Alenka Fikfak, Saja Kosanović, Miha Konjar and Enrico Anguillari [eds.]

sustainability and resilience

socio-spatial perspective

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BOOK SERIES

reviews of sustainability and resilience of the built environment for education, research and design

Saja Kosanović, Alenka Fikfak, Nevena Novaković and Tillmann Klein [eds.]

This thematic book series is a result of the Erasmus+ project, *Creating the Network of Knowledge Labs for Sustainable and Resilient Environments (KLABS)*. The books are dedicated to establishing a comprehensive educational platform within the second cycle of higher education across the Western Balkan region. The series comprises five volumes in the English language:

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FOR SUSTAINABLE & RESILIENT ENVIRONMENTS

Creating the Network of Knowledge Labs for Sustainable and Resilient Environments – KLABS

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Sustainability and Resilience
Socio-Spatial Perspective

Editors
Alenka Fikfak, Saja Kosanović, Miha Konjar and Enrico Anguillari

Reviewers
Ugis Bratuskins, Peter Jozef Gabrijelčič

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sustainability and resilience socio-spatial perspective

Alenka Fikfak, Saja Kosanović, Miha Konjar and Enrico Anguillari [eds.]

Preface

Saja Kosanović, Alenka Fikfak, Nevena Novaković and Tillmann Klein

The continuous evolution of the notion of a sustainable and resilient built environment demands repeated examination. For this reason, the state-of-the-art thematic series *Reviews of Sustainability and Resilience of the Built Environment for Education, Research and Design* contributes to the comprehensive understanding of the two approaches and their interrelations in the built environment by retrospectively investigating their development, addressing current issues, and speculating on possible futures. The series represents one of the results of the Erasmus+ project, Creating the Network of Knowledge Labs for Sustainable and Resilient Environments – KLABS, dedicated to establishing a comprehensive educational platform within the second cycle of higher education across the Western Balkan Region.

The sustainable and resilient built environment is a multi-layered and multi-disciplinary construct. To successfully tackle the intricacy of the points in question, the series of books comprises five thematic volumes that initially approach sustainability and resilience from the socio-spatial perspective, subsequently address sustainable and resilient urban planning and urban design, and then focus on individual buildings and a range of approaches, methods, and tools for sustainable and resilient design, placing particular emphasis on energy issues. By addressing different levels of the built environment and different aspects of sustainability and resilience in a systemic way, 83 academics from 12 different countries gave 54 contributions in the form of narrative or best evidence articles with the main objectives of informing the development of specialised knowledge, building critical awareness of interdisciplinary and transdisciplinary knowledge issues, and connecting university education with the domain of scientific research. The broad aim is to develop the collection of reviews of sustainability and resilience of the built environment that are useful for students, educators, professionals, and researchers, all of whom are dealing with these two important subjects internationally.

We express our gratitude to all authors, editors, reviewers, and members of the publication board for investing significant efforts in the development of the book series in the framework of the Erasmus+ project, KLABS.

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Reviews

Ugis Bratuskins and Peter Jozef Gabrijelčič

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The collection of books "Reviews of Sustainability and Resilience of the Built Environment for Education, Research and Design" displays the promising ambition of a vast group of authors and editors to gather and systematise the latest theories of development of the built environment in transition, to display the complexity of the field, and to provide space for further investigations. The collection is expected to cover the principles of creating and maintaining a sustainable and resilient environment, starting from the general guidelines to the specific technological, social, climatic, and economic aspects of transformation. The first, introductory book of the series deals with the basic theoretical statements of sustainable thinking as they relate to historical, cultural, ecological, climatic, and social aspects of the built environment.

Sustainability, as an attribute of dynamic, adaptive systems that require innovation, foresight, and effective partnerships among various stakeholders on the one hand, and resilience as the capacity of a complex system to adapt, survive, and grow in terms of predictable and unforeseen changes on the other, is discussed. This discussion is presented in eleven chapters of detailed analysis, in terms of topical aspects of up-to-date sustainable transformation in both urban and rural areas – adaptability, engineering, ecological and social resilience and management. Studies are inextricably linked to the present challenges of urban development and transformation – marginal areas, healthy places, climate proof cities etc., both in the broader range of planning and urban design, and in the narrower neighbourhood or site scale. Since, along with economic and technological development, local communities are becoming more and more important players in every stage of design and building processes, special attention is paid to public involvement and participation as an up-to-date "bottom-up" tool in creating high-quality space.

The book represents a collection of highly valuable information that may serve for educational purposes, giving insight into the diversity of the most up-to-date methods and approaches in the evaluation and estimation of the latest tools to further urban and rural development. Since the overall demand for high-quality environments is growing, involved parties, especially planners and urban designers, should have deep understanding of users' needs when creating a diverse and multi-use space.

The list of references included at the end of each chapter serve as excellent sources of extended information on the issues discussed. The Index, the list of terms used in the book containing references to the location of each term within the text, will be of great informative value, as well allowing for easy usage of the book. The book is addressed to a wide range of users – students, teachers, scholars, and practitioners.

Prof. Dr Ugis Bratuskins
Riga, Latvia, March 2018

II

The book "Sustainability and Resilience: Socio-Spatial Perspective" comprises eleven themes connected to form a meaningful whole that provides a systemic, profound, and the state-of-the-art interpretation of the principles of sustainability and resilience in relation to the built and social environments. As such, the book forms a basis for particular research problems considered in all four subsequent volumes of the book series developed within the Erasmus+ project Creating the Network of Knowledge Labs for Sustainable and Resilient Environments – KLABS. Together, the titles of the articles, or chapters, form a logical progress of the debate, from a basic philosophical questioning of the meanings of sustainable and resilient development from the present standpoint, to questioning the current field situation and the necessary indicators of the quality of the built environment, to reviewing the tools and policies for achieving sustainability, and thinking about practical and other possible applications of the principles of sustainability and resilience in urban, rural, and blended environments.

The first chapter provides a broad socio-spatial perspective to the issues related to sustainability, surpassing the narrow concept that is currently offered within the separate disciplines. Reflections about the probabilities and scenarios of different socio-environmental outcomes are illustrated using the example of Holmgren's 'future scenarios', which also takes into account the indefinite and changing future. Subsequently, the concept of resilience is comprehensively deliberated and the need for resilient development is justified, followed by the study of the possibilities to integrate sustainability and resilience principles in the built environment. Furthermore, the book points out that, in previous studies, the social dimension of sustainability and resilience, and the role of the culture, were the least explained and remained without consensus, for which reason a state-of-the-art conceptualisation of socio-cultural sustainability and resilience is made. Subsequently, the book illustrates the measuring methods for sustainable development and urban sustainability, based on defined social, human, natural, and economic values, and then reviews and explains the role of policies and management in the case of climate-resilient cities. From the questions of sustainability and resilience of urban agglomerations, the book steers towards questions of sustainability in rural and "intermediate" areas. The concluding chapters outline several specific socio-spatial

perspectives of sustainable and resilient environments, from defining the course to more flexible communities and sustainable spaces based on overall prosperity, to proposing an approach to identify community resilience as a deliberate act, to responding to the influence and course of social and economic changes and, finally, to providing reflection on the notion of a "healthy place" and challenging its optimal scale in the built environment. The book's final chapter establishes the relationship between sustainability, resilience, and people's health and wellbeing. This is the book's most relevant message. With a strong line of reasoning, it not only proves a direct correlation between the living environment and people's health and wellbeing, but also draws attention to the importance of well-designed spaces.

In the development of the book and its separate chapters, an appropriate scientific research methodology was used. Individual hypotheses or claims are supported by clear and convincing arguments. An important feature of the book is precisely its broad interdisciplinary interpretation of today's topical themes, which surpasses a merely local framework. The considered topics are both globally relevant and undoubtedly applicable on the levels of urbanisation and suburbanisation of the Western Balkans. The book "Sustainability and Resilience: Socio-Spatial Perspective" is an original and commendable source of knowledge for the academic, research, and professional communities dealing with the monumental, unpredictable, and turbulent demographic, as well as social and environmental changes in the built environment.

Prof. Peter Jozef Gabrijelčič
Ljubljana, Slovenia, February 2018

Introduction

Alenka Fikfak, Saja Kosanović, Miha Konjar and Enrico Anguillari

Sustainability and resilience have become indispensable parts of the contemporary debate over the built environment. Although recognised as imperatives, the complexity and the variety of interpretations of sustainability and resilience have raised the necessity to again rethink their notion in the context of the built environment and to reframe the state-of-the-art body of knowledge. The book *Sustainability and Resilience: Socio-Spatial Perspective* so begins with the exploration of the broadest conceptual frame-of-reference of issues related to sustainability, and the re-establishment of the connection between the built environment and the conditions that are vital to its functioning, primarily in relation to energy, land use, climate, and economy. Subsequent discussion on resilience as a term, approach, and philosophy aims to conceptualise an interpretation of key resilience concepts, explain relationships and links among them, and propose the classification of resilience as applicable to the context of urban studies. By studying the processes of transition of the built environment, the book then reveals a coherent formula of 'thinking sustainability + resilience' aimed at improving the ability to respond to disruptions and hazards while enhancing human and environmental welfare. The necessity to integrate the two approaches is further accented as a result of a deliberative discourse on the notions of 'social sustainability', 'sustainable community', and 'socio-cultural resilience'. The potential of measuring sustainable development and urban sustainability on the basis of defined social, human, and, additionally, natural and economic values is presented though an overview of different well-known indicators and the identification of a currently relevant tangible framework of sustainable development. Correspondingly, the role of policies and governance is demonstrated on the case of climate-proof cities. In this way, the consideration of approaches to sustainability and resilience of the urban environment is rounded, and the focus of the book is shifted towards an urban/rural dichotomy and the sustainability prospects of identified forms-in-between, and, subsequently, towards the exploration of values, challenges, and the socio-cultural role in achieving sustainability for rural areas. In the final chapters, the book offers several peculiarised socio-spatial perspectives, from defining the path towards more resilient communities and sustainable spaces based on a shared wellbeing, to proposing the approach to define community resilience as an intentional action that aims to respond to, and influence, the course of social and economic change, to deliberating the notion of a 'healthy place' and questioning its optimal scale in the built environment. The study of sustainability and resilience in this book is concluded by drawing a parallel between environmental, economic, and social determinants of the built environment and the determinants that are relevant to human health and well-being.

Thinking Sustainability _

Shifting Back the 'Shifting Baseline'

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ABSTRACT **The chapter explores the broadest conceptual frame-of-reference for issues related to sustainability, before any specific architectural design and urban planning solutions are considered. The main argument is that narrow disciplinary solutions cannot contribute very much if the overall systemic complexity is not grasped, greater continuum of required practices understood, and dominant narratives challenged. The text first explores the dim *term* 'sustainability', its connotations, use, and politics, and then proceeds to the corresponding *notion* by introducing a wide scope of complexity. The city and the building activity are viewed through the lenses of ecology and environmental history. Discussion further continues to present material, ecological, and systemic limitations and constraints regarding energy, land use (primarily agriculture), climate, and economy. The consideration of probabilities and scenarios in the context of different socio-environmental outcomes is illustrated using the example of Holmgren's 'future scenarios', while solutions are structured through the hierarchy of *technical*, *strategic,* and *cultural*. Finally, the syndrome of the 'shifting baseline' (a propensity to view a current or recently known state of environment as normal) is discussed, and the regenerative power of overall design is speculated upon.**

KEYWORDS sustainability, complexity, energy, resources, scenarios, shifting baseline

TOC

1 Introduction

For several decades now, the way the term 'sustainability' appears in public discourse has been strongly unsynchronised with what the notion of (un)sustainability has to tell us. On the one hand, we are presented with series of unconnected ways in which *usual* activities of our daily life or our professions can acquire just one – among many – improvements called 'sustainable', while on the other we (can) understand that unsustainable can refer to such things as an uninhabitable planet and societal collapse. It even appears that the global culture (including our politics, economy, cities, down to the most trivial aspects) has become incapable of articulating a discussion on threats to its own existence. There are two main reasons for this. The first is that our (globally distributed) culture effectively (though not formally) prohibits all elements of the discussion being on the same table; some key elements, processes, as well as ideas, beliefs, and worldviews appear to be beyond questioning. The second is that the issues of (un)sustainability are deeply complex – and deeply woven into a contemporary complex world – and yet all too often approached with the specialist perspective of individual disciplines.

This chapter will thus use its introductory role to first list and then interconnect all aspects and all main factors related to humankind's ability to achieve sustainable inhabitancy of the Earth. In fact, there seem to be many ways in which sustainability can be achieved, and these ways, as well as some (cultural) *values* that determine them, will also be brought forth to inform an adequate discussion.

In advance, it should be underlined that sustainability is not merely a matter of application of thermal envelopes, public transport, photovoltaics, or any such specific approach or isolated technique. Neither is it just a matter of laws and regulation. Sustainability is, before anything else, a matter of cultural choices and socioeconomic determinants (including power and interests). With 'sustainability', and especially with 'sustainable development', we are presented with narratives, apt of course to be supplemented or confronted by other narratives. This chapter will thus inescapably contain elements of critique, as well as several different narratives, entry points, and sets of scenarios. The text should be read as a web with the key questions being: "What is the importance of this aspect of (un)sustainability?"; "What is at stake?"; "How is it connected to other aspects and factors?"; "If this aspect slides further down to unsustainability, what happens?"; "How – in response to that – the complex system changes?"; "What are the cultural roots of specific unsustainable practices?" etc. Not all answers can be given here, but all the relevant questions should be asked when we plan, build, or otherwise act in our endangered world.

2 Approaching Sustainability Issues

2.1 Strictly Speaking: The Term Initiates the Discourse

The staple definition of sustainability – the version endorsed (in word) by almost any institution, organisation, or individual with a public face and a power leverage – comes from the Brundtland Commission report: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987, para 27). After three decades of use – and despite its many positive effects of formalising the nominal discourse of resource limits, future generations etc. – this definition continues to misdirect the discussion by standing on several problematic connections: It provided a pretext for not separating sustainability from expansive economic activity ('development'); it does not distinguish such economic activity – or any form of 'development' – from 'meeting of needs'; it conflates needs and available resources and, generally, sees the world as not much more than progression of (human) generations. To enable a more complex thinking on sustainability, we will have to start from the foundation of the discourse: the terms selected and circulating. Though used today with considerable emotional charge, the term 'sustainability' is actually value-neutral and not necessarily related to the state of the environment. This sometimes creates confusion, especially when the term is applied to a complex mix of ecology, economy, energy, and material resources. Besides the more archaic (English) meaning of 'sustainable' as being 'defendable', there are two basic notions at our disposal:

'Sustainable' as in: a process that can – under current conditions – continue indefinitely. By this general definition, many different 'sustainabilities' can be recognised. For example, a certain rate of economic growth can (or can't) be sustainable under certain market conditions (such as specific level of demand), or a demanding task can be accomplished by putting greater pressure on those performing the task to exert greater effort, but it cannot be expected for such effort to become the norm (and the situation is thus unsustainable in the long turn), etc. It is noticeable that both examples do not imply any immediate material limits. Regarding this view and a certain abstraction and detachment brought by the term itself, it is worthwhile to compare 'sustainability' with a notion/term that was concurrent for a long time and up until the 1980s in domains of agriculture and soil conservation - *permanence* (Russell Smith, 1929; Mollison, 1988). Just questioning whether any resource-based arrangements of today's global society can remain as permanent brings forth many insights.

The other meaning of 'sustainable' is best described by its negation – unsustainable, as in, a process that by continuing over a long time endangers other processes. It can be, up to a point, that by ruining other processes the problematic one undermines itself, or to a point

at which it is considered unacceptable because it compromises things far more important.

In fact, a total of three faces of (un)sustainability can be observed in the above extrapolations: by depletion, by (overall) destruction, and by unacceptability. It can be said that contemporary (aggregate) concerns about sustainability stem from all three aspects and from (a new) systemic understanding that no process is an island and that the long-term fate of every process lies in fates of its connections, ultimately always dictated by the limits of the natural world. Nonetheless, it took a whole history of human population growth (and a lack of new places to go) for these limits to become immediate and palpable. Still, most of the confusion about sustainability issues in general discourse – besides coming from vested interests – comes precisely from this combination of exact material limits, destruction of vital systemic links (not just the destruction of specific organisms, populations or landscapes), and the values that determine what is desirable, unacceptable or even what is considered to be a norm (as in the 'shifting baseline' syndrome discussed in Section 4.2). If concerns for general human health or social justice are added in, this confusion rises even more, culminating in the paroxysm of "green", which is as imprecise as much as it is suitable for (and used by) the market.

The history of the concept speaks mostly of the difficulties in mobilising cultural, societal, and economic forces for change. The awareness of human-induced environmental damage and resource depletion has been the subject of a number of writings. Among the first, Plato had depicted eroded hillsides and silted river mouths (Hughes, 1994, p. 81; Montgomery, 2007, p. 51). Strabo, Columella, Varro, and Pliny the Elder, besides describing the degradation, proposed practices that would ensure the Earth's 'everlasting youth' (Du Pisani, 2006, p. 85). Practice rarely followed, and societal degradation and collapse often ensued (Montgomery, 2007, p. 55-68). When problems were averted, it was mainly for the reasons other than revised policies based on new awareness, except in a few isolated cases, like Edo-period forestry in Japan (Junichi, 2002, p. 5). Although the subject of human relationships with the environment and key resources ran modestly but continuously through the writings of western authors for several centuries (Du Pisani, 2006, pp. 87-89), the efforts to develop complex working norms appeared at two distinct points in time: The first one was in the 18th century, with treatise on sustainable (*nachhaltende*) forest management by Hans Carl von Carlowitz (*Silvicultura Oeconomica* (Du Pisani, 2006, p. 85)) and the second in the 1970s (Club of Rome (Meadows, Meadows, Randers, & Behrens III, 1972)) and 1980s (World Commission on Environment and Development, 1987) in a much wider (global) context. In the 18th century, not only in Prussia but in the whole of Europe, wood – as a primary industrial source of energy – was becoming ever scarcer. New practices, though employed significantly in some instances, did not save European forests, but a shift to coal (and eventually to all fossil fuels) did. (A major turning point was the Darby family shift from already very scarce wood/charcoal to coke in iron smelting (Hyde, 1977)). Likewise, contemporary concerns for 'sustainable development' coincide with the first impacts

of the fossil fuel bonanza in the 1970s (Yergin, 2008, p. 134), with a public discourse again oriented more towards maintaining the *status quo* than towards assessing the overall position of an energy-intensive socioeconomic (and cultural) model.

2.2 The Web of Problems and the Network of (Discursive) Solutions

Being immersed in immediately available information, images, and narratives of the *global* and its many networks, we can find it hard to imagine today how vast (and larger-than-humans) the world might have seemed just a few decades ago – even to the most observant individuals within a given society. It is perhaps the (trans)historical human collective experience that this large world can recover after any insult made to the environment, or, for new resources to spring at another place when everything at home is thoroughly consumed. The first to recognise a system of global limits were individuals, groups, and institutions in position to gather and cross-analyse large (global) data. This perspective – and its computational tools - truly arose only in the wake of the World War II. The Club of Rome (established in 1968), widely known for its 1972 report *The Limits to Growth* (Meadows et al., 1972) is only one such example in the streak crowned by the official reports (Bruntland, 1987) and conferences (Rio 1992). Within such a milieu, the basic elements of the public discourse of 'sustainable development' were set: the task is to make already established processes of industrial extractive economy (termed 'development' and undistinguished from development of literacy, health care etc.), with all its growth, consumption and re-distribution of power, somehow compatible with finite resources and fragile ecosystems. Although these contradictions were objected from the start (Turner, 1988), and although within specialist disciplines (such as ecology, mining etc.) quantifiable data were the only relevant, the public discourse, as well as the commerce (with new branches of marketing emerging around 'green'), continued to rely almost solely on slogans related (in word) to sustainability. Many professional disciplines and administrative practices operating with complex and multifaceted systems faced the same pressure to develop their own sub-narratives of sustainability. This is especially true for construction, architecture, and urban planning – disciplines and practices that commonly derive their essence and identity through the transformation of natural resources and the environments, hence being elements of 'development' *par excellence*.

Even though urban planning and architecture deal with values, aesthetics, and preferences (both personal and cultural), operate through a very diverse set of parameters, and lack single 'correct' answers, a very narrow approach came to dominate the disciplinary strivings towards an ecologically responsible and resource-wise future. Besides some marginal efforts (Šukalo, 2016), the pursuit of sustainability in these disciplines is almost exclusively an approach of a technically advanced and energy conservative execution of the usual demands of industrial society (Buchanan, 2012).

The thinking process in architecture, as well as the strategic decision-making in urban planning, needs a complex yet operative set of interconnected understandings about environment, resources, and society before any design intention is considered. By exploring the notion and the term of sustainability, we have already delved into some aspect of one such set. Other fundamental considerations are as follows:

Understanding the scale
Eventually, it is the *whole of the world*. The environmental transformations that climate change promises to bring are vast (that is, all-encompassing). Forces producing these transformations are many and they act combined. Constrained resources are almost universally relied upon. Within such a perspective, sustainability efforts of architecture and urban planning can indeed appear as token, thus implying approaches and narratives of *adaptation* to be at least as important as those of *prevention*. Initiating a (public) discourse on the adaptation to great and dismal changes, might even prove sobering enough to improve the prevention.

Understanding the complexity
It is, again, as complex as the world – by now globally interconnected and interdependent. Building industry and city management cannot choose connections and influences (for example, only energy). Every context relies on numerous (interlinked) supportive systems; often much more on diesel-run rice paddy tractors thousands of kilometres away than on a photovoltaic-charged system on the roof of a local office building. High complexity is also often connected with fragility. Perhaps starvation is not an issue if, for example, rice imports cease, but increased food production on a local level would mean a different kind and different level of complexity (often at the expense of a tertiary sector and high culture – and at the expense of the spaces built for those).

Understanding the seriousness
Formulated most directly, climate, resources, and ecological crises threaten, almost literally, with the destruction of the *world* – both in terms of immediate physical elements such as food-producing systems, energy for heating etc., as well as in terms of the overall *image of the world*, as a place worthy and beautiful enough to support us psychologically and spiritually. Confronted with a threat so serious, there stands either an indifference or an array of technical solutions aimed only at narrow particularities. It is practically self-evident that general narratives about the perils of depleted resources and energy, transformed climate, and destroyed ecosystems – let alone depleted soils or water scarcity – failed to mobilise adequate reaction from the general public, economy, and governance. This lack of systemic, overreaching responses permeates every kind of business-as-usual sphere, including contemporary architecture, building industry, and urban planning. Therefore, the means of communicating the seriousness must be altered. An adequate reaction, for example, might be the sharpening of specific (professional) *ethics* that clearly recognises – and denotes – those instances where the best answer is *not to build* (even with all of the technological improvements considered).

Understanding the timeframe

Understanding the timeframe, that is, *the future*. If depletion of a resource, extinction of a species, or destruction of a habitat is predicted (based on specific trends) to happen in the future, it will most probably happen, if the trends remain the same. If a set of new predictions postpone a precise date, the depletion, extinction, and destruction are still bound to happen – again, lest the trends are changed. It belongs to a central logic of sustainability: the *trend* (of use or of destruction) dictates the outcomes, not the time remaining for the continuation of usual ways or yet-to-be-invented solutions. A responsible society (and even any non-irrational one) is not absolved of its duty to apprehend events of unsustainability, no matter how far removed in the future these events may seem. A responsible society plans in accordance with the probability of dire events, not on the basis of its own wishes and aspirations.

The future is easily colonised by whoever dictates the narrative. Its problems should not be discussed only in enclosures of specific technical, disciplinary, or economical/market domains, but always in conjunction with greater debates about possible (future) societal trajectories (though collective discussions about societal futures seem to have passed with passing of the Modern era). Every outcome (desirable or not) of environmental and energetic dynamics has its social, cultural, political, and economic aspects. To put this another way, when talking about an (un)sustainable future, *how (and by whom) questions are asked* is of paramount importance.

Understanding the forces of unsustainability

Despite usual narratives describing challenges ahead in terms of technical solutions or (middle class) consumer choices, there are social and economic forces that confront overall sustainable choices on another plane. It is far beyond the scope of this text to explore the complicated workings of environment-destruction denial (Weart, 2011), policy influencing, (Kamieniecki, 2006; Monbiot, 2013,) and the (poor) economy's vicious cycles (Shah, 2003), but at the core of the problem is an overall understanding that forces of *status quo* are *immediate*, regardless of social status (What to eat today?' 'How to acquire/maintain social status?' 'How to keep balancing daily life?)'. At the same time, the idea of sustainability is governed by abstract concepts derived by analysis of processes that are not immediately observable and which occur over long spans of time. This idea is also guided by a regard for the common good, a regard thoroughly repressed under the current global socioeconomic regime. Finally, it is necessary to understand that there is an aspect of *confrontation* to the whole challenge of sustainability. Like any other it may involve both seeking a consensus and choosing sides.

Understanding the significance of *discourses*

Understanding the significance of discourses and of frames of reference. Writing off preventive actions (and shifting focus to adaptation), insisting on assessing complex influences even before simple professional tasks, labelling some usual buildings and developments (whole types and categories, in fact) as needless and wasteful, promoting the attitude

of 'confrontation' – and many other such approaches in the face of complex problems of sustainability – these are not some universally applicable 'solutions', but crucial points of missing general public discussion about how space is being managed and buildings are being built in the face of energy shortages, soil degradation, natural area destruction, and all else. Not only are these positions not intended to be solutions, but they can't be. Architecture and urban planning are not at the source of decision-making, but are in the executing middle (with lower social classes often being on the 'receiving end' of environmental degradation). These disciplines most certainly cannot, at will, steer global inertia of the industrialised economy and multi-billion human population. Acknowledging complexity means recognising all the significant forces at play and within them usually a small window of possible action (Meadows, 1997) – as far up the hierarchy of the system as possible. Discourses, world views, and cultural preferences often stand relatively high in these hierarchies.

2.3 The City in History: Origins in Extraction, Transformation of the Environment and Prospects for Collapse

Within a collection of processes that have, after more than ten thousand years, brought the whole human endeavour and the entire ecosphere to the verge of catastrophic events, one phenomenon stands out: the city. It is the most visible aspect of human capability to build, to create, and generally to transform the face of the earth. It also vividly displays the heights to which human numbers have grown worldwide. Before advocating any specific approach to urban planning and design (however 'green' that approach might be), a complex context of the city, with regard to sustainability, needs to be examined.

General phenomenon

The city – as a topologically positioned collection of buildings, streets, infrastructure, and people – is not (nearly) a complete phenomenon. It exists in continuum with the places and environment(s) from which it draws resources. Conversely, the largest negative influences of the city mostly happen far from its location (though obliteration of local ecologies within city limits is not negligible). This distant influence is especially true for post-industrial cities of wealthy societies with industries outsourced and the third sector of economy inflated.

Historically (and ever since), the city has been most immediately related to agriculture: food production was a cause of ample population as well as a reason and a model for organising the power (Allen, 1997; Mumford, 1961). Most forms of agriculture (including pastoralism) have, historically and in recent times, been destructive to environment, with several (partial) exceptions (Bezerra, 2015; Montgomery, 2007; King, 1911). The union 'city-agriculture' has seen numerous historical cases of environmental destruction, predominantly through poor agricultural, pastoral, and forestry practices, followed by an imminent societal collapse (Ponting, 2007; Diamond, 2005).

The contemporary city is similar, but also different to the historical one. Urban areas are now home to a larger part of humanity (United Nations, 2014). The resource base of every individual urban centre is no longer local but is spread globally; cities consume ever more resources and energy and, consequently, the specific culture (produced and perpetuated in/by the city) require input of more and different things than mere products of agriculture. It is true that the economy and the culture of surplus were historically also essential traits of urban centres, but the complexity is now raised, fragility increased and – at the source of both complexity and fragility - the amount of energy entering the system is higher by orders of magnitude.

The city as a culture

The city is important to humans. It has been deeply embedded in our imagination for several thousand years. It has been ascribed a divine origin and has been used as a model of heavenly realms. More recently it has been understood – together with its historical twin, 'civilisation' - as (trans)historical inevitability and the only outcome worthy of humans. However, the city can also be viewed as a 'vessel' (Mumford, 1961) – both a product and a source – of *a specific form of culture*, among many other forms exercised by humans, such as hunting and gathering, nomadic herding, rural sedentarism, etc.

No practical conclusions could be easily drawn here except that – unlike in general discourse – problems of 'city culture' should not be emotionally inflated and equated with the fate of 'humanity', and thus many other routes for searching for sustainability could be made open for creative investigation.

The city is about the division of labour and specialisation. The 'great change' brought by the resource crisis does not necessarily mean hunger, insecurity, water scarcity etc. It is possible that many cities would balance out key-resource shortages smoothly, but with significant transformations in what most people do for a living. If anything, a 'great change' is a great change in a (contemporary) city's culture of specialisation, 'opportunity', 'variety', 'choice' etc. (Refer to *Understanding the Complexity* in Section 2.2)

The city as an object of planning

Architecture and urban environment, viewed narrowly, in their usual scope, really offer few possibilities for significant improvement in the field of sustainability. What is to be explored are rearrangements in the greater whole of the city and its resource base – from highly conceptual and farfetched to immediate and practical, together with possible changes in dominant culture oriented at consumption.

On a more abstract level of understanding, all concentrated human dwelling places are nodes in flows and fluxes of energy (Forman, 2014; Odum, 1971). Products of photosynthesis (counted both as energy and biomass), reserves of fossil energy, other direct and indirect gains of solar energy (heat concentrated in mass, photovoltaic, wind, hydroelectric etc.) all enter cities in higher proportions than in

naturally occurring concentrations and circulations. Human/spatial densities (and cultural attitudes) thus enabled often appear wasteful – such as in contemporary dense inner cities relying exclusively on imports of resources or in a senseless sprawl across underutilised landscape. Yet these (or at least similar) densities have prospects for high ecological efficiency (due to optimal care and resources given to productive systems), such as through historical urban agriculture, with cities like Paris exporting humus and 'being able to produce enough food to feed London' (Illich, 1992), or in possible future rearrangements of energetically ideal (but so often underappreciated) densities of *suburban* (Holmgren, 2006).

