development of medium-sized cities in a context of shrinking regeneration. It would be important that in this new season of strategic ferment and urban rethinking, some cities experiment these tools and processes.

A possible future for our cities

by Andrea Boeri and Danila Longo, University of Bologna

What is the future of contemporary cities? Today, under the pressure of several issues such as climate change, new migrations, difficulties of digital technologies integration, urban systems affected by traffic congestion and where poverty is newly involving growing amounts of families, the analysis of the potential evolutions of our urban systems is at the center of the debate. The introduction, in particular, of the new digital technologies seems to give unique opportunities to urban system in evolving fast and effectively. However, their wide implementation can also become a temptation, especially considering how actual cities often deal with limited budgets but very impacting constraints. Citizens ask answers, European rules ask to take action. The digital market is growing day by day promising "the" optimum solution for each problem.

The process of transformation of cities, or parts of them, need to do a step back. The miraculous recipe for solving everything doesn't exist because each urban context has its own specificities. Still characterized by common challenges, effective approaches need to be flexible and adaptable both to local and global and to multiple layers of issues: climatic, green, technological, social, political etc. The processes of transformation can involve the built environment, but also social and technological aspects: innovation needs to point out the integration of approaches and factors (Boeri, 2017).

It can be observed how a multiplicity of approaches characterizes studies and case-studies in Europe and all over the world. Those, since last century, went under the different names of intelligent cities, sustainable cities, resilient cities, ubiquitous cities and so on. The Smart City seems to be only the last label among them, where the centre of attention is shifted from holistic actions toward ready-to-implement tools.

Big cities seem to be more aware on the best processes to undertake in order to come out with successful results, but most part of cities in Europe is smaller with less opportunities in cooperation with the private sector and less financial resources. Nevertheless, those cities can impact on a significative level in reaching Europe and UN objectives.

The author decision to provide a deep reading of this phenomenon, restarting from its evolution and from the theories about utopian cities and questioning if Smart Cities are more utopias or concrete solutions, is actual and allows a deep understanding of the topic, projected into the definition of effective tools and instruments for making existing cities in the condition of selecting the best solution for their territory and not the easier one. This analysis aims to focus on actual existing urban issues linking them with passive and active technologies having the potential to enable transitions to more livable and equitable cities. This research is therefore not anchored only the topic of Smart City, but it includes also a deep evaluation of sustainable and green policies as one of the major challenges cities need to face. Technology is so defined as an enabler, a tool for solving global and local issues.

In fact, the publication offers a holistic reading of the most pressing actual challenges and a deep overview of the main available instruments at European level, in term of policies, networks, regulations and norm, which gives to the publication the characteristic of addressing the topic in a very complete way.

Besides, the major findings of the research are expressed through a qualitative case study analysis, conducted mainly on European cities, with few excursions outside. This range of situations and solutions is framed under an innovative reading that pass through the interpretation of the processes, the dimension of interventions, the involvement of stakeholders. The case studies analysis puts in evidence the existence of different approaches and allowed to underline some common successful practices that can be adapted in other contexts. The reader can appreciate the crucial points that are framing the strategies in very different cities such as Bologna, Paris and New York, considering different sizes of cities.

Finally, the book presents a flexible and replicable method, the Smarter and Greener District Circle which is composed by different tools with the aim to support small and medium-sized cities, but also professionals, in developing sets of actions for actual existing districts.

Opening Smart Cities to architects and designers

by Roberto di Giulio, University of Ferrara

«*The digital revolution is leading to new and innovative forms of artistic creation while making culture and heritage more accessible and opening up new ways of enjoying cultural contents. Making our cultural heritage widely available in the digital era is vital*» (Ansip, Gabriel, and Navracsics as quoted in European Commission 2019).

Digital transformation is actually one of the most pervasive and mediatic phenomena characterizing our era. Digital technologies are permeating society at all level with the aim to ease citizens life, to enhance industrial productivity, to ease access to public services, to facilitate collaboration among experts. Especially in the field of architecture, digital technologies are highly facilitating the processes of design, construction, control and collaboration among different expertises. As an example, the case of BIM technologies is of particular interest in this field.