A reminder: though city culture (together with its resource base) today operates as a global process, individual cities and their contexts do vary significantly, as does their reliance on abundant energy and their fate in a future of constrained resources and climate instability.

3 (Un)Affected by Discourse: A General Framework of Material and Systemic Resources

The continuous use of finite resources cannot continue indefinitely. This is especially true if this use is intensive and encouraged (through socioeconomic imperatives) to constantly grow. The same applies to finite – and ever more compromised and fragile – ecological systems. These are almost truisms that few arguments can counter. Yet, the 'debate' is still on. How? One class of arguments does tacitly admit finiteness of resources, but with an uncertainty of available data it sides with reports and projections of a much more plentiful state, thus postponing the moment of 'depletion' considerably further into the future. Translated into a socio-political and cultural discourse, this quickly becomes a simple (and simplistic) reassurance for the usual "way(s) of life": '(A) supply of natural gas that can last (USA) nearly one hundred years' (Obama, 2012). The reason behind this kind of argument assumes several stances:

– it is impractical to consider such a long timescale;
– at the expense of important economic processes. Further, it requires
– a stance of denying or ignoring the ecological consequences of using said resources (such as greenhouse gas emissions) and
– a faith in the ability of industry ('humanity') to come up with an adequate replacement (in what essentially amounts to a belief in *progress*).

Discussions like this continue throughout the global public arena (with operative decisions all too often siding with the needs of business), but perspectives beyond simple 'full' and 'empty' are not adequately represented. When inquiring into processes and material assets that maintain something as complex as global industrial society, several key concerns need to be addressed. This text will focus most heavily on three cornerstones of large and complex industrial civilization, all three having their 'sustainability' challenged in a different, interdependent,

and mutually amplifying way: abundant energy supply, stability of (climatic) conditions, and the way (not just the amount) that the food is being provisioned for population multitudes. The fourth cornerstone of societal and intimately human aspects will be touched upon only briefly, due to its reliance not on facts and amounts, but on cultural consensus.

3.1 Energy

With regard to energy, there are few non-contested facts; this is the field of most complicated confrontation (and obscurity) of data, views, interests and powers. Some sources of energy (like oil and gas) are deemed so important that major wars are regularly fought over them. On the other hand, fossil fuels, with immense pollution generated by their use - and with wars fought over them - are seen as some of primary drivers of the destruction of the biosphere. For now, and in this format, we will talk about *probabilities* and in a presumption of a wider picture – that of society planning for both a high and low energy future. Key points follow:

Energy is intimately tied to economy, and fossil energy is intimately tied to the dominant form of the industrial economy of the past 200 years (Landes, 1969). It is the economy that relies on growth and asks for the ever-increasing supply of energy and other resources. It can be further speculated that cultural views and expectations of continual human 'progress' were tailored according to this expansive relationship between easily available energy and economy based on the assumption of growth.

Coal, oil, gas and their various derivatives, from the point of view of an energy intensive system, are very convenient sources of energy. They are concentrated (thus indispensable for specific tasks), versatile, easily transportable, independent of specific infrastructure grid (unlike electricity), relatively easily storable, and non-intermittent (unlike solar or wind sources). Renewable sources can replace them relatively easily only in limited scope, like household use, light vehicles etc. For other uses, such as road transportation and large scale industrial agriculture it is less probable, while for an array of usual activities of industrial society, such as mining, air travel, and large-scale inter-continental sea transportation, it borders on impossible (Heinberg and Fridley, 2016, pp. 71-80). Finally, to 'replace' current usage might sound plausible, but to maintain a similar rate of growth to that which has been maintained by once plentiful oil, coal, and gas is outright impossible – as well as it is impossible for fossil fuels and for anything that aims for a perpetual increase.

It takes energy to get energy. In that respect, from the point of view of an energy intensive system, energy extraction is different than extraction of most other kinds of resources where proper demand will justify every effort. At some point, no demand (market or other) will justify spending more energy to obtain less. The ratio of energy acquired over that expended in extraction – *Energy Returned on Energy Invested* (EROEI)

(Gupta & Hall, 2011, p. 1796) has been steadily decreasing for fossil fuels ever since the beginning of their utilisation. The improvements in extraction and refinement technologies has, from time to time, managed to offset this decrease; nevertheless, the conventional oil sources have dropped from a ratio of almost 100:1 in 1930s, to roughly that of 30:1 in recent years (Hall, Lambert, & Balogh, 2014), while 'unconventional' sources like tar sands and shale oil stand at about 1:5 to 1:1 (Nuwer, 2013). The EROEI of wind and photovoltaic technologies is a matter of debate (also of regular technical improvement) but remain relatively low, from 1:1 up to a promising 1:30 (Heinberg & Fridley, 2016; Dale & Benson, 2013).

Non-renewable sources of energy cannot really be 'depleted' and this, again, comes from the logic of EROEI. It is directly linked to a phenomenon common in extraction enterprises (especially in the context of lightly regulated economies): that of 'lowest hanging fruit'. The richest, most concentrated, highest in quality and most easily available resources are often taken first (Heinberg 2011 pp. 36-41). In the context of energy this means that there can be vast reserves left but of low quality and availability; once again extracting them would mean spending more energy to get less. This further combines with the aforementioned need for a dominant form of economy to constantly increase its energy use. It is at the point when global extraction of (combined) energy sources cannot meet this constantly increasing demand that complex socioeconomic problems are likely to arise – not at some imagined point of 'depletion' of very abundant reserves (Illig & Schiller 2017; Heinberg 2011 pp. 78-80).

Once influential narrative of *peak oil*, built on theories and projections of geologist Marion King Hubbert from the 1950s and 1960s (Inman, 2016), was based precisely on this reasoning of decreasing net energy gains, increasing economic demand, and on the perception of contemporary economy being dependent on growth. 'Peak' is a conceptual point when production (either of one specific oil-field or of many combined fields - for example, at the global level) cannot be further increased and enters a stage of terminal decline (Hirsch, Bezdek & Wendling 2005). This narrative fell out of prominence with the failure of some of its prognoses (conventional oil 'peak' in 2006, combined 'peak' around 2012 and similar) as well as with discoveries of new reserves and technical improvements in extraction process (Edmonds, Murray, Hughes, & Heinberg, 2015). While accurate prognosis and actual performance of these new reserves – together with anticipated economic dynamics of peak - continue to be debated (Illig & Schiller, 2017) it is important to remember that such peak is bound to happen ('*Understanding the timeframe*' in Section 2.2) and that the only protective element the global society has placed between that point in the future and economic and social collapse is the widely held and encouraged *belief* that renewable energy technologies will be able, by that point, to replace oil and other fossil fuels.

The problem of coal, oil, and natural gas is exacerbated by the fact that these fossil hydrocarbons are not only energy but a raw material

for numerous products of industrial society – from pesticides and fertilisers to plastics and pharmaceuticals.

Nuclear fission, as a process that releases energy, is also a part of the overall energy equation with a modest ~5% (International Energy Agency, n.d.). Even though it stands as a 'part of the problem' with very high human and environmental risks, and though it is prone to mid-term 'peak'-dynamic, nuclear fission is sometimes debated, even among prominent environmental publicists and activists (Monbiot, 2011), as an inescapable part of the solution to averting the most serious consequences of fossil fuel induced climate change. Nuclear fusion technologies, on the other hand, though imagined – when invented – to be clean, in public discourse still stand as an obstacle to serious discussion about the future of energy.

3.2 Agriculture

The usual focus on available energy and on environmental consequences related to particular sources of energy (for example, fossil or nuclear) conceals other aspects of un-sustainability. These environmentally harmful and unsustainable processes, unlike the recent phenomenon of global warming, have been running for several thousand years. Among them, agriculture is of primary concern.

It is important to mention however that even the emergence of agriculture should not be – as is often done – considered the first (pre)historical step of humans towards unsustainability. In a wide paleontological and anthropological debate about whether numerous extinctions of large mammals on every inhabitable continent except Africa (prior to agriculture, population explosion, and cities) were caused by human over-hunting, the answer currently leans toward 'yes' (Koch and Barnosky, 2006). With the advent of agriculture – primarily in the form in which it was known in Southwestern Asia – several destructive practices and processes were initiated:

– **Land clearing** for crop planting, that is, the destruction of local ecosystems, usually endowed with far more ecosystem services (like, among others, ability to 'seed' rain) than cropland. It sometimes resulted in immediate or very quick degradation, making land immediately unsuitable for agriculture (Montgomery, 2007, pp. 11-13). This continuous process, which subsided only with local human population crashes like Black Death (Ponting, 2007, pp. 87-89), is the biggest visible human change on the face of the Earth. The expansion continues incessantly even as almost all limits of the biosphere are reached;

– **Tilling of the soil**. It may be hard to comprehend that this deeply embedded agricultural and cultural practice stands among environmentally harmful ones. It exposes soil to erosion by wind and rain, over-oxidizes and releases soil-held carbon (Corsi, Friedrich, Kassam, Pisante, & De Moraes Sà, 2012, pp. 11-17) and degrades or destroys the complex ecosystem of soil that is invisible to naked eye but

essential for natural fertility (Coleman & Crorsley, 1996 p. 207, 311). These processes also contribute to the reduction of soils' ability to hold water (Montgomery, 2007, p 205), which not only lowers agricultural production and puts greater pressure on irrigation sources (sometimes also resulting in soil salinisation), but amplifies cycles of wet and dry, flood and famine.

– **Carbon release.** Carbon sequestered in soil by natural processes is released into the atmosphere where it is added to carbon from other sources, including processes of both traditional and industrialised agriculture (e.g. native vegetation burning, crop residues burning, farm machinery, production of synthetic materials, long distance transport, etc.) combining to almost one third of all anthropogenic carbon release (Gilbert, 2012).

As an effect of the aforementioned processes, healthy and productive soil (not just any tillable land surface), being a primary resource of agriculture, has been steadily degraded and destroyed worldwide for thousands of years. This trend is clearly not sustainable; it has its limits. With current agricultural practices and the current rate of soil (fertility) loss, it is estimated that there's about 60 more years left before world food production is very seriously endangered (Arsenault, 2014).

Contemporary (industrialised) agriculture deepened the un-sustainability even further. The list of additions is long: synthetic fertilisers disrupt the symbiotic relationship between plants and soil organisms, thus additionally reducing natural their fertility and slowly destroying soil structure (Coleman & Crorsley, 1996, p. 324); they also leach intensively into the environment, with an array of resultant problems (Odum & Barret, 1953, 2005) together with leaching of synthetic biocides whose negative effects are widely acknowledged. Transition to mined sources of phosphates has additionally made food production dependent on a depletable key resource (Mohr & Evans, 2013). When talking about dependence on non-renewable resources, fossil fuels (and petroleum-based raw materials) step into picture, together with often high dependence on constantly diminishing resources of underground aquifers. Finally, there are practices of growing annual crops (thus already including the negative aspects of tilling, etc.) to be used as a feed for confined animals, taken out of agroecosystem processes, with wastes concentrated to produce large amounts of methane (a highly potent greenhouse gas).

Why was it necessary to present all of these aspects of agriculture in some detail? Primarily to demonstrate that even if miraculous advances are made in renewable energy production and energy conservation, not all is solved in other domains. There are still grave concerns to be addressed on the level of specific (agricultural) techniques, but more importantly on levels of economic, social, cultural, and spatial arrangements within the most basic field of all – that of food production.

Fortunately, on the level of specific techniques and more complex approaches, food production doesn't need miraculous advances.

The world has seen many local historical examples of sustainable agriculture, and contemporary methods (both conventional and 'alternative') are numerous. Even more, adequate practices of agriculture can easily be regenerative, not only conservative. For example, carbon that was continuously released throughout the centuries can be incorporated back into soil (FAO, 2017; Toensmeier, 2016), not through any high-tech geo-engineering but through proper play with plain old photosynthesis - while growing food.

Forests too belong to the continuum of biological and ecological 'resources' that humans regularly use. Forests have been slowly recovering throughout many parts of Europe (and other temperate humid climates) since they were replaced by fossil fuels as a primary source of industrial and domestic energy (Williams, 2006, p. 473) and with gradual abandonment of rural areas. At the same time, assaults on forests in more brittle ecosystems (in the tropics) have been carried out in a quest for commodity wood and for plantation land (Williams, 2006, pp. 397-402). Without going further into the state and trends of forest dynamics and its sustainability, a question needs to be asked: What will be the consequences in the event of the possible return to wood as primary source of energy? How can it be anticipated through planning?

3.3 Climate

Even though high (fossil) energy use and soil destruction are unsustainable in their own right through the diminishing of critical resources, climate change also meets them half way; it renders them unsustainable yet again by making them 'unacceptable' (Section 2.1). Climate change amplifies all systemic consequences of unsustainable uses of natural resources. It is not only that coal and oil cannot be relied upon in the long term because their net energy eventually approaches zero (see EROEI in section 3.1), but burning of these substances eventually changes the whole planetary environment to the point of being uninhabitable. Not only we cannot rely for long on the current model of food production because it destroys its own soil base, but global changes of climate – caused in large part by agriculture and land use change - are bound to bring this production even lower by droughts, floods, and other events of unstable climate and broken ecosystem links. Finally, if we find contemporary socio-political arrangements around the world to be less-than-perfect, the age of 'climate refugees' (Byravan & Rajan, 2005) promises to aggravate these arrangements even further.

For the opposing view of human influence on climate (usually marked as 'denial'), it is worthwhile to consider the aforementioned in reverse: even without anthropogenic climate change, current ways (of food production, energy use etc.) cannot continue indefinitely and are to be replaced by alternatives.

It is beyond the scope and the intent of this text to recount the range of predictions about greenhouse-gas levels, climate forces, feedback loops, and the dire consequences of the average temperature exceeding

the pre-industrial average by more than 2°C (IPCC AR5, 2014). Equally outside the scope (and off the point) of this text would be listing the practical approaches and procedures aimed at averting, mitigating, or adapting to climate change – even only within the domains of building and urban planning. These approaches and procedures are mostly well crafted to reduce the climate impact of buildings and cities, yet the real engines that push us towards catastrophic global warming continue to hum unabated. It is the overall framework of culture and economy (and their demands on energy) that needs adjustment in order for change to fall short of the 2°C threshold. To illustrate the way in which the most basic and fundamental among harmful processes continue despite agreed upon complex solutions, let us consider the following example:

If it really wanted to abide by latest UN climate agreement, negotiated by representatives of 195 countries (USA withdrew in June 2017), in Paris in 2015 (Paris Agreement, 2015), the global fossil fuels industry would need to stop any further exploration of new sources, since what is already in production (capacity to release 942 gigatons of CO_2) is sufficient to override the limit of the 2°C increase (800 gigatons) (Muttitt et al., 2016). Not surprisingly, prospecting for new oil discoveries (only oil, without coal and gas) continue - although 2016 marked a 70-year low with 2.4 billion barrels (due to low prices of oil). It is expected to resume at full steam after voices are raised about such 'small' amounts being a 'concern for global energy security'. It will probably soon return to the average 9 billion barrels (IEA, 2017). This single example, among many, depicts how political, economic, and, in the end, cultural narratives remain confronted with the physical realities of constrained resources and climate change. Processes of environmental degradation continue to run at a faster pace than the pace of implementation of solutions – with predictable consequences. Herein lies a further and a more consequential logic of 'thinking sustainability':

*Emotional and subjective responses***,** together with logical, technical, and practical ones, are integral parts of a complete stance and action on sustainability issues; they are a legitimate part of a systemic view. Personal and group emotions of despair (or such) emerging because of the ensuing *loss of the world* shouldn't be buried by limited immediate action, but should instead be encouraged to enter general discussion – partly in order to help shape the 'understanding of the seriousness' and to instigate a search for different approaches. After all, there is a whole aspect of sustainability related precisely to values and emotions (see 'un-sustainable as unacceptable' in Section 2.1) and there are whole parts and layers of the world whose loss threatens almost nothing but themselves - and our humanness. Apart from pollinators and other similar key groups of organisms, the whole peril of biodiversity loss is related to mostly what (some) humans find dear: from river dolphin and rhino to salamander and lynx.

Educated socio-economic perspective is crucial for adequate stance and discourse on climate change. Responsibility for proper action is not homogenously distributed and vague appellations on 'humanity', 'human civilisation' and the collective 'us' are often used more to

obscure interests and positions of power than to initiate a meaningful change. Leverages of politics and economy are much more powerful than, for example, a 'consumer choice' is. Leverages in hands of *professionals* (such as architects, planners, and engineers) also rank relatively high, not so much in the sense of technical improvements, but in the collective awareness of the critical position that professions hold in the smooth operating of a clearly harmful system. The combat against climate change has occasionally been likened to a state of war (McKibben, 2016), both in (acute) awareness and in the resource mobilisation needed. Unfortunately, or not, neutrality is rarely possible.

3.4 Culture

The previously described dynamic of material limitations to the endless continuation of growth, 'progress', or *business-as-usual* is altered, modified, and steered by societal influences of quite a different kind. We will present them only through rather wide and speculative theses, for consideration.

Any discussion about sustainability is incomplete without addressing the number of people living on this planet. This number has been growing almost constantly for thousands of years and the unimpeded growth alone highly qualifies it among the 'unsustainable'. Yet it is advisable not to indulge in simplifications and treat 'population' as a biotic factor. Cultures and economies set the birth rate. Cultures and economies - not 'humans' - consume the Earth today. Currently, far more important environmental pressure than the increasing numbers are increasing cultural demands caused by the aspirations of poorer countries to reach the wasteful material standards of wealthier ones (Pankiewicz, 2015). Reasons for which the talk about 'population control' is somewhat a taboo are obvious; rather than being imposed by policies, it should be *enabled* by culture and economy. Easing of global (and *globalist*) economic pressures thus becomes an immediate task in tackling population growth as one of the most serious sustainability challenges.

An additional factor needs to be considered: the current state of the discussion about population growth reflects the current state of energy use and it also reflects the overall form of the economy. The stability of human numbers (potentially) achieved in one energy regime, might not be viable in another. For example, a possible (or probable, or inevitable) transition from high to low energy-use (and low-tech) economies brings about the possibility of an increased demand of (physical) human labour, and with it resumed growth of human numbers even in areas that have long had stable or decreasing populations.

A complex economy - and *complexity* itself – are the primary filters of events related to resource limits. While endangered resources are by themselves *primary* (raw energy, food etc.), the effects are bound to manifest mostly in domains of *secondary* (range and diversity of products, maintenance of already existing buildings and products)

and *tertiary* (services, extensive range of specialised knowledge, diverse high culture).

In complex societies, complex governance (for example a *democratic* one) requires, among innumerable other prerequisites, a certain surplus of energy. In possible future energy transitions, a little more than a semblance of democratic social relations might only thrive (or even only be possible) primarily in *smaller scale* socioeconomic arrangements.

4 Envisioning the Future

4.1 Envisioning Contraction

The collective dreams of technologically advanced utopian future slowly started to fade from the 1970s onwards, probably as a result of multiple factors, including disappointment with outcome of the '60s social movements, the first crises of energy prices in 1973 and 1979, the first recognitions of biosphere limits (and the ecological consequences of 'development') as well as the (re)turn to a heavily deregulated market economy in many countries. While prospects of such things as interplanetary expansions and colonisation continue to be discussed with some seriousness and resources invested, together with more earthly expectations from "digital", "nano" etc., it is quite clear that overall collective visions of the future have been shaped to their current state as much by concern as they have by hope (Szeman, 2007).

The lack of a common agreed understanding of the future of society and the planet does not mean that it should be, once again, crafted as a single narrative, but as a complex set of parameters and *probabilities*. Let us here examine just one, relatively simple, example of this way of thinking, akin to logic presented in this text so far.

David Holmgren, co-originator of the *permaculture* concept (Mollison & Holmgren, 1978), has put forth a relatively prominent system of 'future scenarios'. He recognises four 'culturally imagined and ecologically likely futures over the next century or more':

- **Techno explosion**, associated with presumptions (wishes actually) about new concentrated energy sources (the aforementioned nuclear fusion and the like), human technical ingenuity and eventually expansion towards other planets;
- **Techno stability**, also counting on intense technical invention, but mostly within the domain of renewable energy and on the level of energy use similar to what is consumed currently. The 'stability' is presumed to reign also within social and cultural realms;
- **Energy descent** assumes inadequate replacement of decreasing fossil fuels and other non-renewables with other sources. This further draws

gradual and 'soft' decreases in (industrial) economic activity, complexity, and eventually in population;

– **Collapse** that depends on much more abrupt changes in energy supply and/or a strong destructive effect of climate change (Holmgren, 2009, pp. 7-9).

Holmgren, obviously ignoring dreams of space flights and fusion, further systematises and investigates future possibilities primarily through two axes: oil decline (slow or fast) and climate change (benign or destructive). While finding energy descent inevitable, he derives four basic scenarios and supplements them with societal trends that would be required or would likely emerge:

– **Brown-tech** scenario has decline in oil that is slow enough to allow ever more polluting sources (like coal or tar sands) to be utilised, while climate change delivers strong effects. Incentives to maximise economic production, and pressure to deal with problems of food supply and climate displacement, offer pretexts for the emergence of more authoritarian social systems (Holmgren, 2009, pp. 35-38);

– **Green-tech** also includes slow fossil energy decline, demands political and cultural will for a shift towards renewable energy, and assumes more benign effects of climate change. More democratic political models prevail (Holmgren, 2009, pp. 38-40);

– **Earth steward** sees the fast decline of oil and benign climate change. A fast decline prevents adequate and timely replacement by renewables, but still-bountiful biosphere (with favourable climate) enables sustenance of large populations - at the expense of profound shifts in economy, culture, and societal scale (from global to regional and local) (Holmgren, 2009, pp. 41-43);

– **Lifeboat** scenario combines the fast decline of available fossil fuels with the destructive effects of climate change. It results in virtual breakdown of global socioeconomic scale, severely (and possibly abruptly) decreased human populations with highly patchy and ephemeral economies set around rare opportunities spotted in a radically altered climate. *Brown-tech* eventually converges to *Lifeboat* (Holmgren, 2009, pp. 43-45).

Holmgren's assessment was written during the height of *peak oil* debate and it assumes some kind of imminent start of decline in available fossil fuels. It sees decisions (both voluntary and forced) between *brown*, *green*, *hi-* and *lo-tech* set into context of energy constraints. However, the global supply of oil, gas, and coal has been well maintained – mostly as a result of improved extraction technologies able to alleviate some consequences of low EROEI. Mere lack of availability will thus not spare global industrial society from making critical decisions: either to use still abundant energy to enter *inevitable* decline prepared and in a preferable manner or to continue to work incessantly towards the aforementioned convergence between *Brown-tech* (actually our current reality) and *Lifeboat*. Furthermore, lack of any centralised 'global'

decision does not abstain any community, group, or individual from making their own decisions: Holmgren himself has recently explored possibilities of abstention from global economy by a relative minority (of around 10%) that could possibly trigger economic collapses capable of substantially reducing green-house gas emissions (Holmgren, 2014).

4.2 Envisioning Solutions

Although the *probability* of fragmentation and degradation of industrial civilisation in the near future seems to be quite high (if we are willing to look) and although severe climate change is claimed to be almost inevitable, the work on sustainable 'solutions' is far from futile. Such work nonetheless needs to be constantly examined within the complex framework that this text has tried to present so far. In such examination, a specific structure (or hierarchy) emerges:

What might be called the *technical level* encompasses efforts aimed at decreasing harmful side-effects of current established socioeconomic and daily life practices. The increased thermal efficiency of a building will thus decrease unnecessary losses of energy; a well organised bus system will replace many individual automobiles in commuting; ecologically sound agriculture will deliver its products without further degrading its own (soil) base; wind turbines will add far fewer greenhouse gasses while delivering energy to the same established and unquestioned processes. Most actions branded today as 'sustainable' remain at this stratum and its range of options.

Strategic level should, generally speaking, understand that current modes of socioeconomic (and spatial) reproduction are situated within specific trajectory of energy use – a trajectory eventually aimed downwards. It should also understand the seriousness of climate perils. Simply put, it understands 'reality' and the inevitable. Thus, strategies will deal with the organising and scheduling of the (controllable) events towards future states of contracted economy and sparse energy. Several such approaches, though still clearly marginal, have been developed, e.g. Transition Town Initiative (Hopkins, 2008).

Cultural level, as might be expected, has several aspects. First, it should question all of the established notions, values, and practices that demand increased use of resources. It should, before anything else, question the (economic) growth and lifestyles based on wasteful consumption of material resources, but it can also focus on social (and spatial!) fragmentation and its severance of ties between humans and the environment. The second aspect of *the cultural* understands that not all perils of unsustainability are related to human survival and material wellbeing. It understands how deeply sad and almost palpably degrading for humans (that is: for members of this 'city culture') it is to be the cause of a global species extinction akin to the impact of a large asteroid (Carrington, 2016). Consequently, any argument and any 'solution' reckoning only with humans to find some form of their own salvation cannot really be deemed viable.

Finally, cultural level needs to undertake a very broad envisioning of other ways of interaction between human cultures and their local and global environments. It must not only fight against the unnecessary use of resources, but it needs to question the very notion of 'resources' – parts of a living planet somehow standing at our unquestioned disposal and waiting to be used for however trivial purposes. It must not only profess less consumption, but less 'production' – that is, less of such interactions with the environment that are aimed solely on the satisfaction of narrowly defined human needs.

Today, we rarely bother to imagine further than windmills spread through agricultural landscapes, but let us briefly explore some of these different visions and different possible cultures.

4.3 Humans and the World

An extra-ordinary perspective: world without humans

In a hypothetical perspective in which humans never existed, or in which they remained modestly incorporated into their environments, the world would look quite different. This is practically self-evident, but the full implications are far more interesting than the vision of the mind's eye trying to draw before it a forest where now a mine, a motorway, or a city stands. The absence of humans *is* the presence of other forms of (animal) life. Paleontological and paleoecological findings (Malhi et al., 2016) from the very recent geological past (either in a similar climate of the most recent interglacial and early Holocene, or in glacial maximums) point to a vision of the whole terrestrial world as rich with animals large and small as it is now with humans – at least. Fertile lowlands of Europe and Asia, upon which streets of cities now lie, would be roamed by large herds of at least one species of elephant, many rhinos, countless aurochs and bison, swaths of wild horses, elk, deer, wild boar; maybe even hypos and water buffaloes in rivers filled with as much fish as water. And, of course, the predators: lions, hyenas, leopards, lynx, wolves, bears, and eagles. North America would see similar landscapes, also filled with elephants and lions, but also with cheetahs, giraffes, camelids, bison, and flocks of birds that would darken the skies for several days. Every other continent except Antarctica would sport a similar (or less similar, in Australia's case) suite of large animals. (Africa still has the species - in miniscule areas - but does not have the numbers.) The oceans and seas are probably beyond description; even a few hundred years ago they seemed otherworldly for the life swimming in them (Monbiot, 2014, p. 228).

Still, it is not only the number (and the beauty, and purpose!) of species or the size of populations that was – would be – the normal state of the planet Earth. The ecological processes taking place inside this magnificent web of life were equally far removed from the contemporary state of the environment. Oceans were capable of absorbing vast amounts of CO_2 – in large part thanks to abundant whale populations (Pershing, Christensen, Record, Sherwood, & Stetson, 2010). Forests, savannas, and grasslands were able to significantly improve and moderate rainfall

distribution. Soils, rich with living and dead carbon, organised a perfect hydrology beyond drought and flood. Large (often far-traveling) animals distributed seeds and circulated nutrients around whole continents; the absence of these cycles is still felt today, and it even limits natural productivity of places as fecund as the Amazon basin (Gross, 2016).

Such was – or 'is' or 'should be' – the *normal* state of the planet. It gradually – and often abruptly – deteriorated through human influence. Even if local overhunting was not the cause of many extinctions, the rise of 'city-culture' (with its numbers, agriculture, and the great habitat destruction) certainly precluded natural fluxes and re-settlements (Malhi et al., 2016). Yet, even in historic times, the remnants of these riches could still be found, such as in writers of *Gilgamesh* describing their hero entering deep dark forests - in what is desert today (Kovacs, 1985, p. 22), or with Xerxes' army, on its way to Thermopylae, encountering lions in Macedonia (Beach Combing (alias), 2013). The immense flocks of passenger pigeons were exterminated from the skies of North America only during the 19th and early 20th centuries.

The *normal* and its variants

Although this great deterioration and change of global environment happened quite quickly in terms of geological time, the changes were hardly noticeable for every passing human generation, even with written record. This 'shifting baseline' syndrome, named this way by landscape architect and pioneer in ecological planning Ian McHarg in his prominent *Design with Nature* (McHarg, 1969, p. 31), operates in a way in which individuals, groups, and whole cultures tend to define their known particular state of the environment as 'normal', rarely reckoning with long processes of decline (that might even be widely known). Many questions thus arise when a contemporary state of (unsustainable) affairs is compared to a different baseline than its own: Do we already live in a world unbearably simplified and poor? Is to 'sustain' this level of planetary health the most we can strive for – in all our glorious human genius? Is 'sustainable' even an adequate term? How can we define problems not only in terms of defence and conservation but in those of regeneration and enrichment?

A design perspective: shifting back the 'shifting baseline'

So then, are humans – or, to be precise, their cultures and economies – inevitably akin to some kind of locust swarm that in each and every case devours what it lands upon? We ('humans' or cultures) have certainly contributed to environmental health so rarely throughout history as to earnestly deserve this kind of comparison, but the recipe for optimal ecological functioning is not merely an absence of people (a fictitious absence by itself), but their inclusion in this functioning – inclusion that directs our desires, our ingenuity, our designs and our cultures towards this integration.

Even (impossibly) walking away and turning nature loose probably wouldn't be enough to avert dramatic changes that are by now fully set in motion. On the other hand, we can have a profoundly positive impact: *designing* our inclusion around already established densities

and fluxes of energy (as in, individual- and community-centred urban agriculture), beneficially organising (rain)water in landscape in a way that nature never would (yet gently, cautiously, and with very simple technology (Yeomans, 1958)), sequestering carbon while growing food (Toensmeier, 2016), mimicking ecological impact of now gone wild herds with appropriate management of both domestic and wild animals (Zimov, 2005; Savory & Butterfield 1999), setting aside space (near and afar) and actively reintroducing species for wild processes only (Monbiot, 2014), building in accordance with our true modest needs (Šukalo, 2016), while simply using less – all these are just glimpses (and existing practices) of positive human influences that can recover environment from this starting point far more quickly than through 'natural' processes alone. They also far surpass an outlook of conservation and replacement-by-lesser-evil, an outlook pervading our well-known images and aspirations of 'wind and solar', 'energy efficiency' and the like. These positive influences would be – in a true sense of the word – a sustainable development.

A rich intellectual tradition (Mollison & Holmgren, 1978; Papanek, 1972; McHarg, 1969 etc.), which stresses the importance of general design in our relationship to environment seems to be right: the *whole* of our engagement within the environment should be set and organised as carefully as we have for centuries been careful with the narrow technical side of things – and the positive changes would equal in scope those of our historical technological advances. However, there is a deeper prerequisite: as much as being a 'source' and a provider, as much as being an endangered and fragile system, our *world* can be a universal object of interest, cultural focus, and a design playground. It shouldn't be a mere 'resource base'.

5 Conclusion

Any serious examination of sustainability issues has only one conclusion: If global industrial society doesn't radically change its ways, the world we know will most probably disappear. This "world we know" is composed of almost all of the material goods we use, the services we receive, and the complex social interactions we engage in. It is also composed of tigers, elephants, honeybees, healthy forests, and of any bearable and functioning (local) climate. It must be said that "most probably" does leave some doors open for miraculous technological fixes, as well as for the prolonged agony of the environment in case of prognoses that are missing a decade, or even a few, but probabilities will always abide by fundamental laws of cause and effect: If a finite amount of resources is used, eventually it will become unavailable; if the natural world is constantly being stressed, its parts (species, habitats, processes) will eventually fall one by one; if the environment is incessantly being degraded (through sprawl, agriculture, and industry) global warming is not even necessary to bring about misery and deprivation; infinite (economic) growth is impossible on a finite planet. That is all there is to know about sustainability as such.

Confronting this utter (and shrill) simplicity there stands the buzzing and humming cosmos of "business as usual": water being delivered, food being transported, cars rolling, schools working, careers developing, bank accounts swelling etc. It is as complex as the natural world (the one of cause and effect) and humans mostly find it unavoidable, dear, and even the only reality. It is progressively considered more precious the further we look up the social and power ladder – and certainly more fiercely defended. Within such a framework, the realisation of simple ideas - decreasing material consumption, building only when really needed, transitioning from fossil fuels and reforming the way the food is being grown - start to seem complicated. Within and because of that framework specific disciplines (architecture and urban planning, for example) have devised elaborate concepts aimed at adjusting the processes of globalised industrial society in order to make these (often irredeemable) processes more 'energy efficient', 'responsible', and a little bit less wasteful. It is the framework of a very narrow manoeuvring space in which any broader systemic perspective is relegated to margins, bound to dealing with change only in narratives.

Pessimism can thus seem a quite expected, and even a genuinely healthy, stance (for optimism – apart from being detached from the realities of the material and ecological world – quickly becomes integrated into ideological currents of *progress* and *growth*), yet, inaction is impossible. Inaction is actually a complicity. Whether we engage in fighting political battles of environmental advocacy, improving the efficiency of existing processes, promoting *less* as a way or devising designs of (non-industrial) abundance, we do it equally out of the hope for problems to find their solutions, and out of sense that, even if irreparable, our *world* simply asks for us to act.

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Shifting Forward _

Resilience Thinking in Out-of-Order Urban Systems

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ABSTRACT **Complex interplay between spatial, social, economic, natural, political, and other factors made cities more vulnerable and less capable to respond to more frequent uncertainties, sudden upheavals, and disturbances that lead to different types of spatial dynamics such as urban sprawl, shrinkage, brownfield sites, degradation of built environment as a consequence of natural disasters, etc. In response to these multiscale disturbances, the paper introduces and elaborates upon *resilience* as a new term, approach, and philosophy. Based on a review of a large body of literature from the field of ecology, the paper presents origin, history and development of the concept, definition, types and key principles of the resilience approach, i.e. state-of-the-art knowledge and basic ideas about current matters related to the resilience. In the final part, the paper sets the conceptualisation of *urban resilience* by raising the assumption that the city is a *complex adaptive urban system*. Through conceptualisation, the paper gives an interpretation of key resilience concepts from the urban perspective, explains relationships and links among them, proposes classification of resilience applicable in the context of urban studies, and opens the key topics and questions for further research. The main objective of conceptualisation is not to provide ultimate definitions and interpretations, but to open new horizons, create fertile ground for dialogue among scientists and practitioners, as well as to encourage further research in the field of urban planning and design.**

KEYWORDS resilience, complex adaptive system, urban resilience, climate resilience, adaptive management

1 Introduction

From the industrial revolution up to the present day, the human impact on the Earth has been enormous. Civilisation has influenced the biosphere in such a way that it moved humanity into a new geological era, proposed as the *Anthropocene* (Folke C., 2016, p. 7). One of the major anthropogenic marks of new era is urbanisation and climate change. Global warming has led to severe consequences all around the planet, hence society's current witnessing of the melting of Arctic ice sheets, sea level rise, freshwater shortages, floods, hurricanes, heat waves, droughts, species extinction, etc. Recognising the seriousness of human impacts on the biosphere, ecologists have created and developed a new innovative concept/approach for dealing with uncertainties in natural resource management, called *resilience*. Though it is sometimes hard to determine whether resilience is a concept, theory, approach or philosophy, its influence on science, practice, and policies is indisputable.

The last twenty years have been marked by the expansion of resilience research. The idea of resilience is gaining increasing prominence across a diverse set of literatures. The concept has been accepted in academic and policy discourse where it gained large popularity. Nowadays, the resilience concept has spread to such extent that it is almost impossible to give a comprehensive review of the large body of literature associated with it. Such excessive spread across different disciplines and areas has caused some disagreements among different literatures about how to define, apply, and measure resilience. Its overuse and ambiguity put resilience in danger of becoming a vacuous buzzword (Rose, 2007, p. 384). The etymological roots of resilience stem from the Latin word *resilio*, meaning: to bounce back, leap back, spring back or rebound (Davoudi, Brooks, & Mehmood, 2013, p. 308; Klein, Nicholls, & Thomalla, 2003, p. 35). Even though the resilience is a generally accepted notion in the global context, in Balkan countries (Slavonic languages: Serbian, Croatian and Bosnian - SCB) the term resilience is a "non-existing word" (Marot, 2014, p. 1) with more or less (un)related meanings: flexibility, elasticity, resistance. Despite the disagreements among local scientists about its translation, some of them have adopted resilience as an Anglicism, translating it as *rezilijentnost*, while the others use *otpornost,* meaning resistance.

This implies a lack of understanding of the concept of resilience and justify the need for its (re)examination, interpretation, and clarification. Additionally, examination of possibilities and limitations of its application in urban research is needed. Therefore, this paper presents a comprehensive review of a large body of literature, i.e. a review of state-of-the-art knowledge and basic ideas about current matters related to resilience: origin, history, development, and application of the concept on one side, while on the other, it presents definition, types, key principles, and approaches developed within resilience theory. In the final part, a conceptualisation of urban resilience has been given. Key terms, concepts, and tenets of resilience have been introduced and connected with key determinants of the city (components, structure,

and processes). Conceptualisation starts with the assumption that a city is a *complex adaptive urban system* (CAUS). Hereafter, meanings of the terms *complex* and *adaptive* are elaborated and connected with principles of resilience. The main objective of conceptualisation is not to give ultimate definitions and interpretations, but to open the horizons and create fertile ground for further research in the field of urban planning and design.

2 Resilience – History and Application

From its early beginnings in psychology (1940s and 1950s) and engineering (1960s and 1970s) to the present day, the resilience approach has expanded within the spectrum of scientific disciplines and academic fields. Although the concept has a long history of use in other disciplines, its contribution in the field of ecology is particularly important. The concept of resilience was originally introduced into ecology and environmental science by ecologist Stanley Crawford Holling in 1973. His work, to some extent, marked the "renaissance" of the concept of resilience (Bahadur, Ibrahim, & Tanner, 2010) in ecology but, at the same time, it started to gain increasing popularity in several other disciplines. Holling's (1973) seminal paper "Resilience and Stability of Ecological Systems" is one of the most cited as the origin of modern resilience theory (Folke, 2016; Meerow & Newell, 2015; Meerow, Newell, & Stults, 2016). Early on, resilience began to influence work and discussions in fields outside ecology and environmental sciences such as sociology, economics, geography, planning, management, etc. (reviewed in Baggio, Brown, & Hellebrandt, 2015, p. 7; Brand & Jax, 2007, p. 8; Folke, 2006, p. 255; Folke, 2016, p. 3). Diverse research domains address resilience at different scales, from more general to more specific, more theoretical or more practical, concerning resilience as an approach – *way of thinking,* or as a system feature/property - *desirable goal*. In that sense, resilience has specifically influenced fields focused on global environmental and climate change, risk and disaster management, social justice and equity, socio-economic insecurities, social vulnerability, poverty and food security, social protection, etc. On the other hand, resilience as an approach for dealing with uncertainty, surprises, disturbance, and crisis found its place in the following fields: human and economic geography, international development, regional economic development and strategic planning, environmental management, environmental planning, urban study and policy, urban and regional planning, urban governance, sustainable development, political and power dimensions of sustainability; government of complex social-ecological systems, social learning, and knowledge systems, etc. (reviewed in: Brand & Jax, 2007, p. 8; Davoudi, Brooks, & Mehmood, 2013; Folke, 2006; Folke, 2016; Meerow, Newell, & Stults, 2016). Over the past decade, the resilience concept has become widespread, in not only the academic field but also in practice, policy, and business (Folke, 2016, p. 1), where it is largely seen as a response to changes, crisis, and uncertainties. However, Davoudi et al. (2013, p.

307) assume that resilience has remained a vague concept, probably due to (or in spite of) its proliferation.

As an approach for understanding different types of complex adaptive systems, resilience serves as a platform for interdisciplinary and transdisciplinary research (Folke, 2016, p. 1). However, resilience has opened a lot of discussions and contestations among scientists and practitioners, which relate to its utility, application and measurement. Brand and Jax (2007, p. 9) see resilience as a *boundary object* (originally proposed by Star & Griesemer, 1989) that facilitates communication across different disciplines and diverse stakeholders, creating shared vocabulary and bridging the gap between science and policy. However, Simin Davoudi (2012) posed a question of whether resilience is a "*bridging concept* or a dead end"? Pointing to its overuse, she argues that resilience is in danger of becoming just another buzzword. Beyond the simple assumption that it is good to be resilient, there is a lack of clarity about what resilience really means and what are the opportunities and limitations of translating resilience from the field of ecology into planning theory and practice (Davoudi, 2012, p. 299). Nevertheless, she believes that it has "the potential to become a *bridging concept* between the natural and the social sciences and stimulate interdisciplinary dialogues and collaborations" (Davoudi, 2012, p. 306). Baggio, Brown, and Hellebrandt (2015, p. 2), in their comprehensive citation network analysis of resilience, made a distinction between resilience as *boundary object* - an entity shared by several different groups but viewed or used differently by each of them (e.g. resilient city), and resilience as a *bridging concept* that actively links different scientific fields, policy and practice, stimulates dialogue, and fosters inter- and trans-disciplinarity. Their research indicates that use of the term across different fields supports resilience as a *boundary object*, but only in a limited way as a *bridging concept*. Referring to Brown (2012), Baggio et al. (2015) suggest that resilience could be seen as the reframing of existing and conventional approaches, rather than one that is truly new and innovative. Therefore, they conclude that resilience is a *boundary object* that is able to foster interdisciplinary collaboration.

A lot of work on resilience has focused on the system capacity to absorb shocks and still maintain its function. However, resilience requires much wider observation on one hand, while deepening the detail of the research subject on the other. The origin and development of the resilience concept is best understood through the evolution of its definition. Furthermore, to fully understand resilience as a notion, concept, approach or theory, the explanation of a number of crucial concepts is necessary: the adaptive cycle, panarchy, complex adaptive system, resilience, adaptability, and transformability. For the sake of clarity, the next sections investigate the development path of resilience thinking/theory in more detail, and at the same time define the typology of resilience.

3 Engineering and Ecological Resilience

There is a lot of confusion in scientific literature related to the origin of resilience, as well as incorrect interpretation of its classification. Béné, Headey, Haddad, & Grebmer (2016) argue that although many scientists wrongly presented Holling as a founder of the original definition of resilience, the term had been actually first mentioned in the context of 19th century warship design through the 'modulus of resilience' when naval architect Robert Mallet introduced this concept as a means of assessing the ability of materials to withstand harsh conditions (Béné, Headey, Haddad, & Grebmer, 2016). In the 1960s and 1970s, the concept progressively emerged in engineering, where resilience was defined as the capacity of a material to absorb energy when it is elastically deformed and release that energy upon unloading (Callister & Rethwisch, 2012, pp. 216, 878).

Soon after, resilience appeared in the field of ecology through two main approaches; the first more focused on ecosystem dynamics near equilibrium – *engineering resilience,* while the other emphasised ecosystem conditions far from any steady state of equilibrium – *ecological resilience*. Although some authors wrongly interpret Holling's definition of resilience as one that belongs to the *engineering* view of concept, comparing engineering and ecological definition, he declares that his definition of resilience actually represents *ecological resilience* (Holling, 1996, p. 33). Referring to other authors, he explained that the *engineering* definition concentrates on the stability of the ecosystem near equilibrium, "where resistance to disturbance and speed of return to the equilibrium are used to measure the property" (Holling, 1973, p. 33). Contrary to *engineering* perspective, *ecological* resilience emphasises a system condition that is far from a single stable equilibrium, and acknowledges the existence of *multiple equilibria*, where instabilities could be seen as opportunity for flipping the system into another regime of behaviour – that is, alternative *stability domain* (Fig. 3.1.) (Holling, 1973, p. 4). Davoudi (2012, p. 301) points out that despite this difference "what underpins both perspectives is the belief in the existence of equilibrium in systems, be it a pre-existing one to which a resilient system bounces back (engineering) or a new one to which it bounces forth (ecological)".

By understanding that ecosystems are dynamic, with multiple stable states, Holling made a shift from the "stability" paradigm, previously applied in ecology. (Meerow, Newell, & Stults, 2016, p. 40). Even though Holling made a distinction from the engineering perspective, his early work had put the emphasis on the *persistence* and *absorptive/buffer capacity* of the system, so one may conclude that it still had something in common with the *engineering* view. According to his definition from 1973, *resilience* determines the "persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist" or in other words it is a measure of the ability of systems to absorb changes and still persist (Holling, 1973, p. 17). In parallel, exploring the behaviour and dynamics of the ecosystem, Holling

(1973, p. 17) contrasts another important property – *stability*, which represents the ability of a system to return to an equilibrium after a disturbance. Defining the speed by which the system bounces back to a state of equilibrium as an appropriate *measure of stability*, Holling (1973, p. 17) argues that the faster the system returns, the more stable it is. Distinguishing stability and resilience, Holling acknowledges *a measure of stability* as *engineering resilience,* but he rather applies *a measure of absorptive capacity*, labelling it as *ecological resilience* (Pisano, 2012, p. 11).

Therefore, one can conclude that resilience thinking in its early beginnings put emphasis on stability near an equilibrium, system persistence, and speed of return - return time, maintaining *efficiency* of system function, constancy and predictability (Davoudi, Brooks, & Mehmood, 2013, p. 308; Davoudi, 2012, p. 300; Holling, 1996, p. 33). This view may be termed *engineering resilience* (Fig. 3.1). In 1986, Holling (1986, p.76) reset his definition and defined resilience as the "ability of a system to maintain its structure and patterns of behaviour in the face of disturbance". A decade later, Holling (1996, p.33) offers third definition which builds on the first two, stating that resilience is "the magnitude of disturbance that can be absorbed before a system changes its structure by changing the variables and processes that control behaviour". He called this view *ecological resilience*. Equally, ecological resilience implies the ability to adapt to change by exploiting instabilities (Walker, Ludwig, Holling, & Peterman, 1981, p. 495) or the "ability to persist and the ability to adapt" (Adger, 2003, p. 1). Here, one may conclude that *ecological resilience* concentrates not only on the speed of return to equilibrium, but also on the extent of disturbance that it can endure and remain within its stability domain. Thus, ecological resilience focuses on maintaining the *existence* of system function and draws attention to "persistence, change and unpredictability" (Holling, 1996, p. 33) (Fig. 3.1).

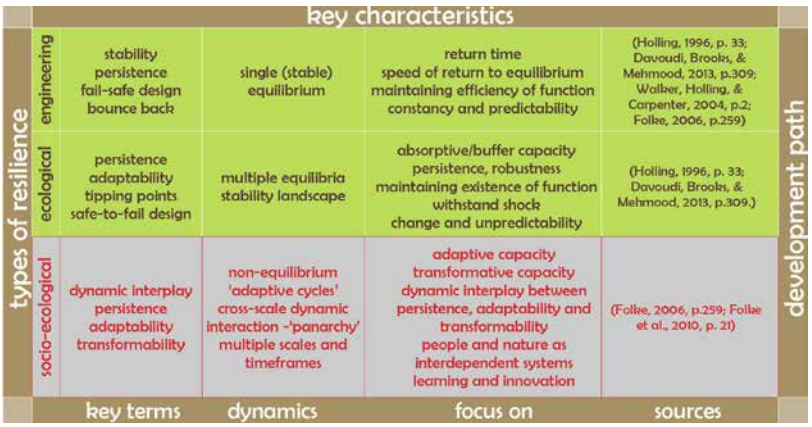

FIG. 3.1 Types of resilience

4 Socio-Ecological Resilience

Since late 1970s, resilience has been broadly extended and it marked a departure from previous paradigms: firstly, in the sense of understanding the system itself (components, parts, properties); secondly, in the sense of understanding the system behaviour and dynamics (complexity, (non) linearity); and thirdly in its conceptualisation - response to changes (short-term stress, long-term disturbances, external and internal changes, uncertainty).

In parallel with ecologists, some social scientists started to apply a resilience concept to social contexts, striving to facilitate and foster the resilience of groups, communities or society. Comparing social and ecological resilience, Adger (2000, p. 361) defines social resilience as the ability of communities to withstand external shocks and disturbances emerging as a result of social, economic, political, and environmental upheavals. Emphasising the institutional context of social resilience, he defines it at the community level, rather than the individual. Hence, social resilience is related to the social capital of societies and communities that have to cope with sudden shocks and large-scale changes or, in other words, it is related to social learning in social institutions (Adger, 2000, pp. 349,361). According to Magis (2010, p. 401), community resilience implies the "existence, development, and engagement of community resources by community members to thrive in an environment characterised by change, uncertainty, unpredictability, and surprise", that is - resilience refers to the ability of a system to respond to changes in such a way that it sustains, adapts and even occasionally transforms itself.

Drawing on these two parallel discourses of resilience (ecological and social) the concept of *social-ecological resilience* emerged in the late 1990s. In this approach, the *social* refers to people, communities, and society, through different aspects of their activity (political, institutional, economic, cultural), and the *ecological* to the biosphere where human life is embedded (Folke, 2016, p. 5). Conceptualising nature and society as an integrated, intertwined, co-evolving system, Berkes and Folke (1998) started to use the concept of *social-ecological systems* (SES) and related it to the concept of resilience. Since then, social-ecological systems have appeared as an interdisciplinary arena where resilience can effectively foster and facilitate collaboration related to dynamics of complex system within diverse groups of actors/stakeholders, in order to provide innovative theoretical and applied knowledge (Baggio, Brown, & Hellebrandt, 2015, p. 8).

Explaining Berkes and Folke's (1998) point of view, Béné et al. (2016, p. 124) argue that "social-ecological resilience was embedded in a new paradigm based in system thinking that was meant to overcome the separation of social from natural sciences, and create a new intellectual basis for responding to the 'environmental' challenges of the modern world". According to Folke (2016, p. 5), social-ecological approach, in essence, emphasises interdependence between society and ecosystem. Furthermore, he explains how people, communities, economies and

cultures shape ecosystems through time and space, "from local to global scales, from the past to the future", and how, at the same time, society is substantially dependent on the capacity of biosphere to absorb pressures imposed by human development.

Other important characteristics of SES resilience theory are related to system dynamics, its complexity and responsiveness to the changes. Social-ecological system is not only an intertwined system of nature and society, but it also presents a *complex adaptive system* (CAS) (Levin, 1998, Levin, et al., 2013, p. 112), which "involves many components that adapt or learn as they interact" (Holland, 2006, p. 1). Understood as a system that is continually developing and evolving, CAS came increasingly into focus of natural and social sciences at the beginning of the 21th century (Abel, 1998; Gunderson & Holling, 2002; Berkes, Colding, & Folke, 2003; Holling, 2001; Holling, 2004; Walker, Holling, Carpenter, & Kinzig, 2004).

In ecology, theory of CAS has been developed through two main concepts that explain behaviour and dynamics of systems: *adaptive cycle* (Fig.7.2) and *panarchy* (Fig.7.3). *Adaptive cycle* was originally introduced by Holling in 1986 (1986, p. 95), when he, for the first time, presented the dynamic behaviour of the ecosystem through the sequential interaction of four system functions: exploitation, conservation, creative destruction, and renewal. It is a heuristic model that contributes to understanding of the dynamics of any complex systems (Holling, 2001, p. 93), and a useful metaphor that can generate testable explanations of SES dynamics and organise ideas in resilience theory (Carpenter, Walker, Anderies, & Abel, 2001, p. 766). A stylised representation in the form of an infinity curve suggests four phases through which ecosystem functions operate within adaptive cycle (∞, see Figure 7.2). According to Carpenter et al., complex systems do not tend toward equilibrium; instead, they pass through four characteristic phases of adaptive cycle: growth and exploitation (r), conservation (K), collapse or release (Ω), and renewal or reorganisation (α) (Carpenter, Walker, Anderies, & Abel, 2001). Three properties shape the adaptive cycle: 1) potential or wealth – determines the number of future possibilities; 2) connectedness or controllability – determines the degree of flexibility or rigidity between processes within system; and 3) resilience or adaptive capacity – is a measure of system vulnerability related to unexpected events, surprise or unpredictable disturbance (Holling, 2001, pp. 393-394). The adaptive cycle consists of two opposing trajectories: *front loop* (sometimes called the *forward loop*) and *back loop* (Gunderson & Holling, 2002, pp. 16-17; Holling, 2001, p. 395; Holling, 2004, p. 3; Walker, Holling, Carpenter, & Kinzig, 2004, p. 2). The *front loop* (from r to K) is a slow, predictable phase characterised by the accumulation of resources, growth, wealth and stability. The *back loop* (Schumpeter (2003, p. 83) – from Ω to α – "creative destruction" is more rapid, less familiar and unpredictable phase characterised by uncertainty, novelty, creativity, experimentation and innovation (Holling, 2001, p. 395; Holling, 2004, p. 3; Walker, Holling, Carpenter, & Kinzig, 2004, p. 2; Gunderson & Holling, 2002, pp. 16-17). In the *front loop*, the potential and controllability increases, but also vulnerability, while the resilience decreases, and vice versa. During the

back loop period, the resilience is high and potential and controllability are low. That means that the system becomes more rigid in the sense of its functioning and more vulnerable to unexpected shocks during the period of the *front loop*, while during the *back loop* it is more flexible, more resilient to sudden more or less desirable changes, and has a high level of adaptive capacity.

Another important notion for understanding SES dynamics, introduced by Gunderson and Holling (2002), is the *panarchy* (Fig.7.3). Panarchy is a representation of a hierarchically nested set of adaptive cycles, as well as a representation of relations and connections between them that determine the sustainability of a system (Holling, 2001, p. 396). Using the Greek god Pan as a symbol for unpredictable change, Gundersone and Holling (2002, p.5) coupled it with the notion of the hierarchy trying to invent a new term that could represent complex structures of relationships within nested adaptive cycles across space and time scales. Thereby they opposed a hierarchically set system based on vertical (top-down) control, rigid nature, and fixed static structure in favour of the panarchical one that represents dynamic, adaptive systems, sensitivity to changes, disturbances and uncertainties which "sustain experiments, test its results and allow adaptive evolution" (Gunderson & Holling, 2002, p. 5)". A stylised representation of panarchy consists of three adaptive cycles: the small and fast, the intermediate size and speed, and the large and slow. Each level operates independently, but at the same time, it is protected by slower and larger levels from above, and stimulated by faster and smaller cycles of innovation from below (Holling, 2001, p. 390). Walker et al. (2004, p. 3) argue that the resilience of a system at a particular level will depend on the influences from dynamics at levels above and below. Besides the fact that the SES theory indicates a non-linear behaviour of CAS through the adaptive cycle model, it additionally emphasises the dynamics of the system that is far from a stable state of equilibrium through the panarchy model. Some scientists suggest that it is in the state of dynamic *non-equilibrium* that the system undergoes constant changes, thus it has no stable state (Meerow, Newell, & Stults, 2016, p. 43; Pickett, Cadenasso, & Grove, 2004, pp. 374-375). Trying to distinguish panarchically posed systems from hierarchical ones, Holling (2001, p. 397) points out the importance of interplay between cycles in the panarchy model, where he suggests two main connections that are critical for the adaptability and sustainability of systems: *revolt* and *remember*. *Revolt* refers to the impact of a small and fast cycle on a larger and slower one, while *remember* refers to the influence of a large and slow cycle on a smaller and faster one.

According to them, these cross-scale interactions are very important in times of change and renewal. Once a *creative destruction* (Ω phase) is started at the smaller and faster level, the collapse can cascade to the next larger and slower level and trigger a crisis, particularly if this level is in the K phase where resilience is low and system is quite vulnerable and rigid. At the same time, opportunities for renewal within the focal cycle are strongly influenced by wisdom, maturity, and potentials (accumulated in K phase) of the slower and larger level (*remember*)

(Holling, 2001, p. 398). Although *revolt* connection primarily emphasises negative impacts, it also opens up the possibility of the appearance of small-scale novelties (during the back loop) that are transmitted to higher levels (Holling, 2004, p. 4). Hence, in complex adaptive systems, there are ongoing interactions between slow and fast systems and small and large ones. Some authors interpret this dynamic non-linear view of system behaviour as self-organising (Berkes & Folke, 1998; Levin S. A., 1998; Walker, Holling, Carpenter, & Kinzig, 2004), where self-organisation implies such patterns of behaviour within the system that result in the feedbacks that influence further interactions and their development (Folke, Carpenter, Elmqvist, Gunderson, Holling & Walker, 2002, p. 438). Arguing that a complex system is self-organising, Folke et al. give further explanation, wherein the context of "continuous change and facing discontinuities and uncertainty (...) self-organization creates systems far-from-equilibrium, characterized by multiple possible outcomes of management" (Folke, Carpenter, Elmqvist, Gunderson, Holling & Walker, 2002, p. 438). Similarly, Berkes and Folke (1998, p. 12) see socio-ecological systems as complex, multi-equilibrium, non-linear, and self-organising, pervaded by discontinuities and uncertainty.

Therefore, Holling (2001, p.390) argues that whole panarchy is *creative and conserving* because it fosters learning, innovation, and continuity through interactions between different levels. Explaining the terms *sustainabilit*y and *development*, he pointed out that panarchy helps to clarify meaning of the phrase *sustainable development*, which, according to him, refers to "the goal of fostering adaptive capabilities (sustainability) while simultaneously creating opportunities" (development) (Holling, 2001, p. 390).

5 Adaptability and Transformability – Toward Definition of Resilience

Summing up the above-elaborated notions and concepts, one can say that socio-ecological resilience, with accompanying ideas of adaptive cycle and panarchy, provides a completely new lens for understanding socio-ecological systems as complex adaptive systems. However, the understanding of its dynamics and responsiveness to changes and disturbances was additionally deepened by the work of Walker, Holling, Carpenter, and Kinzig (2004). Through considering the system's dynamics and its response to disturbances, their paper "Resilience, Adaptability and Transformability in Social–ecological Systems" largely explained possible future trajectories and three related attributes of SES: resilience, adaptability, and transformability. In order to explain system behaviour, they use two key visual concepts/metaphors: *basin of attraction* and *stability landscape*. The first represents the symbolic spatial model within which the system operates and in which it tends to remain, while the second represents the wider perspective, which includes the various basins that a system may occupy and the thresholds that separate them (Walker, Holling, Carpenter, & Kinzig, 2004, p. 3). Walker et al. argue that the system state in *basin of*

attraction - i.e. its resilience - is determined by four key variables: 1) latitude (L - extent to which a system can be changed before losing its ability to recover); 2) resistance (R - resistant to being changed); 3) precariousness (Pr - nearness of threshold); and 4) panarchy (cross-scale interactions). Furthermore, they assume that: "SESs are moving within a particular basin of attraction, rather than tending directly toward an *attractor*" (Walker, Holling, Carpenter, & Kinzig, 2004, p. 3), understood as the state of equilibrium for which systems strive. According to them, both the *basin of attraction* and *stability landscape* are changeable categories within which systems operate, alter, adopt or even transform. Based on their work, the system's behavioural theory is further developed, and thereby, so too are the key concepts of resilience, adaptability, and transformability (buffer capacity, adaptive capacity, transformative capacity).