Understanding this approach at the architectural/building scale is easier than thinking about achieving the same results at the urban or district scale. However, also in these cases technologies can be very helpful and effective. The availability of innovative tools, based on 3D models, the Virtual Reality (VR), the Mixed Reality (MR) and the Augmented Reality (AR) open innovative scenarios also for cities. 3D models can be used not only for documentation and monitoring purposes but also for digital applications (e.g. virtual tours, virtual tourism, digital reconstructions, etc.) and for creating integrated 3D database useful for diagnostic, conservation and management procedures. In the city context, in addition, the collaboration among stakeholders is a crucial aspect when implementing Smart Cities projects as their success is linked with the opportunity of involving at the same time private and public sectors, small and medium enterprises, association, professionals, universities and citizens.

However, Smart Cities projects are often organized and structured through a top down approach, often starting from the public sector with the involvement of digital and energetic engineers, digital industries.

Professionals as architectural and industrial designers seems to be left in the background even if their expertise on the built environment can be highly exploited in similar projects. Actions on a complex system such as the city, or even a district, can benefit from their involvement since the ideation as a hinge figure able to deal with innovation, urban environment, passive and active technologies, end users but also with the most innovative digital technologies. Tools (digital or not) allowing their full involvement into these kinds of processes are needed and the research described in this book proposes it as one of its main objectives. Designers can take advantage into this context from the proposed methodologies of scenario creation, key performance indicators and impacts identification and monitoring.

Starting from a deep analysis of the theories which preceded the Smart City topic, the book guides the reader into a descriptive path tracing, Chapter by Chapter, the increasing complexity of urban systems as a multi-layered structure, in which a "single recipe" for solving problems is not available nor possible. The deep understanding of such complexity at the two scales of local and global, together with the theme of flexibility are two of the core keywords of the book. In fact, the superposition of different challenges, even if with shared aspects, can happen in each territory in very different ways. The intensity of issues such as climate change, poverty, migration, social exclusion, economic crisis can vary as the cities' answers to them. However, the need to act fast and efficiently is recurrent in big as well as in small cities, the first one seeming to be more ready to operate full transitions in respect with less competitive areas. The book proposes a case study analysis as a way to understand if a ratio behind successful practices is present and identifying very different approaches and themes: from cities focusing since years into resilience and sustainability to the most recent innovations on blockchain and democratization of data.

Finally, a concrete and already usable method is proposed with the main aim to ease the process of action design and implementation. The tools are not structured to be used only by municipalities but they can be easily utilized by architects in the process of designing complex actions at the existing districts level. The role given to precisely define a monitoring strategy, based on the identification of key performance indicators and impacts is of particular interest and actuality, as the most innovative digital technologies can give a deep support if correctly used. In fact, the presence of well-designed strategies can be complemented with the big amount of data that are made available by sensors deployed in cities, with the result of increasing knowledge leading to corrective actions during the implementation processes.

1. Smart Cities into the European framework

Did Smart Cities existed before the XX century? This is a question that arise quite soon when analyzing the topic of Smart Cities. The second question is often: where are we going? What is the future for our cities?

Answers are not easy, even if there is the impression that we are not discovering a completely new strategy. There is the impression that somewhere in history other people already addressed similar challenges and had the same questions. At the same time, the current applied strategies all around the world don't seem so clear and structured. The framework in which they are built and their objective is not evident. Are we implementing digital technologies, applications and devices in cities just because of a desire to be innovative, to be on the edge? Or there are more subtle and deep reasons for this implementation?

Starting from the resolutions behind the Kyoto Protocol in 1997 and going through the recent COP 21 in Paris and following, countries all around the world agreed that contemporary cities are facing climatic challenges that need an urgent intervention in order to prevent a non-return point in the way we live our lives. In other terms, climatic changes, already ongoing, are modifying irreversibly the ecosystem where the mankind is used to, and probably can, live. It means that the strategies that we see in our cities nowadays must be targeted to solve those climatic challenges. Innovative technologies seem to give us unprecedented opportunities.

The Smart City is one of the most proposed strategies for dealing with this issues.

However, climate change is not the unique challenge that cities are facing: resource scarcity, lack of identity, economic crisis, people migrations, poverty are some of the other key issues that cities are asked to face.

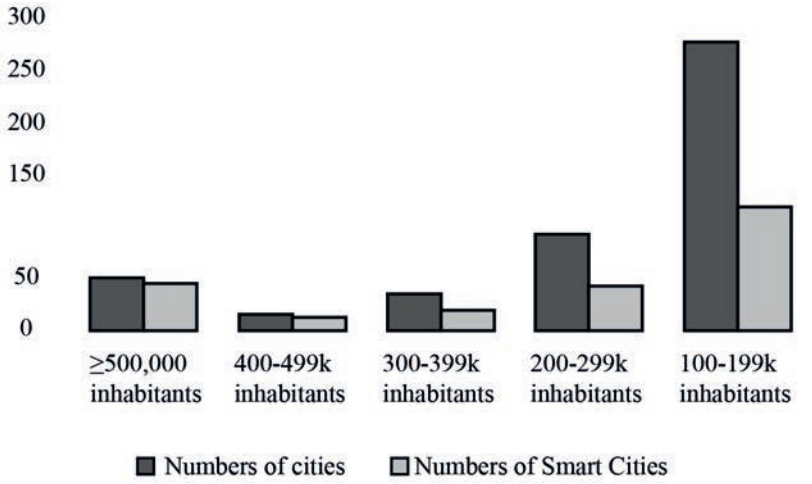

Fig. 01 - Number of Smart Cities in relation with inhabitants. Author re-elaboration based on data from the Directorate General for Internal Policies (2014)

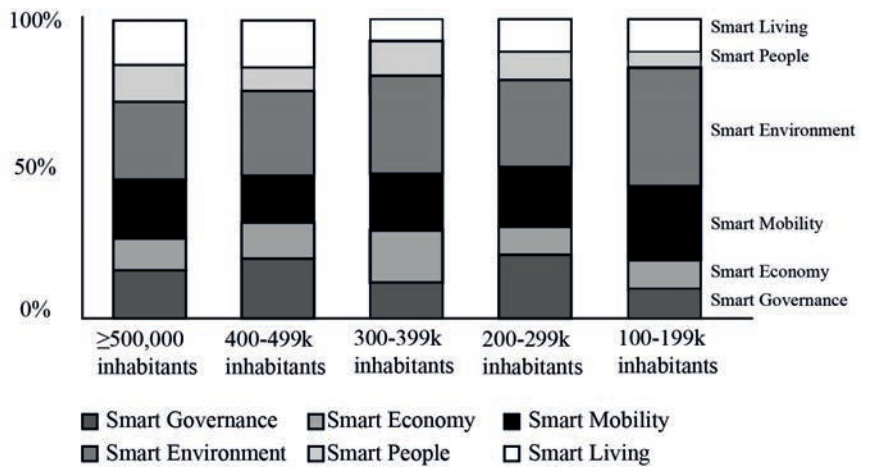

Fig. 02 - Distribution of Smart City projects in relation with the main thematic fields and the inhabitants. Author re-elaboration based on data from the Directorate General for Internal Policies (2014)

The Smart City has reached an important fortune and lot of cities around the world are starting to implement different kind of smart strategies applied to the built environment. This book aims to focus on the application of smart strategies and approaches to the existing built environment (generally named brownfield), instead of to new establishment (defined as greenfield)[1]. The extension of the Smart City phenomenon is very high, not only in metropolitan area but also in medium-sized cities. According to some relevant studies conducted by the European Parliament and by different platforms, into the European context this typology of cities is strongly spread in all EU countries (Directorate-General for internal policies-European Parliament, 2014), meaning that in Europe an increasing number of cities is implementing strategies attributable to Smart Cities' ones. As the European Parliament highlights, 51% of European cities with at least 100,000 inhabitants meet the criteria for the accreditation into the smart group and are extended into all European countries[2]. And the 43% of identified Smart City fits into the group of medium-sized cities, between 100,000 and 200,000 inhabitants. Figure 01 shows the number of smart identified cities divided into the different population ranges. The graph shows the evidence of the increasing number of medium-size cities implementing smart strategies.