Adaptability (*adaptive capacity*) of a system is the capacity of people to learn, combine experience and knowledge, innovate, maintain certain system processes, and adjust them, despite changing internal demands and external drivers, as well as the capacity of a SES to continue operating and developing within the current *basin of attraction* (stability domain) (Berkes, Colding, & Folke, 2003; Davoudi, 2012, p. 4; Folke, Carpenter, Walker, Scheffer, Chapin, & Rockström, 2010, p. 2, Walker, Holling, Carpenter, & Kinzig, 2004). Arguing that adaptability of the SES is mainly a function of the social component, Walker et al. (200, p. 3) determine it as a capacity of actors in a system to unintentionally influence, or intentionally manage resilience, in order to avoid crossing into undesirable system trajectories or succeed in crossing back into a desirable ones. Adaptive capacity that addresses the ability of SES to cope with change is closely related to learning (Gunderson L. H., 2000; Gunderson & Holling, 2002) and helps turn surprises into opportunities. Some authors distinguish *adaptation* (*adaptedness*) from *adaptability* (*adaptive capacity*), arguing that the first is highly specialised, while the second is more generic (Meerow, Newell, & Stults, 2016, p. 44; Nelson, Adger, & Brown, 2007). This delineation led to the further classification of resilience, i.e. the emergence of *general (normative)* and *specified (descriptive)* resilience, which will be elaborated upon below.

On the other side, *transformability* (*transformative capacity*) of a system is the "capacity to create a fundamentally new system when ecological, economic, or social structures make the existing system untenable", i.e. the capacity to create entirely new stability landscape with new state variables or the old supplemented by new ones (Walker, Holling, Carpenter, & Kinzig, 2004, pp. 3,5). Walker et al (2004, p. 5) also argue that the transformations occur mainly due to the trapping of a system in an undesirable basin where restructuring is extremely difficult. It is a state in which crisis can open up space for new ways of thinking and operating. Folke (2016, p. 4) defines the transformability in a more general way, arguing that it does not only imply the creation of new stability landscape, but rather it is also about having the capacity to cross thresholds and move the systems to new basins of attraction. Walker et al. (2004, p. 2) argue that the major distinction between adaptability and transformability is in their focuses. While the first

concentrates on the dynamics and function of an existing system, the second refers to fundamentally altering the nature of a system or creating a new one.

To sum up, all of the above (key ideas, concepts, classification) have led to the current definition of *socio-ecological resilience* that follows. In the context of research of non-linear complex adaptive systems, interpretation of resilience has been more elaborated upon in recent years. Thus, resilience is "no (longer) simply about resistance to change and conservation of existing structures" (the *engineering* definition) (Folke, 2006, p. 259), nor it is about a *buffer/absorptive capacity*, *persistence,* and *robustness* of systems to withstand a wide array of disturbances while maintaining function (Folke et al., 2002, p. 13). In other words, "preserving what we have and recovering to where we were" (the *ecological* definition) (Davoudi, 2012, p. 332; Folke, Carpenter, Walker, Scheffer, Chapin, & Rockström, 2010, p. 6). Instead, resilience (the *socio-ecological* definition) has been viewed as an emergent system property that includes three key dimensions: "*absorptive capacity* - leading to persistence, *adaptive capacity* - leading to incremental adjustments/changes and adaptation and *transformative capacity* - leading to transformational responses" (Béné, Headey, Haddad, & Grebmer, 2016, p. 3).

The most cited definition of socio-ecological resilience determines it as: "the capacity of a system to absorb disturbance and reorganise while undergoing change so as to still retain essentially the same function, structure, identity and feedbacks" (Walker, Holling, Carpenter, & Kinzig, 2004, p. 2). Drawing from Carpenter et al. (2001), resilience can be best described by three crucial characteristics: a) the amount of disturbance a system can absorb while still remaining within the same state or basin of attraction; b) the degree to which the system is capable of self-organisation; and c) the degree to which the system can build and increase the capacity for learning and adaptation (Carpenter, Walker, Anderies, & Abel, 2001, p. 766; Folke C. , 2006, pp. 259-260; Walker, et al., 2002, pp. 5-6).

Through the SES theory, a new sub-classification of resilience has been developed. Thus, some authors distinguish two key approaches, called *general or normative resilience* and *specified or descriptive resilience*. According to Folke (2016, p. 2), *general resilience* is a wider type of resilience for building the capacity of SES to deal with true *uncertainty* and *complexity*, i.e. *unknown* and *unknowable*. On the other hand, *specified resilience* concerns resilience *of what to what* (Carpenter, Walker, Anderies, & Abel, 2001), *for whom* (Cretney, 2014; Lebel, et al., 2006) and *for when, where, and why* (Meerow et al., 2016, Pike et al. 2010, p.66). According to Carpenter et al., specified resilience identifies "what system state is being considered (resilience of what) and what disturbances are of interest (resilience to what)" (Carpenter et al., 2001, p.777). Likewise, Brand and Jax (2007, p. 10) point out that "resilience must be possible (a) to specify the particular objects the concept refers to, (b) to decide whether particular states of a system are resilient or non-resilient, and that it should be possible (c) to assess the degree

of resilience of a certain state". Questions *for whom, for when,* and *for where* refer to social, temporal, and spatial scale at which the measurement is made (Carpenter, Walker, Anderies, & Abel, 2001, p. 767; Meerow & Newell, 2016). With regard to this, Brand and Jax (2007, pp. 7, 10) see descriptive concept as a quantitative, measurable approach to resilience and foundation for its operationalisation and application. In descriptive concept, resilience could be understood as a property of socio-ecological systems, where humans have to search for metrics and indicators of resilience, while on the other hand, in normative concept resilience could be seen as an approach for analysing, understanding, and managing change in social-ecological systems (Folke, 2016, p. 8). In that sense, resilience is a theory of change (Baggio, Brown, & Hellebrandt, 2015, p. 2). It is a more metaphorical and more generic approach. It provides flexibility over the long term, and by dealing with ongoing gradual change it could turn a crisis into an opportunity (Folke, 2016, p. 12). Folke et al. (2003, p. 355) defined four key factors of general resilience for building adaptive capacity that interact across temporal and spatial scales: "1) learning to live with change and uncertainty; 2) nurturing diversity for reorganization and renewal; 3) combining different types of knowledge for learning; and 4) creating opportunity for self-organization toward social-ecological sustainability".

6 Adaptive Management for Building Resilience

Adaptive management emerged and developed as useful tools for resilience-building in social-ecological systems. It is a systematic, multidisciplinary approach to dealing with uncertainty, a model that, on the basis of knowledge gained through decision-making, monitoring and evaluating, improves the management itself. The concept has attracted attention due to establishing a connection between the learning process and the process of making policies in the course of their implementation (Stankey, Clark, & Bern, 2005). The term simply means "learning by doing" and adapting based on what has been learned (Walters & Holling, 1990). In other words, learning in an adaptive model occurs through the management process, i.e. through adaptations that occur simultaneously as the level of understanding of the management process improves (Fig. 7.6) (Williams & Brown, 2012). Although the roots of the idea can also be traced through other scientific disciplines, the original concept of adaptive management, understood as a strategy for the management of natural resources, was introduced by Holling in 1978 (Folke, 2016). By publishing Holling's (1978) book *Adaptive Environmental Assessment and Management*, the potential of adaptive management, as a framework for solving complex problems in the field of natural environment, has become recognised. Subsequent publications such as *Adaptive Management of Renewable Resources* (Walters, 1986), *Compass and Gyroscope: Integrating Science and Politics for the Environment* (Lee, 1993), and *Barriers and Bridges to the Renewal of Ecosystems and Institutions* (Gunderson, Holling, & Light, 1995) have further improved and developed the concept and promoted its potential. The growing interest in this area is reflected in

the extensive scientific literature and diverse application of the adaptive model in practice (Stankey, Clark, & Bern, 2005, p. 6). According to Holling (1995, p.8), this growing interest in adaptive management arises from three interconnected elements: non-resilient and vulnerable (eco)systems, rigid and inefficient management activities, and more dependent society. It seems that, through these three elements, Holling defines the factors that lead to paralysis and the irrecoverable collapse of the system, which society must find a strategy to forestall.

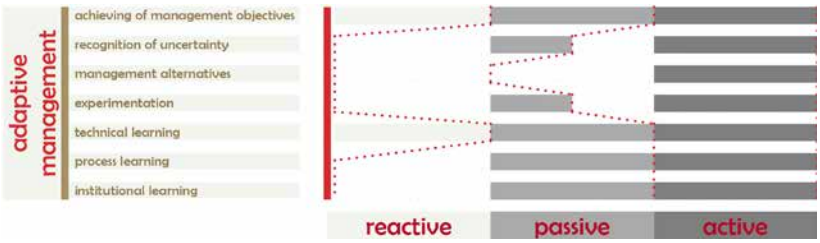

FIG. 6.1 Characteristics of reactive, passive and active adaptive management *(Vujičić, n.d.)*

In the context of the adaptive management model, there are four key approaches: reactive, passive, and active adaptive management (Fig. 6.1) (Walters & Holling, 1990, p. 2060), and adaptive co-management (Folke, Carpenter, Elmqvist, Gunderson, Holling, & Walker, 2002). The basic differences between the first three types are defined by the level of importance that each of the approaches gives to learning, achieving management goals, and reducing possible uncertainties in the process of management. The fourth type is a newly derived form of management model that introduces a social (institutional) dimension in management, connecting it to the specific spatial context (local, national, regional).

Reactive (incremental (Kusel, Doak, Carpenter, & Sturtevant, 1996)) *adaptive management* (RAM) is based on "trial and error" (Williams, Szaro, & Shapiro, 2009), and the basic focus is on achieving management goals, while the role of uncertainty in the overall process is minor. Monitoring and evaluating are primarily focused on the state of resources, while much less importance is given to the understanding of processes inside the system, i.e. learning (Williams, Szaro, & Shapiro, 2009). *Passive adaptive management (PAM)* is an approach in which managers are dealing with uncertainties through the implementation of a single 'best' model, optimised to enable achievement of the set goals (MFR, 2012), where the model and management policies are adjusted and modified in relation to monitoring results (Arthur, Garaway, & Lorenzen, 2002). In contrast to the reactive approach, passive model monitoring and evaluating are directed not only towards recording and evaluating the state of resources, but towards other characteristics of the system that can contribute to a better understanding of the processes within the system, as well as improving the overall knowledge (Williams, Szaro, & Shapiro, 2009). Indicating the learning characteristics within a passive model and approach linearity, Bormann et al. (1999) use the term *sequential learning*. *Active adaptive management* (AAM) differs from other approaches in its relevant integration of experimenting in the process of making policies and management strategies and

their implementation (Kusel, Doak, Carpenter, & Sturtevant, 1996). In other words, policies and management activities are treated as experiments and opportunities for learning (Lee, 1993). Instead of focusing on the single 'best' solution, an approach is designed to give feedback on the effectiveness of several implemented models and policies. Bormann et al. (1999) see active adaptive approach as a form of parallel learning through comparison and evaluation of a number of alternative policies that are simultaneously implemented. In contrast to RAM and PAM, an active model directs monitoring and evaluating of both the recording and evaluating of the state of resources, as well as other characteristics of the system that can contribute to improving the overall knowledge and better understanding of the processes within the system (Williams, et al., 2009). On the other hand, in the model of active adaptive management, learning significantly expands its context. AAM shifts focus from strictly technical learning (about the system, its function, structure, and dynamic characteristics) that is advocated by RAM and PAM, toward learning about the processes and structure of management, changes in the institutional arrangements, changes in perspectives, and in the system of values of the actors involved (Williams et al., 2009).

Adaptive management inevitably implies socio-political activities and technical-scientific ventures. By emphasising the social dimension of adaptive management, in terms of a relationship between scientists, managers, and the public, Kusel et al. (1996, p. 612-613) claim that an adaptive approach, in comparison to traditional management, basically changes the relationships between these three groups of actors. Buck et al. add that this occurs in a way that builds partnership, and a collegial and active working relationship (Buck, Geisler, Schelhas, & Woll, 2001). In this context, there is a concept of the *adaptive co-management,* which is a combination of active adaptive and collaborative approaches, an improved concept of the adaptive model, which supports involvement and collaboration of different interest groups in all phases of management. It spans from the definition and assessment of a problem, through development of management strategies, to monitoring and evaluation (Ruitenbeek & Cartier, 2001). Adaptive co-management represents a flexible, collaborative management system adapted to a specific spatial and institutional context, i.e. dynamic, ongoing, self-organised process of "learning by doing" (Folke, Carpenter, Elmqvist, Gunderson, Holling & Walker, 2002).

7 Toward Conceptualisation of Urban Resilience and Climate Resilience

Understanding the concept of *urban resilience*, *resilient city,* and *climate resilience* requires, first and foremost, clarification of the notion of *resilience* with regard to notions of *urban - city* and *climate change*. The proliferation of the term 'resilience' in urban and climate-related studies indicates that it serves as not only *boundary object* within this scientific milieu, but also as a *bridging concept* between urbanism

and other disciplines that applied a resilience framework (Fig. 7.1). However, the sudden popularity of a notion or concept in the field of urban studies has led to ambiguities, and, sometimes, an incorrect interpretation of the resilience concept. Therefore, this section deals with conceptualisation of resilience in context of urban research based entirely on the author's views and interpretations of the concept/s of resilience described above. For more profound research, readers are called to consult the following sources: Davoudi, 2012; Davoudi, Brooks, & Mehmood, 2013; Eraydin & Taşan-Kok, 2013; Leichenko, 2011; Meerow & Newell, 2016; Meerow, Newell, & Stults, 2016; Otto-Zimmermann, 2010; Resilience Alliance, 2007.

The conceptualisation of *urban resilience* and *climate resilience* aims to connect *resilience theory,* originated from ecology sciences, with *urban theory*. More precisely, the goal is to introduce the resilience concept into the field of urban planning through: 1) defining key terms and concepts; 2) creating relationships and links among key concepts; 3) classification and typology of resilience in the context of urban studies; and 4) opening the key research topics and questions applicable to further research in urban planning.

Boundary object	urban / city / climate / resilience	
Bridging concept	among different	
	disciplines	stakeholders
'urban resilience'	ecology sociology economy management planning engineering psychology	urban planners ecologists sociologists economists politicians authorities (nacional/local) scientists engineers (different profiles) NGOs citizens
'resilient city'		
'climate resilience'		

FIG. 7.1 Resilience as boundary object and bridging concept

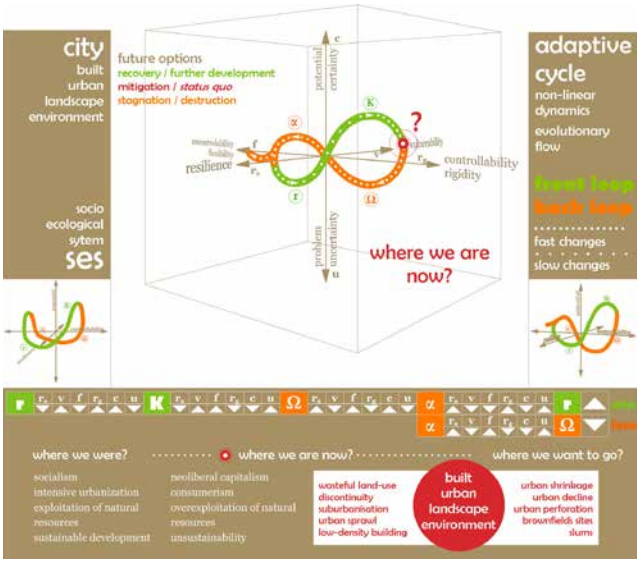

FIG. 7.2 Evolutionary adaptive pathway of a city *(Vujičić, n.d.) (Note: modified representation of adaptive cycle created according to Gunderson & Holling, 2002, p. 34, 41)*

Conceptualisation starts with the assumption that a city is a *complex adaptive urban system* (CAUS). In order to understand the meaning of this catchword/phrase, further explanation of the terms *complex* and *adaptive* is needed. With regard to this, the concept of *socio-ecological resilience* will serve as a foundation for defining the research base of resilience in the urban context. Key notions, assumptions, research questions, and principles will be developed according to four crucial resilience concepts: *socio-ecological system* (Berkes & Folke, 1998), *adaptive cycle* (Holling, 2001, p. 394; Gunderson & Holling, 2002, p. 34), *panarchy* (Gunderson & Holling, 2002, p. 75), and *stability landscape* (Walker, Holling, Carpenter, & Kinzig, 2004, p. 4). A comparison between SES and the city helps to clarify the multilayer, complex structure of an

urban system. *Adaptive cycle* refers to the evolutionary path of a city and helps to determine its current state, i.e. its position on the infinity curve (Fig. 7.2). *Panarchy* links different levels/dimensions of a city with its evolutionary flow (Fig. 7.3). Furthermore, panarchy explains interrelations and interactions between these levels. The concept of *stability landscape* helps to explain possible future evolutionary trajectories of a city i.e. it helps to conceptualise dynamic and behavioural patterns of a city in the face of uncertainties (Fig.7.6). On the other hand, four key approaches developed through resilience theory – *socio-ecological resilience* (Walker, Holling, Carpenter, & Kinzig, 2004), *general resilience* (Folke, 2016), *specified resilience* (Carpenter, Walker, Anderies, & Abel, 2001) and *adaptive management* (Holling, 1978) – suggest possible directions for future development and improvement of methods and tools in urban planning and design (Fig.7.5, Fig 7.6). Each of these terms opens up the set of research questions that present the basis for future scientific and empirical research (Table 7.1).

RESEARCH QUESTIONS RELATED TO KEY RESILIENCE CONCEPTS	
SES	Can the city be considered as a socio-ecological system?
	Does the city consist of the same components as SES?
	What are the main differences between the SES and the city?
	What are key components/dimensions of the city?
adaptive cycle	Is the adaptive cycle applicable to the city?
	Is the evolutionary path of the city comparable with the pathway of the SES?
	Can the evolutionary path of city be perceived, followed, and explained through the adaptive cycle?
	Where was the city? Where is the city now? Where is the city going to be?
panarchy	Is the panarchy model applicable to the city / urban context?
	Which elements/components make the city complex, multi-layered, panarchical?
	What kinds of levels exist within the city (large, medium, small)?
	Does each of levels follow dynamic patterns of adaptive cycle in sense of pathway and speed?
	What kind of relations and impacts exist between different levels?
stability landscape	Is the stability landscape model applicable to the city?
	Can the city be in equilibrium or is it in endless non-equilibrium?
	What does the stable state of a city imply? Is it utopia or the future of a city?
	Is there non-linear stability of a city and what does it imply?
	What does attractor imply in the context of city?
	What do a basin and its bottom imply in the context of city?
	What do a hill and its top imply in the context of city?
	What does crossing the thresholds mean for a city and what are the thresholds?
	Is movement toward the hilltop (un)desirable?
	Is movement toward the basin bottom (un)desirable?
	What does variable resistance imply?
	What are the relations between the concepts of stability landscape and adaptive cycle in context of a city?
	What is the optimal state of a city and should a city strive for it?
	What is the future of a city? What are possible future pathways of a city?
adaptive capacity	How does a city react to negative changes and disturbances?
	What are the consequences of these changes in human environment/city?
	How does society withstand sudden shocks and how does it cope with gradual changes?
	Does the local community have enough capacity to deal with complexity, uncertainties, and surprises that affect the city and how to develop them?

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RESEARCH QUESTIONS RELATED TO KEY RESILIENCE CONCEPTS	
resilience / approach	What does it mean to be resilient in the context of city? What does urban resilience mean?
	What does resilient city mean? What should society do to reach resilient city?
	What is the city / society striving for?
	What should society do in order to reduce uncertainty and mitigate the negative effects of perturbations in the city context?
	What does the concept of resilience offer to city/urban planning?
	Why is the resilience concept useful in urban planning?
	Is the focus on general or specified resilience in urban planning/design?
	How will society address the unknown and the unknowable?
	What city state is being considered – resilience of what?
	What disturbances are of interest – resilience to what?
	For whom is the resilience concept useful? Which target groups will benefit from the resilience concept?
	When and in what spatial context (where), is the resilience approach useful?
	Is the focus on short term disturbances or long-term stresses?
	Is the focus on short-term or long-term resilience?
	What are the criteria, parameters, indicators, metrics, and thresholds of resilience in an urban system/subsystem?
	Is the model of adaptive management applicable in urban planning?
	What kind of adjustments of the adaptive management model should be done in order to meet the needs and requirements of urban planning / planners?
	What does it mean to be climate resilient in context of a city?
	What are the criteria, parameters, indicators, metrics, and thresholds of climate resilience?

TABLE 7.1 Framework for further scientific and empirical research in the field of urban planning (Note: For more research questions related to urban resilience see: Meerow & Newell, 2016, p. 9 and Resilience Alliance, 2007)

Considering the city as a *complex* urban system, it can be defined by applying three key approaches: *administrative*, *morphological,* and *functional* (Fig.7.3) (Vujičić & Đukić, 2015, p. 523).

The administrative approach defines the city as a territorial unit of local governance (municipality), which consists of one or more urban settlements and which ensures a framework for different types of social networking in order to meet the basic needs of community and individuals. Here, the city is labelled through political, economic, and social dimensions of organising, networking, and governance, i.e. through 1) governance institutions - local and national (administration, public services), 2) economy (industry, services), and 3) nongovernmental organisations. In order to justify the introduction of a dimension of human needs into the definition of a city, a recall of Bruntland's definition of sustainable development is needed. According to this report, sustainable development strives to "meet the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 41). According to the *morphological approach*, the city is regarded as a physical object composed of built and natural environments (buildings, utilities, transportations, green spaces).

What is missing in these approaches is functional interrelations between social and natural worlds in order to meet the human needs. Therefore, the *functional approach* defines the city as an *economic* and *social* entity integrated in a *spatial context*, i.e. a system labelled by a complex structure of interrelations between these levels. Returning to the *human needs* and relating them to the three key approaches for defining the city, two main levels of needs are recognised: 1) basic physiological

needs (food, water, shelter, energy, consumer goods, materials); and 2) safety, psychological and self-fulfilment needs (security, health, education, work, equity, justice) (Fig.7.3). The first set is closely related to the physical / spatial environment (morphological approach), while the second set adds social and economic (administrative approach) to spatial dimension. As can be seen, there are many interrelations between different dimensions, levels, and scales of a city that make it extremely complex. However, if one puts a city in the same plane as SES, particularly in the context of development of SES as a concept, the main differences between these two types of systems will be pointed out. The city is, in the first instance, the *system dominated by humans*, while SES is, primarily, the system dominated by biocenosis (plants and animals). Furthermore, the most important characteristic of the city, which separates it from the nature and socio-ecological view of system, is its *built environment*. Even the nature of the city is mainly artificial. Finally, the city is determined by four key pillars deriving from previous definitions and comparisons: *society, economy, built environment,* and *natural environment* (Fig. 7.3).

Resilience, understood as an approach for facing and dealing with uncertainties, requires identification and analysis of different types of changes that affect a city and increase uncertainty. Given that a city is system dominated by humans, most consequences, particularly the negative ones, have been caused by the growing needs of humanity. What the repercussions of these growing human needs are is best seen in (Fig.7.4). In contemporary urban studies, the biggest interests for research are climate resilience and climate changes, mainly associated with global warming. Due to emission of carbon dioxide and other greenhouse gases (GHG) our planet's atmosphere is now like a "thick heat-trapping blanket" (The David Suzuki Foundation, 2017, para. 5). Increased energy stored in the warming atmosphere has disrupted the balance that keeps the climate stable. Consequently, we are now seeing extreme weather events around the globe. Floods, droughts, storms, hurricanes, and fires are only some of the consequences of large-scale climate change. On the other hand, climate changes result not only in abrupt disturbances, but also in slow changes such as balmier winters, intense summers, changing rain patterns, freshwater shortages, environmental pollution, etc. Besides these events caused by climate change, there are also other abrupt changes such as volcanic eruptions, earthquakes, and tsunamis that take human lives and cause devastation of natural and built environments. These geological (tectonic and magmatic) activities are not influenced by humans, but they could radically affect human environment.

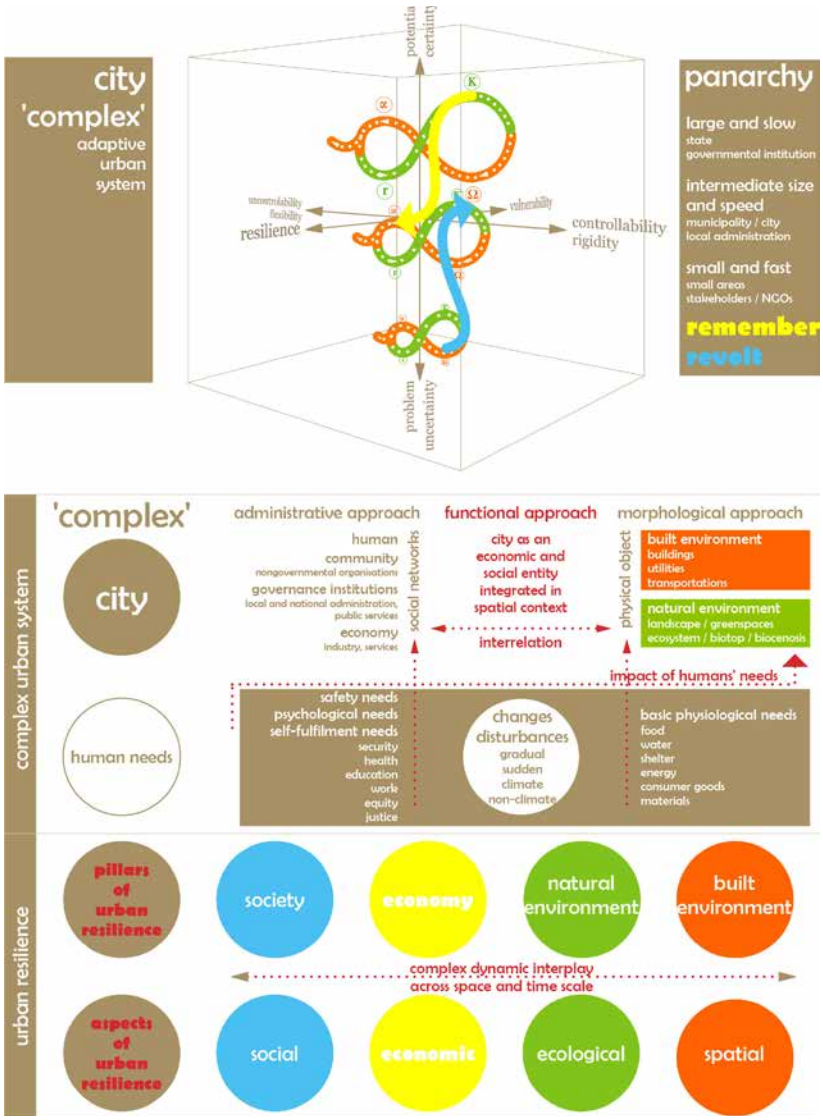

FIG. 7.3 Complex urban system *(Vujičić, n.d.) (Note: Panarchy model modified and adjusted to urban context according to Gunderson & Holling, 2002, p. 75)*

All these changes caused by natural factors have severe impacts on the human environment, and the task of society is to overcome the consequences of its own actions and reduce uncertainty. Furthermore, the paper recognises other type of crisis caused by human (non-natural) factors such as structural or systemic changes, security crisis, social crisis, negative demographic trends, and economic decline. More importantly for urban planners, all these changes led to imbalance in human habitats (built environment). Consequently, we are now seeing: 1) devastation of the built environment as a consequence of natural disasters; 2) urban shrinkage as a consequence of negative demographic trends; 3) brownfield sites as a result of economic loss and structural changes (Đukić, Simonović, & Vujičić, 2014); 4) slums and substandard housing as a result of poverty; and 5) wasteful land use, urban sprawl, discontinuity, and low-density building as a result of bad urban policies and local governance. To sum up, there is a large body of changes that can make the community and human environment more or less vulnerable. This is a place where the resilience approach could make a great contribution in the process of dealing with consequences of these perturbations.

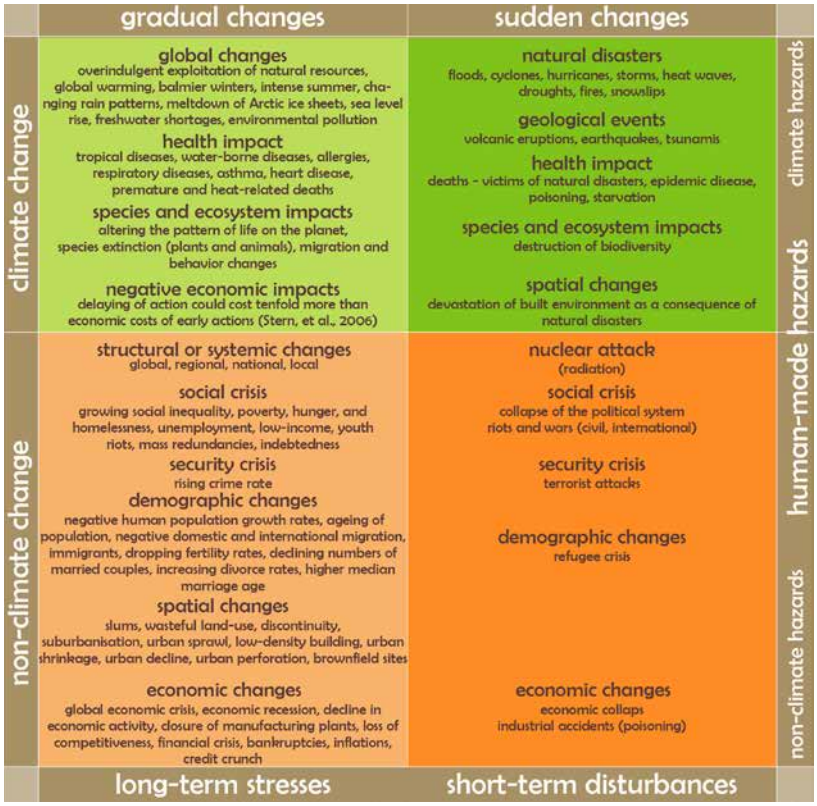

FIG. 7.4 Human-made hazards and changes

Withstanding of shocks and dealing with uncertainty is equal to *being resilient*, having capacity to persist, adapt, or transform following disturbance. Does a community have sufficient capacity to deal with complexity, uncertainties, and surprises that affect the city and how it is developed? What should society do in order to reduce uncertainty and mitigate the negative effects of perturbations? More precisely, what the scientific community do in order to improve the governance of human settlements - built environment - faced with uncertainties, i.e. what should urban planners do to realise a *resilient city*? Here are some recommendations:

- translating the term *resilience* into the mother tongue / local languages;
- defining the concept of *urban resilience* in accordance with the theoretical framework developed by ecologists and the adjustment of the definition for urban research purposes;
- defining *general urban resilience* as well as different types of *specified urban resilience*;
- developing general methodologies based on principles of resilience theory is a crucial prerequisite for redefining urban planning in the face of uncertainty;
- adjustment and application of resilience concept/s in the urban planning/ design and specific spatial context - developing of methods and tools, as well as criteria, parameters and indicators of urban resilience;

– particularly, definition of an operational model of *climate resilience,* which implies climate sensitive urban planning and design, impact assessment, and measurement, as well as risk management;

– guidelines and recommendations for the reframing of the national/ local legislation framework of urban planning.