This data is important in order to understand the evolution of the topic, it shows in fact that the phenomenon is not concentrated into a few numbers of big cities, but it is more spread into medium-sized ones. As a difference with other worldwide territories, the historic formation of the European urban texture is indeed marked by small and medium conurbations, in short distances into the land and having an important role into the development of a common idea of citizenship. For this reason, the implementation into these contexts of innovative strategies or, at least, of a debate for retrofitting, reduction of energy consumption (through the use of technology or other instruments) and mitigation actions is necessary and important in order to foster and accelerate the transition of the European territory, conceived as a whole. The increasing role of mayors and local government into the development of urban strategies, compared to the role assumed by the national government

1. Example of greenfields are Masdar, the PlanIT Valley and Songdo. See (Caragliu *et al*., 2011; Shelton, Zook, & Wiig, 2015; Washburn, D., Sindhu, U., Balaouras, S., Dines, R. A., Hayes, N. M., & Nelson, 2010). The research decided not to focus on greenfield as the challenge given by the actual existing built environment are conceived as more urgent.

2. The analysis is conducted by the Directorate General for Internal Policies of the European Parliament. They analysed cities with at least 100.000 inhabitants in EU-28 countries. The selection is conducted through the observation of strategies and projects ongoing into these countries and cities with at least one project into one of the main six smart sectors are selected as smart.

and to the repercussions and effects of national and general policies, could be one reasons for this extension of interest in smartness (European Commission Directorate General, 2015)[3]. Nevertheless, observations of figure 01 show also the role of bigger cities into the development of these kinds of strategies: 46 of 52 cities analysed with more than 500,000 inhabitants (88%) are implementing at least one project into one of the six main smart sectors. Thus, those realities are significant for different reasons: they can address solutions into portions of the urban site through experimentations, they can improve technologies and collect funds from a wider panel of stakeholders and redistribute them or generate circular economies affecting in a positive way other cities around (Espon, 2012), they can benefit from interntional and public-private collaborations.

The increasing importance of medium-sized cities highlights another significant aspect: their rising role into the development of strategies for refurbishment and emissions can go beyond country boundaries, as well as beyond European ones. The activity of the Covenant of Major, for example, is projected on a worldwide dimension, highlighting the extension of the phenomena and pointing the accent on a debate about the former role of national countries and the new role of mayors. As well, other important associations, giving the dimension of this phenomenon, are for example the following: the Smart City Stakeholder Platform, the 100 Resilient Cities Platform, the Smart Cities and Community platform. All these platform and associations gives the physical dimension of the phenomenon of smart cities, sustainable cities and of the importance for renovating cities and reducing their energetic consumption and greenhouse gas emissions.

The Smart City concept is applied worldwide in different ways: sometimes it is conceived as a punctual project on a city, occasionally is more conceived as a network project (e.g. thermal, electrical, mobility), other times is outlined as an holistic and complex design strategy regarding the entire city. As well, there are few different typologies of smart projects, depending on the specific object implemented (a technology, a process, a strategy, an approach) and the target (sustainability, people participation, social or economic challenges). The approaches for implementing Smart Cities are several and different. All of them have specificities. Depending on the application, on the typology of

3. The national governments are important in order to address the general strategy for the renovation of urban context and the implementation of innovative strategies, but the fallout that can be achieved by the specific local governments are more precise and effective. The reason is the specificity that each city and territory has into the European context and into the same country in itself. The Italian case is exemplary for this because it is characterized by a plurality of different challenges, needs and specificity, that are hard to handle on a general level.

projects, on the urban sectors of application, on the general aim, it is finally possible to find several Smart Cities. There are several differences between projects recorded in the EU context.

The first and most important one is the dimension of the project in itself. Not all cities are implementing holistic approaches, meaning projects able to act on the totality of the city context, but lots of them have implemented sectorial projects or experimentations (Directorate-General for internal policies-European Parliament, 2014).