Simultaneously, governance institutions (national and local) should build *adaptive governance*, i.e. foster and support flexible multilevel institutions, participation and collaboration, self-organisation and networking, and capacity building for learning and innovation (Djalante, Holley, & Thomalla, 2011, p. 1). Adaptive governance should help to build urban resilience, i.e. absorptive, adaptive, and transformative capacities of a complex urban system at all levels in order to withstand not only sudden upheavals, disturbances and shocks, but also gradual, long-term stresses. The best way to achieve this goal is the application of an *adaptive management* model (Fig.7.6), developed in the field of natural resource management, and its adjustment for urban planning and management/governance purposes. Although *adaptive co-management* represents state-of-the-art and the most developed type of adaptive management, application of less advanced models into field of urban planning and governance is more likely, particularly at the beginning of reframing.

Adaptive co-management (Fig. 7.6) represents a flexible, collaborative management system adapted to a specific spatial context, implemented by cooperation with the institutions and organisations at different levels. It implies the process by which the institutional arrangements and technical knowledge are tested and reviewed, i.e. dynamic, ongoing, and self-organised process of "learning by doing" (Folke, Carpenter, Elmqvist, Gunderson, Holling & Walker, 2002). The main characteristics of adaptive co-management include: 1) focus on learning by doing; 2) synthesis of different systems of knowledge; 3) cooperation and division of powers among local, regional and national level; and 4) flexibility of management (Resilience Alliance, 2006). These characteristics promote improvement and development of locally adapted management approaches in which strategies are sensitive to feedback and oriented to the resilience of the urban system and sustainability.

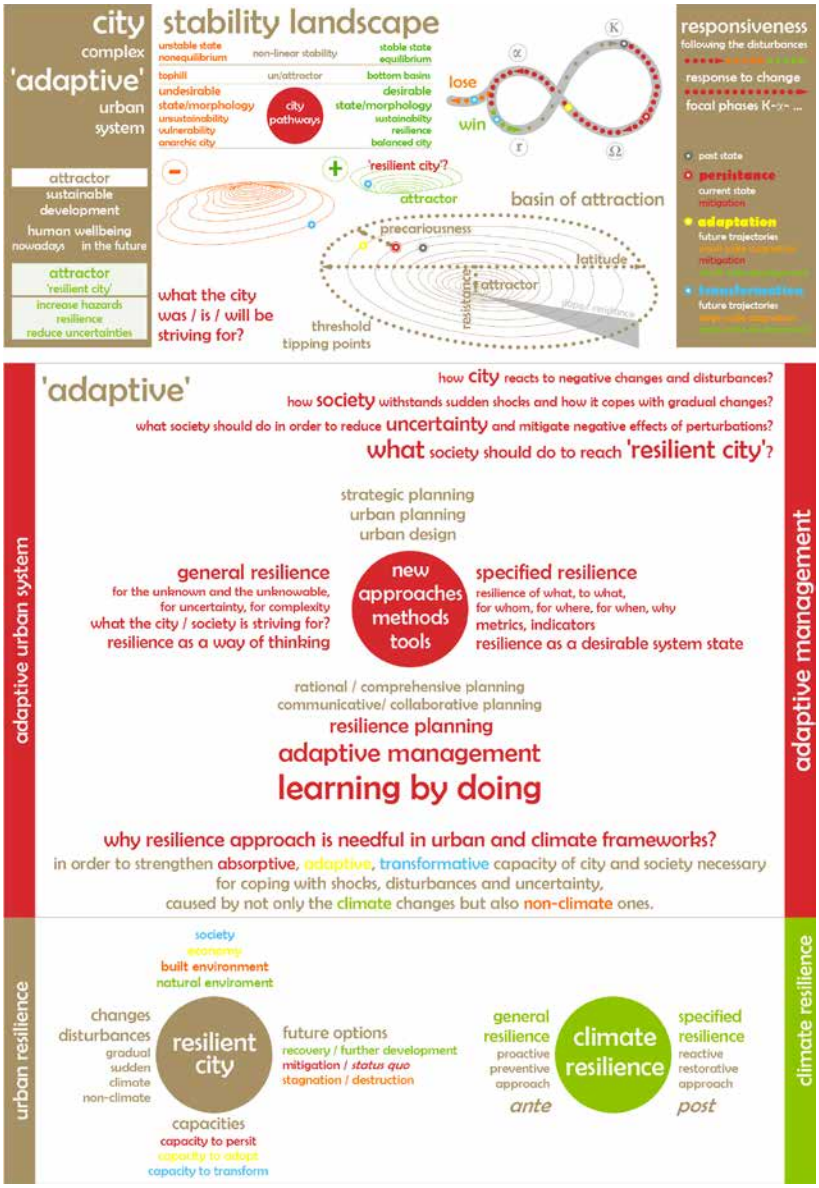

FIG. 7.5 Adaptive urban system *(Vujičić, n.d.) (Note: Stability landscape modified according to Walker, Holling, Carpenter, & Kinzig, 2004, p.11., Fig.1a-1b.)*

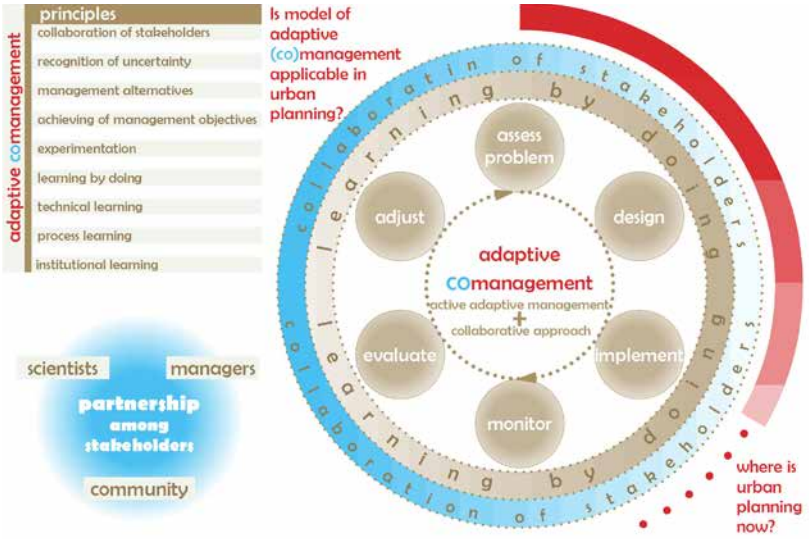

FIG. 7.6 Adaptive co-management process diagram *(Vujičić, n.d.)*

8 Conclusion

This paper gave both a concise and comprehensive review of the resilience theory, i.e. it defined key terms, concepts, classifications and approaches. Based on the review, a conceptualisation of *urban resilience* (and *climate resilience* as its constituent part) has been proposed. The main contributions of the paper are:

- comprehensive review of a large body of literature related to resilience;
- explanation of key terms/concepts and its interpretation from the urban perspective;
- proposal of classification of resilience applicable in urban studies' context; and
- opening of the key topics and questions for further research in the field of urban planning.

As such, the paper can serve urban planners, researchers, authorities, and decision-makers to understand better the key principles of resilience theory originating from ecology, and thereby facilitating the application and integration of a resilience framework into the field of urban planning/design and urban governance. Considering the large body of notions embedded in the term *resilience*, one can ask whether it is concept, theory, approach, discourse, or philosophy. Whatever it is called, resilience framework offers the answers to many of today's questions.

Regarding the translation of term resilience in Serbian/Croatian/Bosnian, the author of this paper recognises some difficulties and limitations. Even though, *otpornost* (understood as resistance) presents the most appropriate translation, it excludes other related connotations, not only within the meaning of the term itself, but also in terms of other

essential principles embedded in the resilience concept / theory such as adaptability (*adaptabilnost / prilagodljivost*) and transformability (*transformabilnost / promjenljivost*). Due to positive connotations, acceptance of the notions of *adaptabilnost* and *transformabilnost* by the general public (especially by politicians) is more likely than of *otpornost. Otpornost* suggests *reactive* response to changes, while *adaptabilnost* and *transformabilnost* put more emphasis on *proactive* approach in management of changes. More precisely, *otpornost* is associated with the ability of a system to *withstand* the negative effects of *past changes* (reduction of the vulnerability of a system), while *adaptabilnost* and *transformabilnost* refer more to the capacity of a system to *respond* to changes and imply *future actions* (an increase of adaptive and transformative capacity). Furthermore, in the literature, the term resilience is often equated with *adaptive capacity* or adaptability (*adaptabilnost*) (Holling, 2001, p.394). Regarding this, *adaptabilnost* could be seen as a synonym for resilience/*otpornost*. Therefore, it can be concluded that there are three main terms embedded in resilience concept: *otpornost* / resilience, *adaptabilnost* / adaptability and *transformabilnost* / transformability. Each of them indicates a certain reaction to changes that are more or less radical, and either past or future oriented. Relying on the etymological root of the resilience (Latin - *resilio*, meaning bounce back), it can be concluded that *otpornost* is the most appropriate translation whose use is recommended especially among professionals and researchers (Fig.9.1). Nevertheless, the wider public will be likely accept other forms of translation because of their positive connotations: *adaptabilnost* / adaptability, *transformabilnost* / transformability, *elastičnost* / elasticity, and even the Anglicism, *rezilijentnost* / resilience. Finally, depending on type of research (focus, content, goal) and type of target audience, different forms of translation can be used.

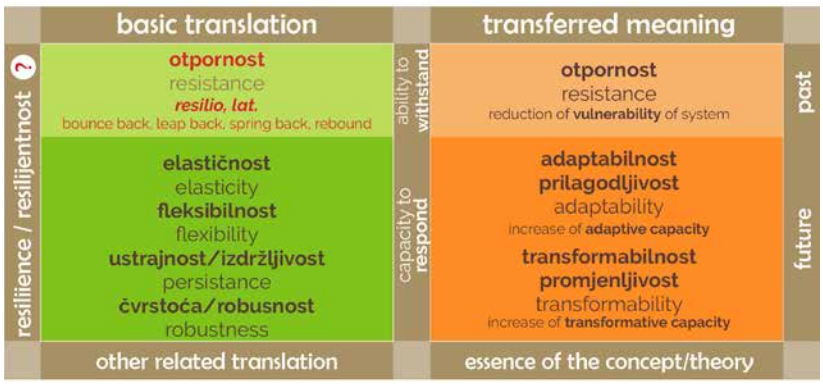

FIG. 8.1 Resilience: a non-existing word in SCB

Summing up the conceptual framework from Section 7, it can be concluded that the *city* is a *complex* urban system labelled by complex dynamic interplay between different components - society, economy, natural and built environment (see Chapter 3, section 3) - across multiple space and time frames (Fig. 8.3). To become an *adaptive* urban system, the city, that is, the society, should build its adaptive capacities through the application of a resilience framework in planning and governance (Fig. 8.5).

With regard to that, *urban resilience* could be considered as:

- the capacity of an urban system (a socio-economic entity embedded in the built and natural environment) to persist and adapt during and following disturbances, maintaining its processes, structure, identity, and feedbacks, i.e. remaining in the same *basin of attraction – stability landscape*;

- the ability to transform structure and processes, and change identity in order to survive and overcome disturbances, surprises and uncertainties - i.e. ability to shift onto another desirable *basin of attraction* or to create a completely new *stability landscape*; and

- the ability of society to anticipate the unknown and comprehend the unknowable, that is, the ability to learn and innovate through a process of management/governance in order to successfully confront with sudden perturbations and long-term stresses.

Key aspects of urban resilience in the city context are social, economic, ecological, and spatial (for more information related to the application of resilience concepts to the built environment see Chapter 3). General and specific urban resilience represent two main types of approaches, suitable and applicable in urban research. The first is more generic and comprehensive - it ensures the integrity of approach and wider perspective. The second is narrower and more focused. It operationalises the approach through the specification of a particular object, the measurement/evaluation of its (non)resilient state, and then it focuses on problem solving, the incensement of hazard resilience, and the reduction of uncertainty.

There is no panacea for urban resilience, however, *adaptive (co) management*, as an approach for managing uncertainties, creates a favourable framework for learning, innovation, and governance through collaboration and partnership of leaders, decision-makers, urban planners, scientists and other stakeholders (Fig.8.6.). With regard to this, redefinition of approaches of urban planning/design, in accordance with the principles of resilience theory, should be encouraged. Such an advanced approach should primarily be focused on the building and strengthening of the city or society's capacity for facing and dealing with uncertainty, and, later, on activities focused on overall development. This implies shifts in:

- *approach* - from planning toward (adaptive) management;
- *discourse* – from sustainable development toward building (hazards) resilience;
- *focus of planning* – from achieving predetermined results toward open-ending process; and
- *vision of future of city* – from development toward any kind of possibilities (development, mitigation, stagnation).

This also entails the shift in governance from *conventional* toward *adaptive*. In order to achieve this transition, the first step is the creation of a new educational profile that will produce educated experts capable of applying and transferring gained knowledge in practice.

In the world of constant, ongoing changes, where surprises and stresses are ubiquitous, uncertainties are more and more likely, and the urban system is more and more complex, *resilience* and *adaptive* approaches appear as outstanding opportunities for reframing urban theory and practice, while at the same time the concept of the *complex adaptive urban system* appears as an emerging arena for interdisciplinary research. The task of scientific community is to adopt, adjust, and develop resilience/adaptive framework in the urban field, i.e. to develop *resilience/adaptive* methodologies, approaches, methods, and tools. Finally, the main research hypothesis has been partially proven. The *city* of the present-day is a *complex* but still not *adaptive* urban system. Whether this will be achieved in the future is very uncertain. However, the *building of adaptive capacity* of a city, i.e. achievement of the vision of a *resilient city* should be the ultimate goal for which contemporary society should strive.

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Thinking Sustainability + Resilience _

Built Environment in Transition

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ABSTRACT **The dynamics of societies and their living environments bring many expected and unexpected changes that need to be considered in order to achieve sustainable development. These changes, their prediction, and the mitigation of their negative impact, are related to the concept of resilience. Starting from the assumption that sustainability and resilience represent two different but complementary approaches, this work aims to clarify their notions and interrelations and to discuss their concurrent, systemic use in the processes of planning, designing and managing the built environment. The work initially studies the context of the built environment affected by sustainability and resilience frameworks, and reveals that there exist different scales to which these two approaches should be applied. Several interconnected disciplines are taken into consideration to present the notions of sustainability and resilience, their application in the context of the built environment and their significance for future development. Based on a comprehensive literature review, some possibilities for transitioning towards sustainability + resilience, i.e. towards improving the ability to respond to disruptions and hazards, and to enhance human and environmental welfare, are discussed.**

KEYWORDS sustainability, resilience, built environment, urban transitions, transdisciplinarity

1 Introduction

Social development directly relates to the development of the *built environment*. In just the last few decades, unprecedented urbanisation has resulted in the transformation of the planet to become predominantly urban (Meerow, Newell, & Stults, 2016). The growth of the urban population raises new resource needs and activates new changes in the environment (Boyle et al., 2010). A growing urban society brings an increase in population density, cultural diversity, and service demands. Increasingly complex human urban systems directly affect infrastructure systems, and vice versa. Infrastructure systems further influence the design and management of physical, social, and natural components of the built (living) environment, their mutual relations, and the mechanisms for future development.

*Sustainabilit*y is a widely applied term in numerous disciplinary fields. Although originating from the context of global development (WCED, 1987), sustainability became indispensable to communities, governments, agencies, and businesses (Pickett, McGrath, Cadenasso, & Felson, 2014). The relations between environmental, social, and economic pillars of sustainability can be expressed in many different ways (Doppelt, 2008), and power, social, and political interconnections, as well as the perception of inner workings of material and biological systems (Pincetl, 2012), are at their core. The details of such workings are essential for the successful implementation of sustainability plans. To that end, even though sustainability aims to provide prosperous social and economic development, it is first understood as a set of ecological principles regarding resource efficiency and conservation, green infrastructure, transport issues, waste treatment, etc. (Munier, 2011).

The term *resilience* is equally widespread in various fields. Accordingly, (too) many different interpretations of resilience (Vale, 2014) have emerged. In the context of the built environment, resilience is pivotal to proper the interpretation and management of complexity, dynamics, and adaptation at different scales. As a principle in building design, resilience traditionally belongs to construction knowledge that dealt with oversizing the components and spaces, reparability, and redundancy. Traditional dimensioning rules were replaced with the modern engineering concept of resilience aimed at simultaneously reducing material utilisation, and optimising structural safety. Nonetheless, Hassler and Kohler (2014a) note that these two notions are not the same and even can be contradictory; while the first provides a specifically tailored solution to a particular brief and a set of functions, the second notion is provided for unknown uses and adaption. The development of the concept of resilience, according to the authors, requires a move from the approach of maintaining stability to one that expressly acknowledges a dynamic adaptive system with multiple equilibria (Hassler & Kohler, 2014a).

This work has emerged from the need to correlate sustainability and resilience within the research boundaries of the built environment and to examine the possibilities for an integrated application of the

two approaches. Following Chapters 1 and 2 of this book, the research starts with the assumption that sustainability and resilience (in the context of the built environment) are two different, yet complementary, approaches. The work provides general explanations, correlations, and comparisons between resilience and sustainability, discusses the context of the built environment and describes components of it that are affected by sustainability and resilience. The study then connects the two approaches and the components of the built environment through a comprehensive review of the state-of-the-art literature and knowledge, and finally considers some strategies and measures for successful transition towards a more sustainable and resilient built environment.

2 Sustainability vs. Resilience

In literature, resilience and sustainability are defined in different ways – some more metaphorical (normative), others more specific and empirical (descriptive) (Chapters 1 and 2 of this book). Some researchers explore them separately, trying to make a clear delineation, while others consider them in combination. For example, resilience theory can be understood as a component, a subset of the broader concept of sustainability science (Folke, 2016), or as an equivalent to sustainability (Holling & Walker, 2003). However, resilience can also be interpreted as a new and a more advanced paradigm (Cascio, 2009).

SUSTAINABILITY APPROACH	RESILIENCE APPROACH
Dominantly accepted and developed in social sciences	Dominantly accepted and developed in ecology
Goal: economic efficiency, human well-being and social justice, environmental sustainability	Goal: ecological, economic, and social sustainability
Stability, predictability	Change, uncertainty, unpredictability
Optimised efficiency of functions leading to sustainability	Maintained system dynamics, existence of function and processes in order to withstand the unexpected
Focus on 'vulnerability' of current flawed state of a system	Focus on 'resilience' – adaptive capacity of a system to cope with unknown futures
Seek for optimal stable state	Multiple stable states are possible – system is in constant non-equilibrium (adaptive cycle, panarchy)
Future options systematically examined and forecasted	Developed absorptive, adaptive and transformative capacity of a system to cope with unpredictable future
Result is predetermined – desirable future based on collective decisions, socially constructed values and/or previously acquired knowledge	Result is not predetermined – flexibility is ensured through the adaptive management of a system based on feedbacks and acquired knowledge in management process – "learning by doing"
Emphasis put on 'outcomes/products'	Emphasis put on 'process'

TABLE 2.1 Sustainability vs. resilience

Resilience and sustainability have a lot in common, and so they are sometimes used interchangeably. Despite the similar goals, there exist some clear distinctions between the two approaches. Key delineations relate to general standpoints, focuses, ways of envisioning or managing the future, understanding of the system behaviour, and the types of outcomes resulting from these differences. Thus, the fundamental

difference between sustainability and resilience lies in the general, normative field (Table 2.1).

A specified (descriptive) definition of resilience does not necessarily conflict with sustainability; moreover, they could be seen as complementary approaches. When understood as a desirable system property/state, resilience represents a crucial prerequisite for achieving sustainability and sustainable development (Folke, Carpenter, Elmqvist, Gunderson, Holling, & Walker, 2002). However, unlike sustainability, which is always given a positive perspective, resilience can also be undesirable (Carpenter, Walker, Anderies, & Abel, 2001). In other words, a system can be resilient both in a desirable and in an undesirable state. Being resilient is not necessarily a good thing (Holling & Walker, 2003). To sum up, resilience can be understood as both a metaphorical/general and specific/operational concept; as a way of thinking – an approach to managing the changes on the one side, and a feature/state of the system that is being assessed, addressed, or achieved on the other side. Although its normative dimension is often contested in the context of sustainability, the resilience approach is normative "at least as much as sustainable development is" (Pisano, 2012).

3 Affected Context of the Built Environment

To provide clarity regarding the notion of resilience, its relation to sustainability, and the links between the two concepts at different scales, it is necessary to give a description of the affected (encompassed) context of the built environment. Basically, built environment includes hard and soft infrastructures, and the community (Anderies, 2014; Hassler & Kohler, 2014a). Hard infrastructure comprises buildings, building networks, physical support systems etc., and soft infrastructure comprises values, knowledge, governance, rules, and institutions. Built environment also includes the 'unbuilt' segment, i.e. the natural environment. The components of the built environment, either public or private but nonetheless tightly interconnected, should be observed as parts of the whole, and not as isolated or independent segments. To that end, Anderies (2014) specifically points at the need for collaboration between social and ecological worlds, as a means of providing ecosystem services inside the network of connections. Considering that the complexity of a system is determined by its composition and dynamics, built environment can be studied at different scales that refer to an ecosystem type – buildings, building stocks, neighbourhoods, cities, and regions. As the scale of the built environment grows, it must be viewed as being embedded in a broader natural system (Anderies, 2014).

Resilience thinking is very significant within the context of the built environment. The resilient built environment should be characterised by persistence and transformation within a self-organising system, with a strong focus on managing principles for natural systems that can, sometimes irrevocably, "move from one stable regime to another" (Anderies, 2014). Instead of linear flows, systems are constantly

changing in nonlinear ways (Meerow et al., 2016). For Hassler and Kohler (2014a), "the concepts of time have a considerable role in the description and in the dynamic of the built environment. In the case of disasters, the time constant is small and sudden. There is a possibility for immediate feedback and understanding the mechanism in detail. There are numerous analogies between the dynamic of very different systems and it is possible to learn from disasters, to reduce vulnerability and design anticipation strategies. However, for slow-moving risks that affect part of the built environment with high time constants (decades, centuries), the possibilities for prediction and anticipation are reduced." An efficient response needs to involve both resilience heuristics and anticipation measures (Hassler & Kohler, 2014a). Anderies (2014) has framed the overall system of interest and identified "practical design features known to promote robustness/resilience, independent of time scale or level of organization", including: redundancy, modularity, and diversity in components or connections.

Redundancy enables the continued functioning of a system in the case of subsystems' failure. It is typically used in biological systems and engineered infrastructure. Since redundancy requires considerable performance and investment costs, its inclusion in wide-ranging built environment systems is questionable.

Different functional modules within a system are provided by modularity. To a certain extent, modules can develop independently. The failure of one module does not endanger other modules if they are loosely linked by design. Designing the sufficient links between the modules affects learning from the activities that occur within other modules. This characteristic refers to the polycentricity.

Diversity provides the capacity to create novelties within a modular system of the built environment, so that the individual modules could be tested without interfering with other modules. The problems in creating the diversity of modules, such as neighbourhoods, public spaces, work areas, etc., relate to extremely high costs and benefits that could be difficult to define.

4 Disciplinary Perspectives

From the ecological science perspective, Pickett et al. (2014) have researched how a general resilience concept could be applied to increase the resilience of the built environment. In this study, resilience is presented as a key conceptual and modeling framework for operationalising (facilitating or inhibiting) sustainability, with sustainability described as a normative, socially derived goal, combining ecological integrity, social equity, and economic viability. "A contemporary theory of ecological resilience starts with the basic idea that internal and external drivers of system structure and activity are a changing template to which successful systems must adjust." (Picket et al., 2014) Resilience, as the ability of a system to conform to all forms

of disruptions and shocks without disturbing its fundamental structure and processes, emerges from synergy between the connectedness within that system and the accumulated wealth. As such, resilience is focused on the relationship between change agents and system capacities. The interpretation given can be summarised as a flexible, *adaptive cycle,* which traces system dynamics in three-dimensional space, determined by resilience, connectedness, and capital or wealth (Pickett et al., 2014) (see Chapter 2 of this book).

As a system becomes more connected, it is more prone to shocks, granted that modularisation does not prevent the generation of negative effects (Pickett et al., 2014). High but equally connected systems and high but fixed wealth are connected to poor ability to acclimate to disturbance, i.e. low resilience. The adaptive cycle occurs in different, but connected, patches that constitute shifting urban mosaics (Hassler & Kohler, 2014a).

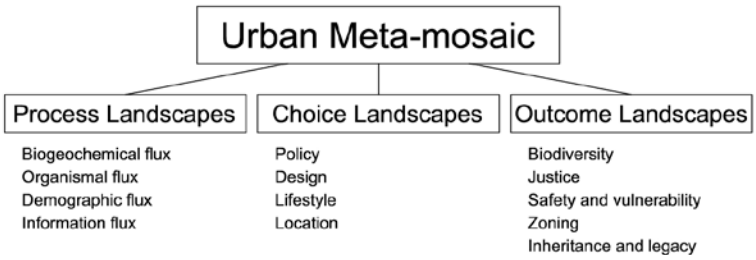

FIG. 4.1 Metacity: Hierarchical diagram *(McGrath & Pickett, 2011)*

Interacting mosaics determine a 'metacity', an open-ended, porous, and dynamic model appropriate for the understanding of urban transformation at multiple scales and across the globe (Fig. 4.1). A large-scale urban meta-mosaic consists of distinct patches with peculiar structure, established interactions with distant and neighbouring patches, and divergent porous boundaries. The patches can evolve over time, following the dynamic types incorporated in the adaptive cycle. A metacity is composed of a spatially and temporally shifting mosaic of patches. Key tools used to combine ecological thinking on resilience and social deliberations involve: the new idea of metacity, landscape/path ecology, the design and assessment of ecological models, and the use of designs as experiments.

While ecological resilience underlines the capacity of the site to adapt to external changes and disturbances in controlling interactions, 'engineering resilience' underlines the capability of returning to a state that existed prior to disturbance (Pickett et al., 2014). On the other hand, 'resilience engineering' is, according to Hollnagel (2011), the capacity of the system to sustain the required operations under expected, as well as the unexpected, conditions by adjusting its operating, before, during, or after the occurrence of disturbances, shocks, or changes. So, resilience is not so much a characteristic or a quality as it is a feature of behaviour or performance of a system. A built system is considered resilient if it possesses the ability to monitor, anticipate,

respond, and learn. Regarding the level of a built system en masse, it is possible to use resilience engineering to propose appropriate steps for improvement, depending on the characteristics of a particular field of activity (Hollnagel, 2014). Ascertaining the significance and the right proportion of the main abilities is necessary for any organisation or domain. The prerequisite for establishing a resilient system is that none of the abilities are excluded. All abilities must be able to address what happens within and without the system boundary (Hollnagel, 2014). Survival is enabled thanks to the anticipation of what may happen outside the system boundary, now and in the future. Therefore, it is more significant to understand the operation and purpose of the system than the structure or components, and to focus on its ability to withstand threats and use favourable circumstances. For built environment that is referred to as a socio-technical system, built in order to provide a particular service or functionality, resilience is not just a problem of sustainability and disaster risk management. It is a matter of sustaining the necessary operations under expected, as well as unexpected, conditions, which are also opportunities rather than only threats. A built system that is incapable of recognising and learning from opportunities will eventually prove to be no better than a system that cannot respond to disruptions and threats (Hassler & Kohler, 2014a).

Hassler and Kohler (2014a, 2014b) have analysed the context of the sustainable, lasting management of the built environment that consists of an array of capitals (such as physical, natural, social, economic, and cultural), and brought resilience into context with other long-lasting concepts of stability, continuity and equilibrium, durability and duration, vulnerability and robustness, as well as slow and fast-moving risks. By reviewing vulnerability and continuity, the authors have revealed that the notion of resilience evolves according to the differences in scale, from an engineering definition at the level of a building to an ecosystem definition, devoting special attention to the neighbourhood, city, and regional levels. Different scales have different time constants; regarding capitals, it is possible to connect time scale categories with different dimensions (Hassler & Kohler, 2014b). "As a design principle, resilience increases according to the expectations for time scale (longevity) and can be used as a central timing and memory concept". (Hassler & Kohler, 2014b) Considering that anticipation could only refer to shorter intervals and related dimensions and scales, it presents a strategy which permits a quick reaction and a fast learning process fundamental to risk management. Reducing vulnerability and increasing resilience depends upon progressive increase of control in practical and conceptual ways, such as scenarios, future options, time horizons, etc.

In view of the interpretation derived by Hassler and Kohler (2014b), resilience becomes a superior guiding principle that utilises lessons from lasting surviving systems and incorporates limited ability to predict the future. Namely, the built environment is in danger of both fast-moving and slow-moving risks whose profiles are different and thus require distinct, separate approaches. "Although a system may have some adaptive capacities, this does not guarantee the quality of the subsequent situation." (Hassler & Kohler, 2014b) Here, natural

and cultural capitals are central aspects of resilience because they cannot be replaced or reproduced. In this sense, resilience would allow a rising value of the human-made capital and positive feedback loops for natural and cultural capitals. Resilience can be put into use when referring to some forms of clearly defined social or ecological systems, but for built environment and other more intricate systems, no simple modes or metrics are available. An anticipation-based strategy is attainable for more or less known threats, by increasing the adaptive capacity and reducing the vulnerability. Due to unknown threats, their combination, or reactions of the built environment to human-made and natural disruptions, tackling uncertainty can only rely on heuristics obtained during the observation of successful outcomes (Hassler & Kohler, 2014b). Resilience does not have much to do with the precise definition of social or ecological systems in this sense, but is more a rule of design for such intricate systems. Instead of a descriptive concept, resilience becomes a standardising one (Brand & Jax, 2007).

For Moffatt (2014), resilience and sustainability are processes that depend highly upon the framing and interpretation of the notions of time. At their very core is an innovative outlook on how humankind perceives and values the future. Resilience and sustainability are attempts to redefine the time concept, because in the modern age time concepts generally favour present over future, which is called time preference. Both approaches share low time preference, i.e. slow change. If built environment fails to recover losses and endure a reasonable time period, then it is neither resilient nor sustainable (Moffat, 2014). The notion of sustainability recalls a static perspective aiming at an immutable and stable future (Hassler & Kohler, 2014a). Sustainability, even though it is often viewed and characterised in utopian terms, is actually based on a single slow-moving disaster scenario where humanity exhausts all critical physical resources or miscalculates the ecological carrying capacity (Moffatt, 2014). On the other hand, resilience presents a more dynamic outlook on the future; risks, surprises, and uncertainty are viewed as the norm, and the increasing size, intricacy, and co-dependencies of the built environment create an increasing frequency, severity, and diversity of disaster scenarios (Hassler & Kohler, 2014a). The inherent capacity of built environments and their socio-economic systems to adapt and recover from change and loss, proactive policies, and foresight may, in fact, dictate the quality of life in such a dynamic future (Cole, 2012).

The incorporation of resilience within urban plans, requires that time frames, as well as the expert teams, must be determined. With the passage of time, the likelihood of various disaster types and uncertainty rise. The teams of experts indicate transdisciplinarity, having regarded that, for achieving sustainability goals, the disturbances and shocks of every sector have to be considered. For the goals regarding biodiversity, air quality, water quality, preservation, and increment of green spaces, etc., potential threats refer to climate change, earthquakes, tsunamis, floods, etc. Liveability, health, security, and choice within the social goals could be threatened by sabotage, crime, civil unrest, war, computer viruses, etc. Achieving economic goals such

as community development, assets, work opportunities, and prosperity is also threatened by urban development, loss of critical revenue, global financial system, or the disruption to trade. Nonetheless, the identification of all potential threats is not possible, considering that the further research brings the uncovering of more threats (Moffatt, 2014).

Bosher (2014) has determined 'built-in resilience' through the reduction of disaster risks, and defined it as an ability of the built environment to continue to conform to current and developing threats, a quality considered in social, physical, institutional, and economic terms. Bosher (2014) noted that, for disaster risk reduction, the required information needs to be contextually specific. Local knowledge is crucial to correctly ascertain risk levels and options to further reduce risks. If levels of risk are considered important, the risk could be reduced, eliminated, transferred, or controlled in various ways. The classification of typical risk reduction options implies:

- inherent safety (refers to the elimination of the possibility of occurrence of threats/hazards);
- prevention (refers to the reduction of the expectance of possible threats/hazards);
- detection (refers to securing measures for early warning of imminent disasters);
- control (refers to the limitation of the hazards' magnitude);
- mitigation and adaption (refers to retrospective or proactive protection from the damage effects of hazards); and
- emergency response (refers to organisation of evacuation and access for emergency services) (Bosher, 2014).

The classification is made according to the preference, so the first to be addressed should be 'inherent safety', indicating that the threats and hazards should be eliminated. This can be possible for some hazards, such as certain floods and fires, but not for some others, unless the built assets are relocated to areas not disposed to disasters. Although some risk reduction options may be suitable for one kind of hazard, they may not be appropriate for other types. Therefore, the assessment of multi-threats/hazards needs to be undertaken, and any threat reduction recourse should be proportionately examined alongside any other threats that have been identified. This indicates that the decision-making processes need to involve a complex range of stakeholders. However, up to now, the research has shown that there is a large gap between the actual implementation and regulatory intentions. To bridge the theory and operationalisation, Bosher (2014) defines built-in resilience as a process, a quality, and an ultimate goal. The quality presents the capability to intuitively and proactively cope with an array of dynamic changes. In that way, a resilient built environment is in consensus with sustainable development.

Nicol and Knoepfel (2014) have studied housing stocks as parts of the built environment that is affected by resilience and sustainable development. To these authors, resilience and sustainable development are substantial generic postulates that cannot be applied directly;

instead, implementation could be possible through the institutional framework. Namely, a sustainability study involves a very systematic implementation of the framework of institutional regimes. In every stock, each service and good could be assessed in terms of sustainable use and the effect on the use of other services and goods. Regulations controlling every use should be analysed to assess whether incoherence in, or between, regulations could be producing unsustainable uses. Nicol and Knoepfel (2014) conclude that a more comprehensive understanding of the regulation of services and goods related to resilience is necessary, as is further research into determining the best kind of institutional conditions to ensure the maximal resilience of housing stocks.

5 Transitioning Towards Sustainable and Resilient Built Environment

Instructions for operationalising how built environments could progress to a more resilient future are presented as feasible facets for devising and sustaining the strategies of urban transition, including geospatial information and communication technologies (G-ICT), new design using collaborative responses, climate planning, limiting urban sprawl, short-circuit economic approaches (Collier et al., 2013) and green infrastructure planning.

G-ICT and spatial data infrastructures are supporting tools for sustainable development and urban resilience. Developed geospatial databases of cities improve the process of planning and facilitate e-planning (Wang, Song, Hamilton, & Curwell, 2007), and directly assist in providing crucial answers to the problems of sustainability and resilience, like resources depletion, climate change impact, and urban sprawl (Collier et al., 2013). Integrated planning relates to the utilisation of data represented in different scales and with boundaries obtained through analytical, institutional, and administrative processes, as well as the data defined ecologically, and a lot of textual, numerical, and graphical information from planning documents. G-ITCs are aimed at overcoming problems regarding integration of the data from various sources and securing their functional interoperability and formatting, by administering all facets of the planning process and allowing the application of various methods including visualisation, communication, and analysis.

A policy on transition towards sustainability and resilience should be communicated clearly, founded on deliberative processes, and informed by important interconnection between the stakeholders, thus ensuring their full participation. Given conditions ultimately imply a transdisciplinary approach (Collier et al., 2013), and a balance between scientific and non-scientific – local knowledge (Collier & Scott, 2009). Collaboration aims to stimulate the processes conceived and driven by citizens, promoted by a sizeable number of stakeholders and relied on existing social capital networks with continuing collaboration from management practice, novel design groups, and academic research

(Hostetler, Allen, & Meurk, 2011). Regarding the occurrence of threats or hazards (Kosanović, Hildebrand, Stević & Fikfak, 2015), continuity in planning and managing would help to overcome the lack of interest of stakeholders.

Collier at al. (2013) have explained that the challenges regarding climate city planning operationalisation need to be taken into consideration because the effects of natural hazards on global economies and cities will likely grow in the future for two complementary reasons. The first is that severity and frequency of climate related events are expected to rise. The other is that the economic impact might increase due to growing population and activity in vulnerable areas. Adaptation measures reduce transfer risks or potential damage and decrease the probability of disasters.

Planning for a climate resilient built environment is faced with further challenges regarding heat and energy management. Strategic energy planning aspires to lower the demand for end-use and to increase renewable energy shares, which further strengthens "urban energy resilience through lower long-term costs of running urban energy systems" (Collier et al., 2013). There is a need for implementing new infrastructure-related measures (e.g. water- or energy-related) through land use management and urban planning. As these measures imply changes in current land use, their success is very limited in urban areas. Where requirements for green areas, different building strategies, food protection, or water storage are in collision, the priorities in land use must be established. To support the adaptation planning, the assessment of urban functions and improved techniques for linked land use modelling are necessary.

Resilience and sustainability of the built environment should be analysed through spatial patterns derived from diverse policies and strategies for land use, in order to limit urban sprawl. This is important because urban density is a requisite factor of sprawl, and its increment could have a negative impact on urban development. According to Ostrom (2010), contemporary urban spatial patterns can be classified as 'dispersed city', 'compact city', and 'polycentric development'. Particular problems with city sprawl are related to the differences regarding economic and social opportunities and the varying environmental quality in certain parts of a city. The compact city model, as an alternative to sprawl issues and the dispersed city, is a mixture of land uses, growth within the city boundaries, and innovative and intensive use of urban space (Collier et al., 2013). On the other hand, the experience has pointed to some problems regarding overdevelopment and congestion without clear social benefits. In contrast, the idea of polycentricity promotes medium-sized cities, cooperation between urban areas, and endogenous potential, to concurrently fulfil the functionality and physically connect the regions. The central goal here should be to combine spatial and social cohesion with economic growth.

Besides previously mentioned spatial patterns, 'shrinking cities' are becoming a frequent problem of present times. Referring to Florentin

(2010), Vujičić & Đukić (2015) have pointed out that the shrinking city significantly deviates from the traditional concept of the compact city as an entirely new pattern of distribution of population and the economy. Lütke-Daldrup (2001) has depicted the spatial manifestation of this phenomenon as a 'perforated city', where spatial holes of abandoned land – so-called brownfields – dramatically degrade urban fabric. Considering the complexity of the problem, implementation of the resilience framework is central to the achievement of sustainability of these cities.

Recognising that social and economic legislation are slow to arise, or that they might have conflicting effects, reveals the challenges related to deficient management of transformations. These challenges irrevocably dissipate the land and seriously limit the opportunities to be granted to future generations, as well as to their welfare and socio-economic development. Hence, it is necessary to determine municipal accounting tools for land use and the availability of under-used and non-urban areas (Collier et al., 2013). Innovation opportunities and emerging economic tools would play a key role in resilience planning and would also create an opportunity to embed resilience in communities.

Urban greening is a potent measure for enhancing the sustainability and resilience of the built environment. The sufficient existence of greenery in urban areas gives numerous ecological benefits, such as: mitigation of the urban heat island (Goode, 2006); reduction of flood occurrence by runoff water retention; and improvement of water quality by purification (Vijayaraghavan, 2016); improvement of air quality and reduction of greenhouse-gas emissions (Rowe, 2011); noise reduction (Yang et al., 2012); support to biodiversity (Nurmi, Votsis, Perrels, & Lehvävirta, 2013), etc. By improving the existing green infrastructure, a number of additional social and economic benefits could be achieved. In already densely built urban spaces, the only way to achieve the benefits of greening is most often through the interventions on building envelope. With regard to the building stock, ecological performance would be improved with system application in any case, but for achieving social and economic benefits, some physical characteristics of the stock also need to be taken into consideration (Stamenković, Miletić, Kosanović, Vučković, & Glišović, 2017). To perform ecosystem functions, acting on the private property with greenery systems' interventions is required; in that way, the municipal ecological network (De Lotto, Esopi, & Strula, 2017) is being established. Green infrastructure can be optimised by mixing private and public initiatives and new technologies into a methodical strategy aimed at creating healthier, more sustainable, and resilient urban environments.

6 Discussion and Conclusions

In the last few decades, sustainability and resilience have become crucial concepts dedicated to responding to numerous looming challenges posed by environmental change and urbanisation. The approaches to

sustainability and resilience are related to each other, but are neither identical nor interchangeable, due to the differences found in their foci, the way of envisioning or managing of future, the understanding of system behaviour, the dynamics and types of outcomes, i.e. the general standpoints, etc. To that end, Hassler and Kohler (2014a) have provided a central description of the conditional relationship between the two approaches, where sustainability has been identified as a group of protection goals addressing different types of capitals that need to be maintained for future generations, and resilience as a tool aimed at providing a mindset and a series of methods used to overcome difficulties regarding adaptation to current and future unknown changes. By handling these changes and managing the uncertainty, resilience becomes an instrument for operationalising sustainability over time.

The particular relationship between sustainability and resilience depends on the context to which these two concepts are applied, as well as on the disciplinary perspective taken (e.g. Pickett et al., 2014; Hollnagel, 2011; Moffat, 2014; Bosher, 2014). The achievement of a sustainable and resilient built environment presents a complex, long-time process due to a range of threats/hazards at different scales and the contributing involvement of all stakeholders. Collier et al. (2013) have assigned a central role to communities in fulfilling the transitioning objectives, accented the importance of transdisciplinary approaches, and proposed a set of strategic measures to achieve sustainable and resilient urban development, which have been discussed in this work.

Nonetheless, the measures for enhancing both sustainability and resilience also need to be custom-tailored, as every particular built system requires a specific kind of performance feedback. The context of the built environment, viewed through the lenses of sustainability and resilience, is multi-component. According to Anderies (2014), characteristic temporal and spatial scales, and their associated levels of organisation and scales of operation, together form the overall systems of interest, where resilience and robustness should be used in tandem to provide adequate responses to shorter-, intermediate-, and long-term design challenges. Additionally, the author has identified practical design features that were briefly debated in this paper, including: redundancy, modularity, and diversity in components or connections.

Although resilience is often perceived as "good", it can also be analysed from a less positive perspective. Hassler and Kohler (2014a) and Andereis (2014) have provided a thorough insight into the weaknesses in the current understanding of resilience and potential obstacles in the implementation of resilience-building policies and design measures. However, the development and implementation of the concept of resilience into sustainable development need to be encouraged without question because of their paramount importance for countering the complexity, changeability, and uncertainty affecting the built environment.

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About Socio-Cultural Sustainability and Resilience

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ABSTRACT **Sustainability and resilience have become an indispensable part of contemporary research discourse. In the literature, the notions of these two concepts are numerous and diverse. Approaches to sustainability and resilience thus range from philosophical, political, economic, psychological, ecological, etc., to more complex, systematic considerations, i.e. from broad theoretical or metaphorical views to particularised sets of proposed measures and actions. Although sustainability and resilience basically deal with human systems and social organisations, for which reason expressions like 'sustainable community' and 'resilient community' are often used in current studies, the social dimension of sustainability and resilience and the role of culture, however, persist as the least clarified and are without consensus. Recognising the challenge that, in a multitude of interpretations, can primarily be connected with a necessity to revisit the conceptualisation, this paper unfolds several fundamental questions: What is the relationship between environments, communities, sustainability, and resilience? What is social sustainability and what does social sustainability have to do with sustainable development? What are the concepts and characteristics of sustainable/resilient communities? What are the roles of individuals and of community as a whole? Finally, how do sustainability and resilience relate to each other within the socio-cultural dimension?**

The research based on the questions posed above, however, does not aim to find the only correct answers, but to assist in deepening the understanding of some of the most intricate and least illuminated topics in the fields of sustainability and resilience, thus bridging a knowledge gap regarding the socio-cultural implications of planning and design decisions for built environment subjected to shifting dynamics, irregular and unexpected changes, and growing uncertainty.

KEYWORDS notion, social environment, community, sustainability, resilience, culture

1 Introduction

According to the Oxford Dictionaries (n.d.), the term *environment* means: 1) "The surroundings or conditions in which a person, animal, or plant lives or operates"; 2) "The natural world, as a whole or in particular geographical area, especially if affected by human activity". To understand complexity and diversity regarding the environment, a systemic approach and an interdisciplinary perspective of its different parts and to the interrelations among these parts are needed (Park, 2001). Watson et al. (2015, p. 4) identify the use of resources and the production of waste, health and wellbeing, and productivity and performance as "three areas where the interplay between people and the designed environments around them is key". Bartuska (2007a) has distinguished between *perceptual* (a part of environment intercepted by senses), *functional* (a portion of environment that physically impinges on an organism, i.e. a part in which we operate or function), and *conceptual* environment, which is society's cultural world, including the built environment, a world shaped by human ideas and the meaning they convey. Although the built environment is manifested in constructed surroundings, physical artefacts, and places (Squires, 2013; Bartuska, 2007), it is meaningful only in socio-cultural terms (Rapoport, 1990; Niculescu, 1975). For Bartuska (2007a), relations between humans and environment lie at the core of human experience; human concepts and abstractions are underpinned by symbols that express the reality, and so even myths and legends develop as a part of built environment. Broadly speaking, built environment can be seen as cultural landscape, organisation of space, time, meaning and communication, or a system of settings in which the systems of activities take place (Rapoport, 2007). From a user-centred perspective, the basic purpose of built environment is to support the activities of the users that it shelters (Vischer, 2008, p. 231). The components of built environment that emerge from human needs, thoughts, and actions (Bartuska, 2007) consequently have an influence on their creators and users. Between an initial need to create, and a goal to use the created, lies the *socio-cultural realm*.

The literature review reveals that the interest in exploring the links between social worlds and physical spaces is not new (e.g. Strauss, 1970; Tuan, 1979), and that *social environment* can be studied from different standpoints, in narrow or wide contexts, on different scales, and in changeable relations towards natural and built environments. For Hundertwasser, the social environment that is the identity represents the fourth of man's five skins (the first skin is his natural epidermis, the second his clothes, the third is his home, and the fifth skin is the planetary skin) (Restany, 1998). Squires (2013, p. 15) conceptualises social environment as a sub-category of the environment which "considers the culture that an individual lives in and the people and institutions with whom they interact". For Rapaport (2007), culture influences the mechanisms that link people and environments (from homes and offices, to parks, streets, buildings, to cities) in a number of ways, and cultural variables result in a multitude of environments. According to Barnett and Casper (2001, p. 465), the broad notion of human social environment that encompasses "immediate physical

surroundings, social relationships, and cultural milieus within which defined groups of people function and interact" can be experienced at multiple interconnected scales (from households and neighbourhoods, to cities, to regional, national, and international scales). Therefore, social environment placed in a certain physical (geographical) context can actually be understood as a system of different overlapping social environments, a network with an intricate web of connections among the units it is made of (Palla, Derényi, Farkas & Vicsek, 2005), that is, among the different 'groups of people'. A group (unit) of people who have and share something (in) common is defined as *community*.

Community is a type of social organisation (Hunter, 2008), a familiarised social environment exempted from generality. At the same time, community is, according to Cnaan, Milofsky, and Hunter (2008, p. 5-6), a complex construct consisting of many important dimensions that can be grouped into: shared ecology (specifics of spatial location), social organisation (network character, types of on-going social processes, and organisational systems), and shared cultural and symbolic meaning (shared sentiments, values, sense of community, identity, and others). The social and personal identity of an individual (Niculescu, 1975) is related to the identity of other members in a community, and the entire group reflects the patterns of these relationships, which ultimately becomes its characteristic. Nonetheless, community should not be viewed as an isolated space where only the relationships between insiders are considered as important (Cnaan et al., 2008, p. 14). To that end, Wang, Qiu, Wang, and Zhang (2008, p. 637) describe community, from the topological view, as a group of nodes connecting densely inside and sparsely to the outside.

Traditionally, communities are formed according to the age, sex, race, occupation, religion, ethnicity, etc. Rapoport (2007) makes a departure from this simplified categorisation and recognises lifestyle as one of the main criteria of grouping community members and the main specificity on the basis of which a diversity of communities can be explained. Lifestyle, as stated by Rapoport (2007), lies at the core of human activity and activity systems that are specific and hence suitable for analysis. Thus, one of the most significant community determinants is its dynamics.

An individual can be a member of several communities, which is the reason for the occurrence of the 'overlapping communities' phenomenon. In a time of advanced technologies and rapid exchange of information, these overlaps are getting a new, stronger dimension, often shifting from physical to virtual reality in which interactions are easy to establish and network structures are quickly evolving (Rosseti, Guidotti, Miliou, Pedreschi & Giannotti, 2016). "...Bicycle activists, slum dwellers or community gardeners often have more in common with other similar groups around the world via virtual communication networks than with neighbors with physical proximity" (McGrath & Picket, 2011, p. 56). Community structure is further compounded and heterogenized because of the development of global culture and the diversity of individual responses to globalisation trends. While

traditional cultural traits among members of the same community are maintained with significant differences, new 'real' world issues and global values such as sustainability and resilience are concurrently adding additional complexity to the notion of community.

2 The Notion of 'Social' in Sustainability Framework

Omann and Spangenberg (2002) have characterised sustainable development as perhaps the most challenging policy concept ever developed. According to Becker, Jahn, and Stieß (1999), sustainability has emerged as a response to the prevailing societal transformation trends, including erosion of 'development' and merely economic modernisation. Based on a widespread understanding, sustainability encompasses environmental, economic, and social dimensions, and their diverse interlinkages established through culture. Environmental sustainability (sometimes also referred to as technical or ecological sustainability) is the most comprehensively employed sustainability segment so far, followed by economic sustainability. *Social sustainabilit*y started to become relevant in research, politics, and practice only at the beginning of the 21st century (Colantonio, 2007).

At the present time, when key sustainability postulates are already being questioned (e.g. Robinson & Cole, 2015), the consensus on what social sustainability is and what its indicators are has not been reached yet. A significant body of literature testifies to the accepted challenge of defining an inclusive notion of social sustainability, as well as to the difficulties in establishing such a definition. Existing interpretations reflect different approaches and a wide range of philosophical, political, and practical issues (Woodcraft, 2012). The more general the perceived objective of social sustainability, the more notable the difficulties encountered in defining the term. A particular barrier to describing social sustainability, according to Colantonio (2007, p. 6), is "the multifaceted nature of the concept of sustainability that amalgamates social, environmental and economic matters into a new independent entity". Similarly, Murphy (2014, p. 32) recognises that the difficulties in identifying 'purely' social issues actually represent a consequence of considerable overlaps across the three pillars of sustainable development. Besides variable interpretations of sustainability as a whole, another difficulty in defining the notion of social sustainability is a durable ambiguity (e.g. Sachs, 1999) regarding the relationship with other sustainability segments, which most often stems from discipline-specific observations.

With regard to the overall sustainability concept and its constituting dimensions, it appears that the term 'social sustainability' can be understood as:

- implication of environmental sustainability;
- support for the processes of achievement of environmental and economic sustainability goals (through behaviour, policies, institutions, etc.);

– prerequisite for the achievement of environmental and economic sustainability goals, where individuals and groups are placed at the core of the process; or
– a set of features of social environment valued in its own integrity and desirably contributing to the environmental and economic sustainability goals. This is the most complex form of interpretation of social sustainability and with the greatest diversity; it can equally refer to the widening of the traditional (holistic) meaning of sustainability, or be understood as the 'sustainability of social environment', e.g. the sustainability of community (Dempsey, Bramley, Power, & Brown, 2009).

For Becker et al. (1999), sustainability, as well as non-sustainability, conditions refer to a combined system of nature and society in real time and space, because of which it is not possible to consider social or environmental sustainability in isolation; rather, it is the viability of their relationship over long periods of time that defines the course of (non-) sustainability. On the other hand, the prerequisite for dealing with social sustainability, according to McKenzie (2004), is to define it as distinct from environmental or economic sustainability. Criticising the division of the 'three pillars' of sustainability, Mundt (2011, p. 90) has proposed returning to the original concept of the use of natural resources without trying to widen the meaning, and indicated that social issues should not be mixed with sustainability and that they have to be dealt with separately and on different levels. To define social sustainability, Woodcraft (2012, p. 32) has posed the following questions about its purpose: "Who and what is being sustained?" "Why and at what costs?" For Vallance, Perkins, and Dixon (2011), social sustainability is crucial for the fulfilment of environmental goals. "Only when people have potable water, healthy food, medication, education, employment, equity and justice, they can change their behaviour and place their concerns on global warming, energy efficiency, and other environmental issues" (Vallance et al., 2011, p. 345). What people need, what people want, and what is good for the bio-physical environment, therefore emerge, according to these authors, as three main factors enabling an understanding of the complex, and, to a certain extent, contradictory and conflicting, conditions within social sustainability itself (in relation to environmental sustainability); yet, the awareness about bio-physical sustainability goals intervenes with practices, preferences, and places people would like to see maintained (sustained) or improved, i.e. with the patterns of behaviour, values, and traditions that people would like to see preserved. Although people tend to keep and preserve what they subjectively find as valuable (beautiful), these values inevitably represent a part of socially constructed, socially shared reality (Niculescu, 1975, p. 291). According to Rapoport (2007), the evaluation of environmental quality is performed at the level of a group of users, according to its values, ideals, images, and schemata. Correspondingly, user groups, at least partially represent a function of culture. "Finally, how people behave and their social structures are all culturally highly variable and can be seen as specific expressions of culture. Thus culture plays a role in socio-behavioral phenomena" (Rapoport, 2007). Alexsson et al. (2013) have placed cultural values next to social

values for a given landscape, and then presented the diversity of local sustainabilities using an example of Swedish municipalities. Within a newly proposed conceptual framework consisting of four interrelated concepts (equity, eco-presumption, safety, and urban forms), Eizenberg and Jabareen (2017) interpret social sustainability as "a part of a wider framework for sustainability that strives to cope with environmental and climate change risks".

In conclusion, there is not only one form of social sustainability. The indicators, criteria and objectives of social sustainability (e.g. Dempsey et al., 2009; Murphy, 2014) are often context-specific (Omann & Spangenberg, 2002). On the one hand, different forms of social sustainability are determined by its general framework, i.e. by the 'hard' and 'soft' themes (Colantonio, 2008),which includes here the satisfaction of basic needs, quality of life, self-determined lifestyle, health and wellbeing, happiness, education, experience, inclusion and participation, opportunities, income, poverty alleviation, employment, gender equity, human rights, generational issues, security, cultural diversity, social justice, social capital etc., and contextual variable factors on the other hand (e.g. Reich, Riemer, Prilleltensky, & Montero, 2007). The unique integration of these two, more or less contrasting, components generates diversity and requires sufficient knowledge and active involvement of a broad range of stakeholders on different levels, including communities.

3 What is Sustainable Community?

People represent an integral part of every definition of sustainability and sustainable development. Being the ultimate beneficiaries and the critical component (Watson et al., 2015), people are the ones who bring sustainability into each dimension of the built environment, particularly into the social dimension, regardless of laws, regulations, physical space characteristics, etc. Therefore, a strong relationship between social sustainability and sustainable development undoubtedly exists.

The concept that is most closely related to social sustainability – *sustainable community,* emerged in spatial and urban planning across Europe during the 2000s (Raco, 2007). To that end, McKenzie (2004, p. 23) has interpreted social sustainability as "a positive condition within communities, and a process within communities that can achieve that condition".

According to the *Bristol Accord*, sustainable communities "are places where people want to live and work, now and in the future. They meet the diverse needs of existing and future residents, are sensitive to their environment, and contribute to a high quality of life. They are safe and inclusive, well planned, built and run, and offer equality of opportunity and good services for all" (ODPM, 2005, p. 6). Bristol Accord also establishes the main features and describes sustainable communities as: active, inclusive and safe; well run; well connected; well served;

environmentally sensitive; thriving; well designed and built; and fair for everyone. To the present day, this document has remained the basis for research and development of sustainable communities.

A study of the notion of sustainable communities in this work is structured according to several research questions, where no answer has a consensus:

A *What are the features of sustainable communities*? Dispersive discourse on social sustainability (Section 2) is inevitably transmitted to the concept of sustainable communities. Reviewed literature provides different definitions derived from variable perspectives and a variable scope of included issues or features of sustainable communities (e.g. Colantonio, 2007; Maliene, Howe & Malys, 2008; McKenzie, 2004; Raco, 2007). The main reason for the absence of a consensus in this domain is precisely the contextual variability. Therefore, the notion of sustainable communities must be seen as two-layered: generally-significant and context-specific, which is in agreement with the description of sustainable communities regarding diversity and reflection of local circumstances (ODPM, 2005, p. 7);

B *What is the optimal scale of sustainable communities?* From the perspective of urban sociology, a neighbourhood represents an "important arena in which social activity occurs" (Dempsey et al., 2009, p. 295). In urban studies and projects, neighbourhood is often represented as the right scale for operationalisation of social sustainability (e.g. Bacon, Cochrane, & Woodcraft, 2015). On the other side, some authors protest against such spatial-social scaling and framing. For example, Woodcraft (2016) criticises the 'sustainable community' construct built on the imagined homogeneity of urban life and focused on neighbourhood as the primary setting for social relationships and practices that supports a collective sense of belonging and attachment, and negates some other forms of identity. Earlier, Lee (1968, p. 241) had criticised the elusiveness of the concept of neighbourhood and the lack of correlation between an isolated piece of territory and human behaviour. As contrasting opinions are spread over a large body of literature, the optimal scale of sustainable community continues to persist as an open topic;

C *What do sustainable communities have to do with sustainable development?* Originally, sustainable communities were related to environmental issues, but their notion grew over time to include other dimensions of sustainable development. In current literature, sustainable communities are related to a variable range of issues, such as: socio-environmental relations (e.g. Agyeman, 2005); food systems (e.g. Carlsson, Callaghan, Morley & Broman, 2017); economic development (e.g. Kim & Lim, 2017); social sustainability in its own integrity (e.g. Alawadi, 2017; Bell & Morse, 2008; Dempsey et al., 2009); resilience (Section 4); a broad set of issues on sustainable development (e.g. Kusakabe, 2013); etc.