It is possible to analyse the general distribution of thematic projects, by using the 6 general themes of Smart Governance, Mobility, Environment, Economy, Living, People. Figure 02 shows the relationship between Smart City characteristics and cities' size. As already anticipated, the relation between the smart topic and sustainability and environment is strict. Their relation can be defined as a cause-consequence relation where the smart city is one of the possible answers to the necessity for urban sustainability.

Indeed, the smart environment characteristic (or sector) is the prevailing one in each cities' size. After the definition of actual environmental challenges in 1997 with the Kyoto protocol and furthermore, in all the next agendas, and with the enactment of the 2010 and 2012 directives, it is clear that the actions related to the environment are conceived as a priority of the national government and the local one. If we analyse the presence of smart cities, following the EU criteria, it appears evident the dimension of the phenomenon and the attention that quite all the European countries are giving to both smart and sustainable cities. The smart trend could be seen as the new green trend of the previous century. Its extension is indeed involving an increasing number of cities worldwide. For instance, the Indian government announced in 2014 the development of new 99 smart cities.

In Italy, the Smart City revolution is growing day by day with a large impact on the management of cities and of communities. After being one of the country in Europe more active into the platform Covenant of Major (3.187 joint signatories, compared to the 1.438 of Spain, the 83 of France, the 34 of United Kingdom, and the 24 of Netherlands), Italy candidates itself for being one of the main context for the development of Smart City initiatives. The ANCI Observatory of Italian Smart Cities[4] calculates a totality of 1.311 specific smart projects, with the involvement of 15.446.552,084 citizens and € 3.713.591.167 of investments. Into the platform, 150 municipalities are collected and described with the specification of the processes involved, the funds structures and the citizens engagement.

4. For more information see their website: www.italiansmartcity.it

From this framework the present research has been elaborated with the aim to produce a complete overview of the Smart Cities topic and with the aim to understand the extension and the recurrent features of the approaches. In particular, the interrelations between smart actions and climate-related ones is investigated as cities are nowadays facing a complex and multi-layered system of actions that go beyond the single definition of smart city. Thus, the research is set up on the one hand as an overview of the concept (Chapter 2), on the other hand as a repertoire of cases supporting the theory of the recurring approaches, presented in Chapter 3.

The book collects the most innovative findings and approaches on the topic and the most interesting operative addresses for integrated actions aimed at solving current worldwide and local challenges, despite the specific definitions of smart and green / sustainable cities.

The selection of cases answered the need to cover geographical, typological and dimensional differences, from small cities to metropolis and regions.

The repertoire of Chapter 3 and the overview of Chapter 2 is preliminary to the identification of a set of operative methods applicable in a flexible way to European built environment and targeted to make the decision making easier and more efficient (Chapter 4).

2. Smart Cities toward 2050?

2.1 Are Smart Cities utopias?

«*L'Europa si costruisce. È una grande speranza, che si realizzerà soltanto se terrà conto della storia: un'Europa senza storia sarebbe orfana e miserabile. Perché l'oggi discende dall'ieri, e il domani è il frutto del passato. Un passato che non deve paralizzare il presente, ma aiutarlo a essere diverso nella fedeltà, e nuovo nel progresso*» (Jacques Le Goff, in Benevolo, 1996).

The actual existing cities are often the result of a layering process that involved in history cultures, social dynamiques, economic and technical crisis and rises. Those aspects shaped what we see in cities today and also how we perceive and identify ourselves in its physical and relational space. Urban complexity is a heritage coming from the past: complex spaces where social relations are deeply interlinked with the architecture and the infrastructure; where it is no more clear if it is the architecture that shaped the social conformation of the space or viceversa are the social dynamics asking specific shapes and spatial qualities.

However, in the best scenarios, that complexity created high quality spaces where people live well, where services are well conceived and structured. But often, instead, in several moments of the history, a broken interrelation among people, needs, geography and architecture or the need to fast build houses created low quality areas, with poor quality of life, where services are lacking and the functionalities of the urban system relies on the wide use of cars.

Maybe a moment, into the recent history, where cities and the architecture begun to follow different paths. A kind of crisis happens also for cities and architecture: once the intellectual exchange was constant and fruitful, later