With regard to the interrelations discussed, between social and built environments, and social environment and community (Section 1), notions of social sustainability (Section 2) and the key determining questions about sustainable communities given above, sustainable community can hierarchically include the following components:

- group of people who reside or work in a shared physical environment with determined boundaries;
- social environment encompassing both end-beneficiaries and the factors (such as governing bodies and other relevant stakeholders) that manage general and recognised context-specific sustainability issues on local level;
- community with empowered individuals able to promote processes of achievement of universally relevant social, environmental and economic goals of sustainable development, thus connecting global, regional and local scales.

As the processes (e.g. education) within the three possible components of a sustainable community overlap, or flow from one to another component, proposed hierarchy should not be understood as a set of stand-alone entities. An individual can be connected to all three hierarchical components of a given community, and even further, to multiple communities (e.g. Hyde & Chavis, 2008). Nonetheless, the greatest differences between the three components of a sustainable community refer to the roles of individuals and groups, defined physical boundaries, the aspects of sustainability involved, the ways of managing these aspects, and the relationship between the global, regional, and local. At the same time, these are the fundamental criteria on the basis of which sustainable communities can be formed and developed, under a precondition that they are resilient.

4 Socio-Cultural Resilience

Resilience aspects are interpreted with clarity when the answer to the question "Resilience to what?" (Carpenter, Walker, Anderies, & Abel, 2001) is known. This work deals with *specified resilience* (Folke et al., 2010) to climate change in accordance with the profession and the contribution that the profession can give towards adaptation. Interpretations and discussion on the topic of socio-cultural resilience aim to emphasise the need for a systemic approach and transdisciplinary methods in engineering branches.

Climate change carries a complex field of risk that can be treated both as a physical and a social phenomenon (Reser & Swim, 2011) and that affects all layers and scales of social environment, from individuals to different social groups – communities, i.e. from the physical environment (Bosher, Carrillo, Dainty, Glass, & Price, 2007), to the psychological domain, to interpersonal and intergroup relationships. Strategies that aim to strengthen social resilience to climate change inevitably address intra-individual psychological processes, such as emotion

regulation and behavioural responses (Reser & Swim, 2011). To that end, Doherty and Clayton (2011) have identified a range of adaptive (e.g. creativity, curiosity, concern, scepticism, humour, suppression, etc.) and maladaptive, acute, and disordered individual responses (such as trauma, stress, anxiety, dysregulated defences, etc.), and have defined a potential for psychological distress that lies between these two poles.

The psychological aspect cannot be omitted when considering the effects of climate change on communities and community responses, as it accounts for one of the main references of the intensity of impact. To analyse the complex and multi-layered impact of climate change on communities, certain characteristics and processes, such as proximity and exposure, social understanding, social comparison, social construction, and social reinforcement (Reser & Swim, 2011; Doherty & Clayton, 2011) need to be explored. According to Reser and Swim (2011), the characteristics of communities are among the main moderators in each step in the psychological process that influence adaptation and coping with climate change.

Community perception of climate change and its manifestations differs from that of the individual. Accordingly, community responses to climate change are not the same as individual responses. Collectively and in mutual interaction, people perceive, interpret, assess, and react (respond) to reality and its threats through consensual social construction, on the basis of provided social representations (such as media, literature, public discourse, and others) and social processes that can amplify or attenuate understandings of climate change (Reser & Swim, 2011). Therefore, any generic strategy for resilient communities should, at its basis, tackle both the processes and the representations, just like any general strategy for a resilient built environment should centrally deal with communities (e.g. Collier et al., 2013), having regarded that negative weather and climate events potentially transform into disasters only in social environments (Bell, Greene, Fisher & Baum, 2005), and that community features represent a key to successful adaptation.

As for many other resilience references, adaptation is at the core of a community response to climate change. Holling (2001, p. 394) has suggested the following "three properties that shape the adaptive cycle and the future state of a system": wealth, internal controllability of a system, and adaptive capacity, i.e. the resilience of the system, a measure of its vulnerability to unexpected or unpredictable shocks. According to Ahern (2011), resilient systems are those able to reorganise and recover from a change without transfiguring into a qualitatively different stage. Resilient communities have systemic property (Lang, 2010) and sufficient resources and capitals to not only survive and adapt, but also to develop in circumstances characterised by change, uncertainty, unpredictability, and surprises (Collier et al., 2013; Flint, 2010; Magis, 2010; Walker & Salt, 2006). In the literature, community resilience indicators are set according to various applied methodologies and degrees of comprehensiveness, e.g. The Disaster Resilience of Place (DROP) model (Cutter et al., 2008). In developing the multiple

equilibria of resilient communities, in any case, the role is played by their numerous processes and components, built and built-in natural systems, policy makers, governance and other stakeholders in the built environment, and the members of those communities.

The process of adaptation to climate change needs to be adjusted to cultural determinants (e.g. Swim et al., 2011). As cultures are many, resiliencies are also diverse. The bottom line is that resilience is a socially constructed and culturally bounded concept (Berger, 2017). In a rather brief period of time, culture is not impacted by climate change because of the short adaptation period, but the culture certainly determines resilience-related community attributes, as climate change is perceived in a culture-specific manner. In the long term, it can be expected that climate change will shape culture and embody aggregated resilience-related experience in it. To that end, Doherty and Clayton (2011, p. 273) have posed a question: "How are different cultures likely to be affected by climate change, in ways that are both concrete (loss of homeland) and more abstract (changes in cultural practice and values)?" Another challenge in this process would be cultural (diversity) preservation as one of the goals of sustainable development.

When sustainability is coupled with resilience to climate change, the notion of community becomes even more complex. While social sustainability can be somewhat more easily scaled, "resilience is based on the shifting relationship between scales, and between autonomy on the one hand and connectivity on the other" (Allan & Bryant, 2001, p. 43). Noting that sustainability is impacted by internal (social, political, ecological, or economic) and external factors (such as foreign debt, structural poverty, global environmental problems, and social/political/economic conflicts), and that the sustainability indicators derived from these factors suggest incompleteness on one hand, and the complexity that overwhelms understanding, on the other, Holling (2001) has suggested that sustainability needs to be approached together with adaptive capacity. Ahern (2011) has criticised early thinking on sustainability, which tended to be a static concept with foreseen long-term stability and durability, exempt from unpredictable disturbance and change, and recognised resilience theory as a possible solution to this sustainability paradox. For Magis (2010, p. 401), community resilience is an important indicator of social sustainability. A community, according to Flint (2010), must have certain characteristics that promote sustainable and healthy ecosystems with multiple social benefits. Transformation is therefore necessary, and it will be successful when local communities develop resilience management methods to ultimately become more sustainable, that is, when resilience building becomes an integral part of a natural response that directly affects risk factors. Holling (2001) viewed the patterns of living systems as a panarchial organisation that creates diversity and thus contributes to resilience and sustainability. When biological entities are understood not only through emotional connections developed by social systems, but also as an agent that is crucial for sustainability and resilience, regeneration could be unfolded as an approach to a higher degree of functioning. In this way, sustainability moves from a strictly anthropocentric concept to

a concept of integrated systems, and community becomes equally capable of desirable dynamics and desirable outcomes (Redman, 2014).

5 Discussion and Conclusions

Interactions between people and their environments are complex, multi-scalar, and vary among individuals. The choices that individuals make, characteristics of their lifestyle, worldviews, behaviour and activities, health, psychological processes and barriers (e.g. Gifford, 2011), education, economic conditions, capacity to cope with the unknown, to adapt, develop (through change) and to learn, etc. can all be related to sustainability and resilience. However, the characteristics of interactions and networks among individuals in social environments represent another significant determinant of sustainability and resilience. When these interactions and networks are based on a defined commonality, they are encompassed by the concept of community. Again, the features of a community, such as stability, safety, connectedness, or friendship, all play important roles in evaluating sustainability and resilience. In the frameworks of sustainability and resilience, community organisation transforms into community organising according "to the specific needs of any given locale and tailored to the resources available for their realization. In short, community at the local level cannot be mass produced" (Hunter, 2008, p. 29).

Socio-demographics, economy, technology, environment, and governance are, according to Romero-Lankao, Gnatz, Wilhelmi, and Hayden (2016), five main domains of socio-ecological systems that need to be concurrently addressed to thicken sustainability and to transition from fail-safe to safe-to-fail resilience. Building the capacity to adapt (as a key condition of the capacity to be sustainable) also means addressing the natural, physical, financial, social, and human capitals, and establishing a balance between them (e.g. Jacobs, Nelson, Kuruppu, & Leith, 2015).

In current literature, sustainability and resilience are most often presented as two different, yet interrelated, concepts that need to be studied concurrently. In actuality, the achievement of sustainability does not necessarily mean the achievement of resilience, nor vice versa. For example, when technical resilience is not reached, social sustainability is called into question. The societal bottom line is that preparedness is placed at the core of resilience, while empathy represents the essence of sustainability, capable of overcoming different community disparities. Therefore, sustainability- and resilience-related features of a community are mutually conditioning and even interchangeable. From this newly emerged perspective, social sustainability could represent the 'we-type' readiness for uncertainties, changes and surprises, and socio-cultural resilience the capacity of a community to last and to continuously develop. In conclusion, in socio-cultural terms, sustainability and resilience must be seen as a horizontally and vertically integrated interdisciplinary and transdisciplinary approach.

To that end, traditional socio-cultural values must not be exempted from applicable strategies for a sustainable and resilient future.

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Indicators of Sustainable Development and the Urban Sustainability

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ABSTRACT **One of the main challenges for sustainable development is to define a measurement system that would present a current state of the process and direct future actions. The response to this challenge has been provided through the indicators of sustainable development that are promoted by various organisations. This paper starts with a discussion regarding the justification for the need for indicators of sustainable development. Furthermore, the paper illustrates the evolution of various sets of globally applicable indicators, and gives an overview of some particular (composite) indicators of sustainable development. Subsequently, the paper discusses a capital-based approach to the definition of indicators, and considers the interrelations between the economic, environmental, and social spheres of sustainable development. In the last section, different well-known indicators of urban sustainability are presented and compared in the context of the chosen criteria. Finally, an overview of the current most relevant indicators of sustainable development is given, followed by a discussion regarding the further development and application of indicators.**

KEYWORDS urban sustainability, sustainable development, indicators, criteria, challenges

1 Introduction

Sustainable development has been taken as the main determinant and principle of general future development, but it could also be said that it represents an indicator of the progress of society. One of the most important steps in making a successful platform for the action in the sphere of sustainable development is the definition of indicators (e.g. United Nations, 2007; Dalal-Clayton, 1993; Hart, 2002).

The indicators are a compass on the road to sustainability (Spangenberg & Bonniot, 1998). They "help incorporate physical and social science knowledge into decision-making", (United Nations, 2007, p. 3), and are used to assess and present the state of reached development, to measure success in previously applied actions and plans, and to form a basis for (corrective) future measures; as such, the indicators also represent a means of disseminating the level of achieved sustainable development to the public (Neumayer, 2003a; Dalal-Clayton, 1993; Spangenberg & Bonniot, 1998; McKenzie, 2004). The ultimate aim of the application of indicators is to optimise current problems of sustainable development (Minken, 1999) and to formulate future goals.

Concerning the significance of the indicators, this paper aims to explore and present their development from first proposals to the current challenges, by differentiating between the general sets of indicators and the indicators that are intended for a specific domain of sustainable development, and by pointing to the relevance of a capital-based approach in the definition of indicators. To demonstrate the formulation of the indicators intended for a particular social environment, the paper focuses on urban areas, that is, on the presentation and comparison of different indicators and criteria for the assessment of urban sustainability. At the very end, the paper provides an overview of the most current relevant indicators of sustainable development, derived on the basis of a comparison of different studied global frameworks.

2 Development of Indicators of Sustainable Development

2.1 General Indicators Sets

In the action plan *Agenda 21*, representing the outcome of The United Nations Conference on Environment and Development organised in Rio de Janeiro in 1992, a call went out to the countries and the "international, governmental, and non-governmental organisations to develop indicators of sustainable development that can provide a solid basis for decision making at all levels" (United Nations, 2007, p. 5). Following the joint recognition of the need for indicators, an initial set of 134 indicators of the UN Commission on Sustainable Development (CSD indicators) was developed, classified into four main groups (social, economic, environmental, and institutional indicators),

and published in the so-called *blue book* (United Nations, 1996), the pioneering global platform that aimed to cover sustainability in its broad sense and to serve as a reference for the development of national indicators of sustainable development (van de Kerk & Manuel, 2010). In the period from 1996 to 1999, the first CSD indicators were tested in 22 countries. From 1999 to 2001, they were evaluated and revised, which subsequently resulted in the publication of the new edition of the *blue book* containing the reduced set of 58 indicators. The last version of the CSD indicators set was issued in 2007; it contains 50 basic indicators that are part of a larger set of 96 indicators of sustainable development, and all of the main themes that were adopted in 2001 were kept (Table 2.1). In this revised set, the is no longer a division of indicators into social, economic, ecological, and institutional categories, which emphasises the importance of the integration of sustainability pillars (United Nations, 2007).

In line with the United Nations Conference on Environment and Development, the Eurostat and the UN Commission on Sustainable Development (UNCSD) established the collaboration and, in 1997, published the European Union (EU) Sustainable Development Indicator (SDI) compilations. The main aim of the SDI, as defined by the EU Sustainable Development Strategy (SDS), is to improve the general wellbeing that would have an impact on improving the quality of life for present and future generations. The development of the EU indicators was guided by the goal of monitoring the progress regarding the challenges of sustainable development, and their scope included ten thematic sections that covered economic, social, environmental, global, and institutional issues. The latest version of these indicators is based on the document *Transformation of Our World: A Sustainable Development Agenda 2030* (United Nations, 2015) in which the objectives of the post-2015 development were processed. The newly-formed set of indicators is used to measure progress towards the Sustainable Development Goals (SDGs), which count 169 items and aim to stimulate action in the areas that are crucial for the planet and humanity over the next 15 years. They are foreseen as a universal set that will help the world to move towards sustainable development by putting the emphasis on poverty reduction, problems of inequality, and climate change issues (United Nations, 2015).

Another general set of indicators was proposed by the Organisation for Economic Co-operation and Development (OECD) in 2001. Their goal was to measure maintenance of current assets as well as the fulfilment of current needs. Although this set had its limitations because it was not designed to give a broader picture of social-ecological-environmental relations but was more focused on current trends and selected issues, it was easily understandable (Stevens, 2005). The subsequent development of the OECD indicators aimed to "assist decision-makers at all levels to adopt sound national sustainable development policies" (van de Kerk & Manuel, 2010, p. 23). The OECD updates its set of sustainable development indicators on annual basis. The latest outcome of the update – Green Growth Indicators – includes five groups of indicators that are: socioeconomic context and characteristics of

growth; environmental and reduced productivity of economy; natural asset base; environmental dimension of quality of life; and economic opportunities and policy responses (OECD, 2017). The OECD list of indicators is flexible and can be modified according to the needs of a specific country or the availability of new data.

INDICATORS SET / YEAR OF RELEASE / ORGANISATION	GOAL	SCOPE
CSD set / 1996 / UN Commission on Sustainable Development	To measure progress towards sustainable development	– Social – Economic – Environmental – Institutional
CSD set / 2007 / UN Commission on Sustainable Development	To measure sustainable development in its entirety, and by taking into account its multi-dimensional and integrated nature	– Poverty – Governance – Health – Education – Demographics – Natural hazards – Atmosphere – Land – Oceans, seas and coasts – Freshwater – Biodiversity – Economic development – Natural hazards – Global economic partnership – Consumption and production patterns
EU SDI set / 1997 / EUROSTAT	To monitor progress with regard to the challenges of sustainable development	– Socioeconomic development – Sustainable consumption and production – Social inclusion – Demographic changes – Public health – Climate change and energy – Sustainable transport – Natural resources – Global partnership – Good governance
EU SDG set/ 2015/ EUROSTAT	To monitor progress towards sustainable development goals at local, national, regional and global levels	– No poverty – Zero hunger – Good health and well-being – Quality education – Gender equality – Clean water and sanitation – Affordable and clean energy – Decent work and economic growth – Industry, innovation and infrastructure – Reduced inequalities – Sustainable cities and communities – Responsible consumption and production – Climate action – Life below water – Life on land – Peace, justice and strong institutions – Partnerships for the goals

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INDICATORS SET / YEAR OF RELEASE / ORGANISATION	GOAL	SCOPE
OECD set / 2001 / OECD Statistical Office	To measure maintenance of current assets and the satisfaction of current needs	*Resource indicators:* Are we maintaining our asset base? – Environmental assets (air quality, water resources, energy resources, biodiversity) – Economic assets (produced assets, R&D assets, financial assets) – Human capital (stock of human capital, investment in human capital, depreciation of human capital) *Outcome indicators:* Are we satisfying current needs? – Consumption – Income distribution health – Work status/employment – Education
Green Growth Indicators / 2017 / OECD Statistical Office	To monitor progress towards green growth	– Economic growth, productivity and competitiveness – Labour market, education and income – Carbon and energy productivity – Resource productivity – Multifactor productivity – Natural resource stock – Renewable stock – Non-renewable stock – Biodiversity and ecosystems – Environmental health and risks – Environmental services and amenities – Technology and innovation – Environmental goods and services – International financial flows – Prices and transfers – Regulations and management approaches – Training and skill development

TABLE 2.1 General sets of indicators of sustainable development

2.2 Particular (Composite) Indicators

Besides sets of general indicators, there are many other indicators intended for a specific domain of sustainable development, e.g., Ecological Footprint (EF), Living Planet Index (LPI), Environmental Sustainability Index (ESI), Sustainable Society Index (SSI), Happy Planet Index (HPI), Environmental Performance Index (EPI), Human Development Index (HDI) (Table 2.2), etc.

Following the publishing of the first set of the CSD indicators, William Rees and Mathis Wackernagel (1996) defined the **Ecological Footprint** (EF) with the purpose of indicating and quantifying changes that come with human ecological transformation, i.e. urbanisation (Rees & Wackernagel, 1996; Wackernagel & Yount, 1998), with the ultimate goal being the re-establishment of balance between man and nature. There was also an idea that the EF could become an important tool for developing biophysically-based ecological economics (Moffatt, 2000). But only few years after its emergence, the EF approach was criticised for its insufficient determination, lack of comprehensiveness and transparency (van den Bergh & Verbruggen, 1999), and later for its limitations within the policy context (Wiedmann & Barrett, 2010). Nevertheless, Ecological Footprint remains to this day an effective tool

for measuring how fast people and economies consume resources and generate waste compared to how fast nature can absorb that waste and generate new resources (Global Footprint Network, n.d.).

INDICATOR /YEAR OR RELEASE / ORGANISATION	GOAL	SCOPE
Ecological Footprint (EF) /1996/ Global Footprint Network	To indicate ecological changes caused by human demands	– Cropland – Grazing land – Forest – Fishing ground – Built-up land – Carbon
Living Planet Index (LPI) /1997/ WWF	To measure trends in biodiversity	– Terrestrial – Freshwater – Marine
Environmental Sustainability Index (ESI) /2000/ Columbia University and Yale University	To measure progress in achieving sustainable development	*Environmental Systems* (air quality, biodiversity, land, water quality and water quantity) *Reducing Environmental Stresses* (reducing air pollution, ecosystem stress, population pressure, waste & consumption pressures, water stress, and natural resource management) *Reducing Human Vulnerability* (environmental health, basic human sustenance, and exposure to natural disasters) *Social and Institutional Capacity* (environmental governance, eco-efficiency, private sector responsiveness, and science and technology) *Global Stewardship* (participation in international collaborative efforts, greenhouse gas emissions, and reducing trans boundary environmental pressures)
Environmental Performance Index (EPI) /2006/ Columbia University and Yale University	To show the current situation regarding national environmental protection	– *Environmental health* – Health impacts – Air quality – Water and sanitation – *Ecosystem Vitality* – Climate and Energy – Biodiversity and Habitat – Fisheries – Forests – Agriculture – Water Resources
Happy Planet Index (HPI) /2006/ New Economics Foundation	To measure what matters the most to the planet and human wellbeing	– Life satisfaction – Life expectancy – Inequality of outcomes – Footprint
Human Development Index (HDI) /2010/UN	Measure development of a country	– Life expectance – Education – Decent standard of living

TABLE 2.2 Some well-known indicators of sustainable development

The **Living Planet Index** (LPI) measures the changing state of the world's biodiversity over time (Loh et al., 2005, p. 295). This applicative indicator addresses causes, pressures, states, and benefits of biodiversity. It uses information from the **Living Planet Database** (LPD) that represents the most comprehensive collection of data of all populations that inhabit the planet. The relevance of the LPI is growing in line with the existing declining trend of population types (World Wide Fund for Nature, 2016).

The **Environmental Sustainability Index** (ESI) was presented for the first time in 2000, at the World Economic Forum in Davos, Switzerland. It was developed by researchers from the universities of Yale and Columbia (Siche, Agostinho, Ortega, & Romeiro, 2006) as a measurement tool for achieving environmental sustainability (Socioeconomic Data and Applications Center, n.d.). ESI represents a composite indicator, consisting of 21 separate indicators of environmental sustainability that allow for comparison of a range of issues classified into five categories: state of environmental system, both natural and managed; environmental management efforts on those systems; vulnerability of society, as well as the influence and response to changes in the environment; ability of society to deal with environmental stresses; and the contribution of a country to global stewardship (Esty, Levy, Srebotnjak, & de Sherbinin, 2005, p. 11).

Due to the identified needs for changes that would improve the efficiency of the ESI, the **Environmental Performance Index** (EPI) was developed in 2006 to evaluate the performance of countries in the fields of human health protection and the protection of ecosystems (Yale University, n.d.). ESI 2016 recognises environmental health and the vitality of the ecosystem as variables that are relevant for the development of related specific indicators (Table 2.2). While environmental health is about measuring the protection of human health from harmful environmental effects, the vitality of ecosystems measures ecosystem protection and resource management (Yale University, 2016).

The **Sustainability Society Index** (SSI) integrates human and environmental well-being, and above all, economic prosperity. During the development of the SSI, economic well-being was considered as a condition for achieving human and general environmental well-being. The index was released in 2006 by the **Sustainable Society Foundation** (SSF). Since then, SSI has been updated every two years (Sustainable Society Foundation, 2017). According to de Kerk and Manual (2008, p. 239), "the SSI offers a country a practical tool for defining targets on its way to sustainability and for monitoring the progress over time".

Another index presented in 2006, which was equally focused on the sense of well-being, was the **Happy Planet Index** (HPI). This index uses four elements (life satisfaction, life expectancy, inequality of outcomes, and ecological footprint) to best show human effectiveness that varies across countries. The HPI measures environmental efficiency and its positive impact on human life, its length, and happiness. It shows that, even though it is expected that wealthy countries are highly rated on the HPI scale, many other countries with much lower income are far ahead in achieving high life expectancy and well-being (New Economic Foundation, n.d.). Simultaneously, there have been many ambiguities about the HPI, predominantly regarding its understanding. Although it has been widely accepted that the Happy Planet Index measures personal happiness, it actually measures the 'happiness' of the planet. In other words, it deals with the well-being efficiency, i.e. the price of well-being as a function of how many resources are consumed (Heavy Lifting, 2006).

Finally, the **Human Developing Index** (HDI) puts emphasis on people and their abilities, stressing that precisely these factors should be the norm for evaluating the development of a country. The average achievement in the three key dimensions of human efficiency (having a long and healthy life, being knowledgeable, and having a decent standard of living) has been used to present a summary measure of the HDI. The limitations of this index concern simplification and partial caption of the notion of human development, and lack of reflection on inequalities, poverty, human security, empowerment, etc. (United Nations Development Programme, 2016).

3 Capital-Based Approach to Sustainable Development Measurement

The idea of viewing sustainable development from economic, social, and environmental angles came from John Elkington, who defined the so-called 'triple bottom line revolution' (Elkington, 1997). He considered the interconnectedness of these three spheres of human activity and concluded that it was not possible to achieve effective sustainability in a single sphere if it has not been simultaneously forced in other two domains. Many authors based their research on correlations between the three dimensions of sustainability, such that there are studies about socio-ecological relations (e.g., Azar, Holmberg, & Lindgren, 1996; Ostrom, 2009), socioeconomics (e.g., Hannum & Buchmann, 2005; Benhabib & Spiegel, 1994; Riahi, Grubler, & Nakićenović, 2007), as well as relations between the economic sphere and natural wealth (e.g., Constanza & Daly, 1992; Rennings & Wiggering, 1997).

In order to assess sustainability, it is necessary to establish a certain measurement system. This certainly puts the focus on the issue of selecting the values that can actually be measured, and in the most appropriate way. Taking into account the interrelations between the economic, environmental, and social aspects, various methods, systems, and measurement units have been developed, among them the capital-based approach.

In the report *Measuring sustainable development* of the joint UNECE/OECD/Eurostat Working Group on Statistics on Sustainable Development (WGSSD), the promotion of the capital-based approach has been associated with the understanding of "sustainable development as non-declining capita wealth over time" (United Nations, 2008, p. 5). In this document, four types of capital have been taken as the basis of a fundamental measurement of sustainability – economic, natural, human, and social capital.

Due to the complexity in defining economic wealth, economic capital has been divided into financial and produced capital. Financial capital means assets for which there are counterpart liabilities by another institution, such as "currency and other forms of bank deposits, stocks and bonds, derivatives, accounts receivable, pension funds and

insurance reserves" (United Nations, 2008, p. 48), while produced capital implies fixed assets, such as roads, buildings, machinery, harbours, and airports (as tangible ones), and specialised knowledge, original works of artistic value, computer software, etc. as intangible assets (United Nations, 2008).

The earth's natural resources represent the natural capital, both renewable (forests, water, sun, etc.) and non-renewable (land, coal, oil, gas, etc.).

"Human capital means knowledge, skills, competencies and attributes of individuals that contribute to the creation of personal, social and economic well-being" (United Nations, 2008, p. 51). Human capital can be created through the process of consumption, as well as through investment. Social capital, as a relatively new type of capital, puts the focus on "identifying the positive elements of society to be conserved and further developed" (United Nations, 2008, p. 52). Many theoretical approaches to defining social capital are based on the distribution of basic goods, social peace and its maintenance, the protection of society and constitutional goals, and networks and related norms. Although it is hard to determine the exact measure of the contribution of these types of capital in the context of human well-being, no doubt they all aim to improve that state, which is, according to many researchers, the basis of sustainable development. In addition, various approaches to measuring well-being, both individual and collective, have emerged as guidelines for national sustainable development (House of Commons – Environmental Audit Committee, 2012).

In the early stage of the development of indicators, it was very difficult to set the measurement units in which economic, natural, human, and social capitals should be presented. For example, for the capital stocks it seemed that the best option was the monetary measurement, but it was very hard to determine all the positive effects that money has on well-being; even for those contributions that can be registered, their value can be hardly presented in currency. This is especially emphasised for social, human, and natural capital, because their contribution rarely takes place outside the market place. Besides the fact that monetary indicators are an inseparable part of any set of indicators of sustainable development based on capital, physical indicators are seen as necessary when it comes to measuring non-market well-being. Therefore, the UN has made a specific system for economic capital, known as the System of National Accounts (SNA) that represents "a measurement framework for capital-based indicators of sustainable development" (United Nations, 2008. p. 68). Additionally, a set of indicators and a relevant framework has been made for natural capital (the System of Integrated Environment and Economic Accounts). The least attention has been given to social capital, due to its complexity, despite which, however, its indicators are in the regular process of defining and developing. Summa samarium, the capital-based approach requires a measurement framework, both for market place and non-market place, which has led to the basic division of measures into monetary (e.g., real *per capita* economic wealth, real *per capita* genuine economic

savings) and physical ones (e.g., temperature deviations from normal temperatures, greenhouse gas emissions) (United Nations, 2008).

If the measure of the current level of sustainability is important, anticipating future possible outcomes is crucial for sustainable development. In this regard, numerous studies have led to the definition of various indicator sets for all four capital sectors by different organisations such as Eurostat, OECD, CSD. All of these indicators are interconnected, so the well-being benefits cannot be imagined without the decreasing unemployment rates or proper economic planning, and these parameters of development influence the natural capital and vice versa. The indicators are actually seen as main road signs for guiding policy-makers toward sustainable development, in order to enable them to make the integration of four fundamental capitals: environmental, economic, social, and human. Furthermore, "the success of sustainable development programs is determined by their ability to achieve the highest attainable increase in living standards measured against the least possible environmental degradation" (McKenzie, 2004, p. 13).

4 Indicators of Urban Sustainability

Different studies refer to the following domains of key interactions in urban environment: economic, health-related, socio-cultural, environmental (Pakzad, Osmond, & Corkery, 2017; van Kamp, Leidelmeijer, Marsman, & Hollander, 2003), and institutional and governance (Yigitcanlar & Dur, 2010; European Commission, 2015). All these domains mutually depend upon and influence each other, and the complexity of their ties and their effects that extend beyond the city boundaries (especially in the environmental segment), together with the continuous evolution and transformation of the overall urban environment, make the definition of urban sustainability an intricate task.

Urban sustainability relates to "the ability to improve the local quality of life (Human Development Index) whilst remaining below the environmental carrying capacity (environmental footprint)" (Gibberd, 2015, p.49). As a preferred direction of future urban development, sustainable urbanisation actually represents complex system engineering (Zhou, Shen, Song, & Zhang, 2015) that refers to the optimised combination of a broad range of measures aimed at enhancing the quality of environment, economic efficiency, and human well-being (Ali-Toudert & Ji, 2017). Whereas the individual buildings, and infrastructural objects and networks, when observed in isolation from urban systems, act as generators of significant negative environmental impact, their function in systemic considerations is linked to the provision of positive services affecting sustainability, which opens further questions regarding contradictory urban- and building-level sustainability assessments (Kallaos, 2010).

INDICATOR / TOOLKIT	ORGANISATION	GOAL	SCOPE
Urban Ecosystem Europe (2007)	International Council for Local Environmental Initiatives (ICLEI)	– To measure strength and weaknesses of cities in sustainable context	– Local action for health – Natural common goods – Responsible consumption and lifestyle – Planning better mobility and less traffic – Energy and climate change – Local management towards sustainability
Urban Metabolism Framework (2007)	European Environmental Agency	– To model complex urban flows (energy, water, food, people etc.)	– Energy and climate – Water – Waste – Land-use
European Green City Index (2009)	Economist Intelligence Unit	– To measure environmental performance through 30 indicators	– Energy – Buildings – $_{c}$O2 emissions – Transport – Water – Waste and land use – Air quality – Environmental governance
European Green Capital Award (2014)	European Commission	– To guide European environment policy	– Climate change and energy performance – Sustainable urban mobility – Nature, biodiversity and land use – Air quality and noise – Waste and circular economy – Water
City Blueprint (2015)	Waternet Amsterdam	– To define city's challenges and how can they be overcome through sustainability	– Trends and pressures framework – City Blueprint performance framework – Governance capacity framework

TABLE 4.1 An overview of some indicator sets used in Europe

"The biggest advantage of an indicator-based comparative urban sustainability assessment model is the quantifiability of the comparative sustainability levels" (Yigitcanlar & Dur, 2010, p. 323). The role of indicators for urban sustainability is complementary to the role of indicators of overall sustainable development. A literature review reveals that the indicators of urban sustainability and the criteria to which they belong are approached with different methodologies. Munier's method for setting down the urban sustainability criteria is based on the concept of entropy and programming that emphasises finding and measuring of "those aspects of society, economy and technology that make up the sources of pressure on the environment" (Munier, 2011, p. 1021). To select the indicators of urban sustainability, Zhou et al. (2015) proposed the four stages of the responsibility-based method: identifying strategic goals, defining responsive actions, identifying responsibility departments and, in the end, selecting the indicators. According to Cook, Saviolidis, Daviosdottir, Johannsdottir, and Olafsson (2017, p. 463) the optimal methodology for determining indicators has five stages, including the "setting of appropriate policy or trend-based targets given the nation-specific context". At the same time, the researchers emphasise the importance of stakeholders' participation and interaction with them in efficient identification and selection of relevant indicators that would be used later in making

adequate policies and monitoring the progress (Zhou et al., 2015; Tran, 2016; Mascarenhas, Nunes, & Ramos, 2015).

There have been a considerable number of sets of urban sustainability indicators developed worldwide, and some of those used in Europe are presented in Table 4.1. The application of a particular set depends on many factors, especially in terms of identified challenges and set goals.

Urban Ecosystem Europe
Urban Ecosystem Europe is a set of 25 sustainability indicators for integrated assessment of European urban environments within the following main themes: local action for health, natural common goods, responsible consumption and lifestyle, planning better mobility and less traffic, energy and climate change, and local management towards sustainability (European Union, 2014). Some indicators that are included in the assessment system are: particulate matter concentration (PM_{10}), nitrogen dioxide concentration (NO_2), ozone concentration, people exposed to noise pollutions, re-use of rain water, domestic water consumption, waste disposal, low emission public transport, pedestrian areas, public green areas, passengers travelling on public transport, energy consumption of public buildings, etc. By comparing results obtained by using these indicators, every city can define its profile and potential targets for future (Bono, n.d.).

Urban Metabolism Framework
Urban Metabolism Framework is a specific method that treats the urban environment as an ecosystem and intends to foster its orientation towards sustainability. The main idea is to (re)model a city by defining the urban flows of energy, water, waste, people, etc. The method can be used for an analysis of interaction between human activities and the built environment on the one hand, and the natural environment on the other hand (Research Group of the Department of Urbanism – Delft University of Technology, 2007). The Urban Metabolism Framework consists of four main thematic parts, each with a range of corresponding indicators:

- energy (CO_2 intensity of production, transportation, and residential users; carbon footprint, energy efficiency of production, transportation, and residential use; renewable energy production; energy footprint);
- water (territorial water extractions; groundwater levels; water scarcity; water use efficiency; waste water treatment; water quality extraction; water quality release; water footprint);
- waste (waste intensity of production; residential waste intensity; waste recycling; waste incineration; and landfill);
- land-use (soil sealing; land footprint) (Minx, Creutzig, Medinger, Owen, & Baiocchi, 2011).

European Green City Index

European Green City Index measures sustainability level through the following eight domains: energy, buildings, CO_2 emissions, transport, water, waste and land use, air quality, and environmental governance. Water consumption, waste management, environmental governance, and greenhouse gas emissions are just a few of more than 30 indicators from all eight areas that are defined as ranking parameters. This index also emphasises the role of financial funds and wealth in sustainable development strategies, since richer cities have more ambitious policies and goals (Economist Intelligence Unit, 2009). To date, the European Green City Index has been used to quantify and compare the environmental performance of almost every European capital.

European Green Capital Award

European Green Capital Award is recognised as one of the main guiding European policies and action programmes towards sustainability. It emphasises the importance of natural capital, the safety of its citizens, and benefits of moving towards a low-carbon economy. The main principles for achieving these goals are: better implementation of legislation, better information, and investments and protection of the environment and integration of its requirements (European Commission, 2015). The Green Capital Award is given to a city if it fulfils the requirements regarding each of the following 12 environmental indicators that are defined as measurement parameters: climate change – mitigation and adaptation, sustainable urban mobility, sustainable land use, nature and biodiversity, air quality, noise, waste, water, green growth and eco-innovation, energy performance, and governance (European Commission, 2017).

City Blueprint

City Blueprint is diagnostic tool that helps cities to define their sustainable development challenges through seven categories: water quality, solid waste treatment, basic water services, wastewater treatment, infrastructure, climate robustness, and governance. This ranking set includes more than 20 indicators such as water efficiency measurements, climate robust buildings, green space, energy efficiency, drinking water quality, solid waste recovery etc. This indicator also gives climate adaptation options, if they will severely influence the city in the future. Up to now, this diagnostic has been applied to nine cities, of which four are in Europe (Rotterdam, Amsterdam, Hamburg, Istanbul) (van Leeuwen, Frijns, Wezel, & van de Ven, 2012; van Leeuwen & Koop, 2015).

All of the indicator sets presented above aim to assess the sustainability of urban areas by observing them as a whole. They define suitable parameters and explore the values in the interconnection between the built and natural environments. Next to the described methods, a range of assessment models have been developed to assist urban planners and designers, and local decision-makers, e.g., Sustainable Infrastructure, Land-use, Environment and Transport Model (SILENT), Built Environment Sustainability and Quality of Life (BESQoL), LEED for Neighbourhood Development, CASBEE for Urban Development, etc.

5 Discussion and Conclusions

5.1 Current Framework of the Indicators of Sustainable Development

Following the review of different proposed indicators of sustainable development, their development paths and ongoing discussions in the field, the most relevant current indicators of sustainable development are summed up in Fig. 5.1.

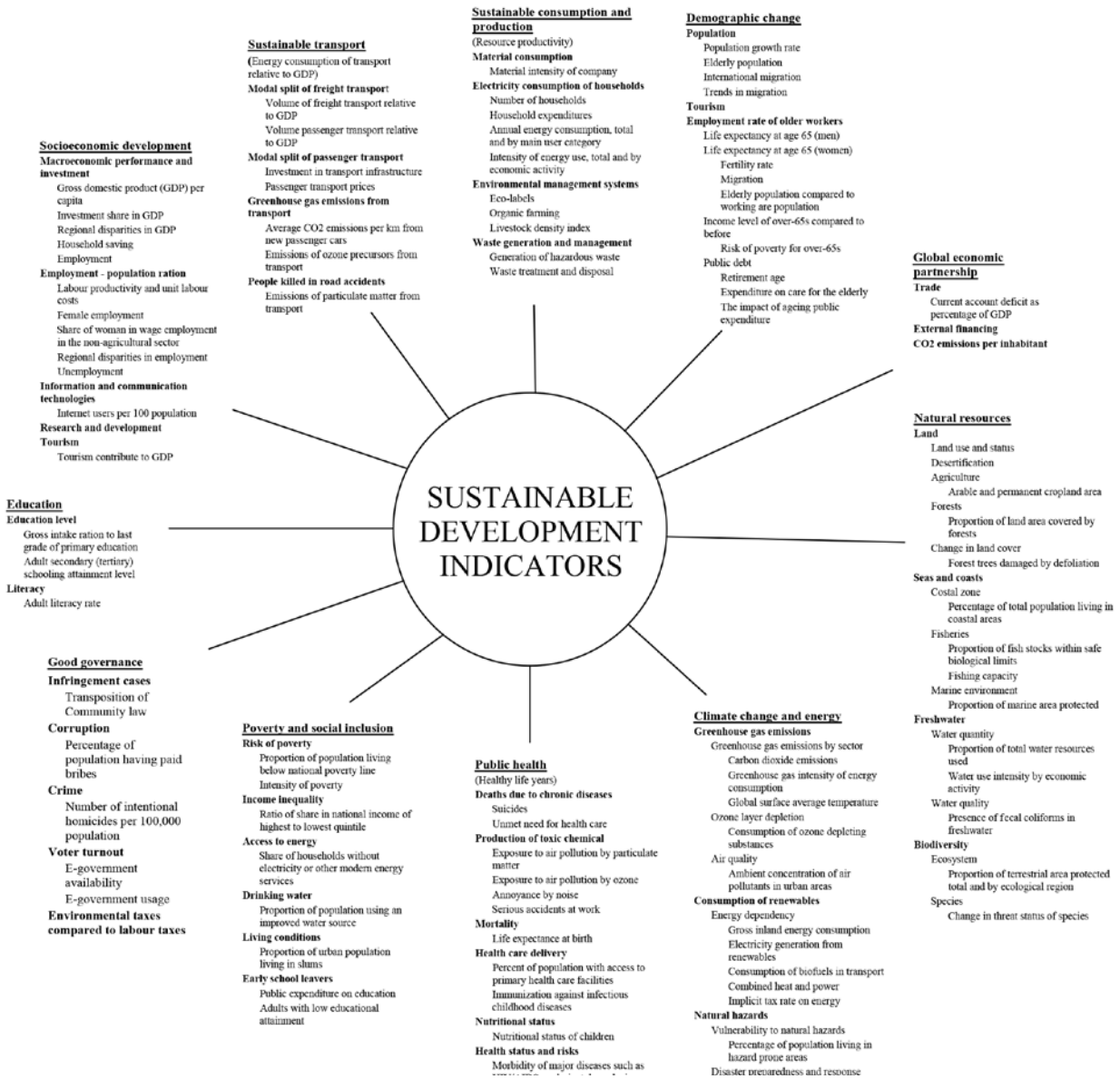

FIG. 5.1 Current framework of the indicators of sustainable development

The presented set consists of 11 groups of indicators: socioeconomic development; poverty and social inclusion; public health; climate change and energy; natural resources; sustainable transport; demographic changes; sustainable consumption and production; good governance; education; and global economic partnership. All of the listed indicators have a particular role in creating a realistic view of the current situation, on the basis of which all the future decisions and actions in relation to sustainable development should be defined. However, at the same time, none of these indicators is independent, and each one influences a number of others to a greater or lesser extent.

Parameters that define **socioeconomic development** such as macro-economic performances and investments, employment, information and communication technologies, research and development, and tourism, must be analysed and adequately measured in order to see possibilities for a given society's future sustainable progress. It is also important to record all of the weaknesses that aggravate the development of society, and to eliminate them if possible. Together with education, socioeconomic development is the driver of general progress. As such, it also affects indicators like **poverty and social inclusion**, which take into account the risk of poverty; income inequality; access to energy; drinking water; living conditions; and early school leavers as relevant indices. When it comes to **public health**, i.e. healthy life years, the deaths due to chronic diseases, production of toxic chemicals, mortality, health care delivery, nutritional status, and health status and risks are seen as the most appropriate measurable values. **Climate change and energy**, as one of the main challenges for developing indicators, consists of three main parts: greenhouse gas emission; consumption of renewables, and natural hazards, which are further divided into: greenhouse gas emissions by sectors (carbon dioxide and greenhouse gas emissions, global surface average temperature); ozone layer depletion (consumption of ozone depleting substances); air quality (air pollutants concentration in urban areas); energy dependency (gross inland energy consumption, generated electricity from renewables, consumptions of biofuels, combined heat and power, implicit tax rate on energy); and, when it comes to natural hazards, vulnerability (percentage of population living in hazard prone areas), disaster preparedness and response are recognised as their indicators. The indicators for **natural resources** imply land (use and status, desertification, agriculture, forests, changes of the cover), seas and coasts (coastal zone, fisheries, marine environment), freshwater (water quantity and quality), and biodiversity (ecosystem and species). **Sustainable transport** or energy consumption of transport relative to GDP relate to reducing: modal split of freight transport; modal split of passenger transport; greenhouse gas emissions from transport; and people with fatal outcomes in road accidents. **Demographic changes** include population variables, tourism trend and employment rates of older workers, while **sustainable consumption and production**, i.e. resource productivity implies material consumption, electricity consumption of household, environmental management systems, and waste generation and management. Infringement cases, corruption, crime, voter turnout, and environmental taxes compared to labour taxes

belong to the **good governance** group of indicators. **Education** considers education level and literacy. Finally, the **global economic partnership** group consists of trade (current account deficit as a percentage of GDP); external financing; and CO_2 emissions per inhabitant.

5.2 The Challenges of Sustainability Indicators

The definition of an indicator is an intricate task. Any effective indicator must have "the capacity to simplify, quantify, analyse, and communicate otherwise complex and complicated information, and the ability to make particular aspects of a complex situation stand out and thereby reduce the level of uncertainty in the formulation of strategies, decisions or actions" (Warhurst, 2002, p 10). In relation to this, the formulation of indicators of sustainable development was recognised as a challenge for two main reasons – the definition of sustainable development and the lack of a common basis for the establishment of indicators, for which reasons, especially in the early analyses of sustainable development, different indicators were used to assess the same items, which further led to the obtainment of different results and disabled the comparison.

In order to enable a more efficient approach to achieving sustainability and defining the indicators, several principles and recommendations have been defined by the United Nations (2011) such as:

- indicators should be harmonised;
- framework should be developed gradually;
- existing data should be reused;
- the capital approach is essential for making a good indicator set;
- the producer and the consumer are equally important;
- collaboration and communication with stakeholders is crucial;
- indicators should be scientifically based;
- a strict system of rules should be developed; and
- timelines should be objective.

Even though a mutual harmonisation is one of the first principles in the process of defining indicators, it is necessary to emphasise that every set of relevant indicators, as well as the accompanying strategies, action plans, and defence mechanisms, should be accustomed to the regional and local levels in order to gain the best possible results.

Climate change has a major impact on all three spheres of sustainable development - economic, social, and natural (European Union, 2015). As such, it also influences the definition of the indicators of sustainable development, either directly or indirectly. An inability to stop climate change has been reflected in the necessity to formulate both adaptive and mitigation-related measures in all relevant strategies (Milovanović, 2015), by considering the complexity of the climate system and addressing uncertainty in the most effective way (Milovanović, Kurtović-Folić, & Lekić, 2017). There are two main ways of embedding climate change into sustainable development: by targeting climate change mitigation

(energy issues) and by defining the inclusion of climate change manifestations into future sustainable development goals, strategies etc.

In addition to ubiquitous climate change, education is the next challenge to be addressed in order to reduce the negative impact caused by human habits that are incompatible with sustainable development. Particular challenges for defining the indicators in this domain are human resources and the coordination of education-related measures.

In a metaphorical sphere of studying the natural environment, the challenge regarding the definition of indicators emerges due to the lack of strict and clear scientific rules by which the measurement parameters would be created (Neumayer, 2003b).

As is the case for general sustainable development, the definition, selection, and application of the indicators of urban sustainability are all complex. To face current challenges successfully and to enhance the use of the indicators of sustainable development, it is necessary to establish a standardised legal basis, allow open access to standardised and comparable data (Klopp & Petretta, 2017), and address both regional and local variations and specificities regarding sustainable development more profoundly.

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Towards Climate Proof Cities _

Innovative Tools and Policies for Territorial Government

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ABSTRACT **Climate change is one of the most relevant issues (both political and scientific) of the twenty-first century. If every crisis has brought to light new issues, new research paths, and sometimes even new solutions, then the challenges posed by climate change offer the opportunity for spatial planning to come back and reclaim its social usefulness to solve problems by redefining objectives, fields of investigation, and methodologies.**
The purpose of the chapter is to add a further element in this field of research by reconstructing the state-of-the-art scientific research and finding the limitations and potentialities of initiatives undertaken to date, as well as to synthesise a methodological and practical proposal in order to offer to public administration and local authorities a 'practical way' to make local climate policies and plans more effective. It therefore proposes an investigation process that moves away from the urgency and need to address some initial questions: what does planning or designing low carbon or climate-proof cities and territories mean? What are the obstacles to developing this kind of planning process? What are the governance implications on a local and transnational level, and what is the relationship between these two levels?
Moving from a theoretical dimension to a more practical one involves different areas of public administration, and means developing innovative processes for the re-designing of instruments, priorities, actors, and organisational structures, thus leading to a new governance paradigm for cities and territories. This paradigm represents a new model to address the challenges of climate change towards climate proof cities.

KEYWORDS climate change, planning tools, governance, climate policies

1 Introduction

The Larsen B ice shelf collapse in Antarctica and the possible disappearance of the Kiribati islands due to sea-level rise are both dramatic examples of the negative externalities that global society will have to deal with in the future.

While these events might look unrelated from a local perspective, thus making the future seem less pessimistic, analysing the problem and its impact from a global perspective reveals dramatic scenarios. International organisations like the World Bank, the Intergovernmental Panel on Climate Change (IPCC), the Organisation for Economic Co-operation and Development (OECD), the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP), highlight that the impact of extreme rainfalls and drought that occurred in the last 50-100 years could be disastrous for some areas of the planet, forcing millions of people to migrate. Cities will bear the highest cost in terms of economic and human loss (Biesbroek, Swart & van der Knaap, 2009; Bulkeley & Betsill, 2005; Van der Veen, Spaans, Putters, & Janssen-Jansen, 2010).

As most of the dramatic events that occurred over the last few years demonstrate - from New Orleans to New York, passing by Genoa and Hamburg - the consequences of bad urban settlement choices, made without taking due consideration of risk factors, are being paid for by the cities, and these damages are inevitably bound to increase in a scenario of global temperature rise (IPCC, 2014; Swart & Raes, 2007; Un-Habitat, 2011a, 2011b). Being primarily artificial settings, cities are characterised by low resilience and a low capability to react or adapt to sudden changes.

This aspect makes all levels of the administration aware of the unseen consequences that have been produced, and continue to be produced, by anthropic activities, population increase, and urbanisation, to the detriment of natural resources and the atmosphere.

For some time, scientists and climate experts have agreed upon the necessity to react, not only as an emergency response, but also as preventive adaptation towards a climate that has already changed, and continues to do so. This means maintaining ongoing actions for the reduction of greenhouse gases in the atmosphere, decreasing and eradicating fossil fuel consumption and, in the meantime, preparing cities and territories to face a changed climate scenario (Bulkeley & Betsill, 2005; Musco, 2008, 2010; Musco & Magni, 2014). Analysing the impacts of extreme weather phenomena (cyclones, storms, heat waves, etc.) and downscaling to a local level have therefore become essential fields of research for those dealing with city planning and urban politics.

The aim of the chapter is to add a further piece to this field of investigation. The objective is, firstly, to reconstruct a state-of-the-art discipline regarding the relationship between climate change issues and spatial planning, and to identify theoretical and cultural prerequisites,

directions, and modalities that have emerged in the disciplinary debate. Research also aims to provide some examples focused on territorial governance processes that face climate issues in a proactive way, that is, by considering safety and development needs as opportunities to start climate proofing processes. New York, Stockholm, Copenhagen, Barcelona, Seattle, and, again, Rotterdam, London, Bologna, Padua, are just a few of the cities that, with increasing coherence, have shaped their policies towards climate innovation by integrating mitigation and adaptation targets.

With these best practices in mind, this chapter identifies a methodology to effectively configure regional and local strategies towards the reduction of greenhouse gas emissions and the adaptation to climate events. The necessity of moving from a theoretical to an operational dimension involves the public administrations in different areas. Moreover, it requires innovation within the processes of tool designing, priority identification, and stakeholder involvement, which will lead to a new paradigm of city and territorial governance. This paradigm represents a new model for facing and managing climate change challenges, moving towards a climate proof city.

2 Planning and Climate Change: Between Consolidated Certainties and Innovation

The increasing impact of extreme weather phenomena on different areas of the planet over the past few years has brought climate change to the attention of the scientific community, especially considering the empirical evidence of actual and potential future damages. Up until now, the issue of adapting to climate change has been addressed by national and international research, through the analysis of phenomena already underway (UNFCCC, 2011; UNISDR, 2010) – from deforestation and desertification to the melting of polar ice and mountain glaciers; from the rise in sea level affecting the most vulnerable coasts, to the possible damage caused to tourist activities, farming, water resources, and public health.

Since the highest social costs of global warming are registered in cities, large urban areas, and territorial systems (Folke et al., 2011), these are gaining importance within the research on spatial planning, highlighting the need for increased attention to be placed on adaptation strategies.

Urban areas are mostly artificial settings characterised by low resilience, so their adaptation capacity is related to a punctual action, in many cases still consisting of engineering systems and hard infrastructures (Solecki, Leichenko, & O'Brien, 2011). This aspect has become important for urban planning, which entails complex analyses, phenomenon assessment and interpretation, citizen education and involvement, target and action selection, and coordination on different institutional levels (MATTM, 2014). In such a rapidly-changing scenario, architecture, urban planning, and policies must transform deeply and

define new priorities and targets. These targets include contributing to greenhouse gas reduction, the requalification of public areas, cities and transport infrastructures, and the reduction of energy consumption and related climate-altering emissions (mitigation actions). Today, urban projects should respond to the demand of climate safety with increasing urgency, not only through emergency management, but also through new *ex ante* and structural mitigation and adaptation strategies.

To make urban planning useful for mitigation and adaptation targets, it is therefore necessary to revise knowledge at the root, and carry out a substantial renovation of planning systems at all levels (Biesbroek, Swart, & van der Knaap, 2009). The increasing attention to these processes has not yet led to adequate political responses: it is clear, now more than ever, that 'climate protection' is still rather diverse – there are cases in which adaptation plans and strategies have been introduced, versus cases in which risks and impacts are still being underestimated despite the relevance of the actual phenomena. The main reasons can be found in the lack of a public and shared awareness on climate variability and its territorial repercussions, in the slow response to climate disasters due to the lack of skill, public resources and policies, and urban and territorial planning regulations for climate change management. (Musco & Magni, 2014).

The achievement of climate-proof cities and territories will be an inevitable field of action and research over the next few years, and everyone will have to identify the most adequate measures to accomplish a few essential targets. This comprises, firstly, of the protection of the population, infrastructures, and economic systems. Moreover, it is fundamental that local contexts (counties and cities in particular) rethink and redefine their administration instruments to adapt their territory to new scenarios thus becoming safer, more resilient, and attractive.

2.1 Between Decarbonising and Climate Proofing: The Role of Spatial Planning

Despite considerable uncertainties, it seems clear that the knowledge about the causes and impacts of climate change has significantly improved. It is now recognised that the spatial configuration of cities, and the way in which the soil is used, have significant implications both on the adaptation to climate change, and on the reduction of the emissions that cause the change in the first place (Agrawala & Fankhauser, 2008; Jha, Miner, & Stanton-Geddes, 2013; UNDP, 2010). The various types of settlement, their impact on natural resources, and their related emission levels are all influenced by many complex factors such as available technologies, buildings typologies, investment strategies of public and private institutions, public policies (relating mainly to housing, transport and environmental systems), institutional traditions, social regulations, culture, and the behaviour of each individual. Territorial planning interventions, therefore, become a decisive factor when shaping sustainable settlements and considering

site-specific actions and interventions, based on 'critical thinking on spaces and places' (RTPI, 2003). In actual fact, the recognition of the complexity, uncertainty, and irreversibility of climate by climate sciences is changing the nature and overview of territorial planning, favouring the leading role of mitigation and adaptation actions within urban systems (Solecki et al., 2011).

Developing climate-proof solutions within urban and territorial planning doesn't mean decreasing the risk of sudden and variable climate phenomena to zero. The idea behind the concept of climate-proof planning is to reduce possible risks to a quantifiable level acceptable for society and, above all, for the economic system (Baltzar, Varbova, & Zhechkov, 2009). Risk reduction is promoted by the integrated and combined use of infrastructures, and management and planning measures, which can include 'adaptation portfolios', insurance packages focused on local impacts, alert and evacuation systems as well as pre-consolidated civil protection capabilities (Desouza & Flanery, 2013; Rosenzweig et al., 2015). Civil protection approaches themselves need a deep revision to guarantee that 'protective' actions are effective not only after calamitous events, but are actually integrated *ex ante* in planning and designing (Musco, 2014).

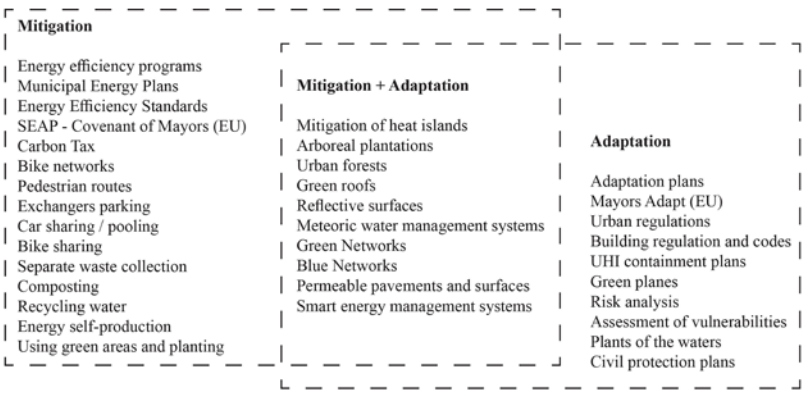

FIG. 2.1 Integration between mitigation and adaptation measures on an urban scale *(Image by Musco, 2012)*

Bearing this in mind, the protection of urban systems from extreme climate variabilities means safeguarding the population and realising that the frequency and intensity of natural dangers will increase, or have already increased. For example, heat waves and extreme droughts were, up to now, considered secondary or only partly relevant events (EC, 2013), but they may happen with more frequency in the future, meaning that the actions to be undertaken as part of planning processes must be evaluated according to the spatial dimension of the events and their geographical distribution (UFPP, 2009). The search for decarbonised and climate-proof urban planning should be considered as an opportunity of technological and institutional innovation for society as a whole, rather than being purely moved by the fear of the negative effects of climate change. Admittedly, the transposition of these objectives into policies and ordinary territorial management processes is not always so smooth (save in specific trials) (Biesbroek, Swart & Capela Lourenco, 2014; Bulkeley & Betsill, 2005; Musco, 2008, 2010; Musco & Magni, 2014).

The reduction of emissions and adaptation targets are complementary in many situations (Fig. 2.1), but they may also be in conflict.

Climate proofing (verb): Waterproof, weatherproof.
Proof (adjective): proof, safe from, anti-. – Includes methods, tools and procedures to ensure that plans, programs and strategies are available for the adverse effects of climate change (Olhoff & Schaer, 2009) – For urban development is a methodological approach aimed at integrating climate change issues into development planning. (Fröde & Hahn, 2010). – A process to ensure that climate change risks are reduced to acceptable levels through lasting, environmentally-friendly, economically and socially acceptable sustainable change (Baltzar, Varbova, & Zhechkov, 2009) – The set of activities aimed at ensuring the sustainability of investments throughout their lives, while explicitly taking into account a changing climate (EC Green Paper, 2007)
Climate proof cities: cities that have adopted strategies, processes, measures and spatial devices to accommodate the risks arising from the impacts of climate change (adaptation measures to climate change). (EC Green Paper, 2013)

TABLE 2.1 What is meant by Climate Proof?

3 City, Climate and Urban Policies

On a global perspective, state-of-the-art climate change issues, and climate protection planning in particular, are tackled in a very diverse manner.

An overall reading of European policies about mitigation and adaptation to climate change (Fig. 3.1) reveals an uneven perspective, characterised by very different institutional systems and cultural-territorial features (Musco & Magni, 2014; Wilson & Piper, 2010). Each country has its own national orientation (mitigation and/or adaptation plans and strategies, if any) and local initiatives such as climate planning, tools or local organisation networks.

The condition of the latter varies considerably case by case, and only a few local organisations have introduced integrated strategies of adaptation, mitigation, and energy efficiency into the existing territorial planning system (Musco & Patassini, 2012). Although effects are recurrent to a specific area, every urban context is subject to different ones depending on different combinations of climate change exposure and specific dimensional, localisation, social, and productive features (which can be more or less sensitive to climate change). Downscaling forecast and climate analyses is key (current climate models mainly work on a larger scale and therefore provide inadequate indications for planning on a local scale). However, in order to understand local impacts and vulnerabilities, climate resiliency studies are fundamental support tools to identify strategies, priorities, and action plans suitable for the actual needs of every settlement (Ombuen & Filpa, 2014). Even though scientific overviews (Andonova, Betsill & Bulkeley, 2009; Biesbroek et al., 2009, Biesbroek et al., 2014; Bulkeley & Betsill, 2005; van Staden & Musco, 2010) and international reports (EEA, 2012b, 2013; IPCC

2007, 2013) consider territorial planning an essential paradigm to face both climate change causes and consequences, its transposition into policy and ordinary territory management processes is not always so straightforward (Musco & Magni, 2014; Musco & Patassini, 2012). In Italy, just like in other European countries, some aspects concerning the realisation of a better urban energy output and 'climate protection' policies, albeit more rarely, have gradually started to be introduced into the regulation systems (urban plans and building codes). But results still remain very restricted or based on voluntary experiences, and are definitely not in line with expectations on the reduction of energy consumption and greenhouse gases.

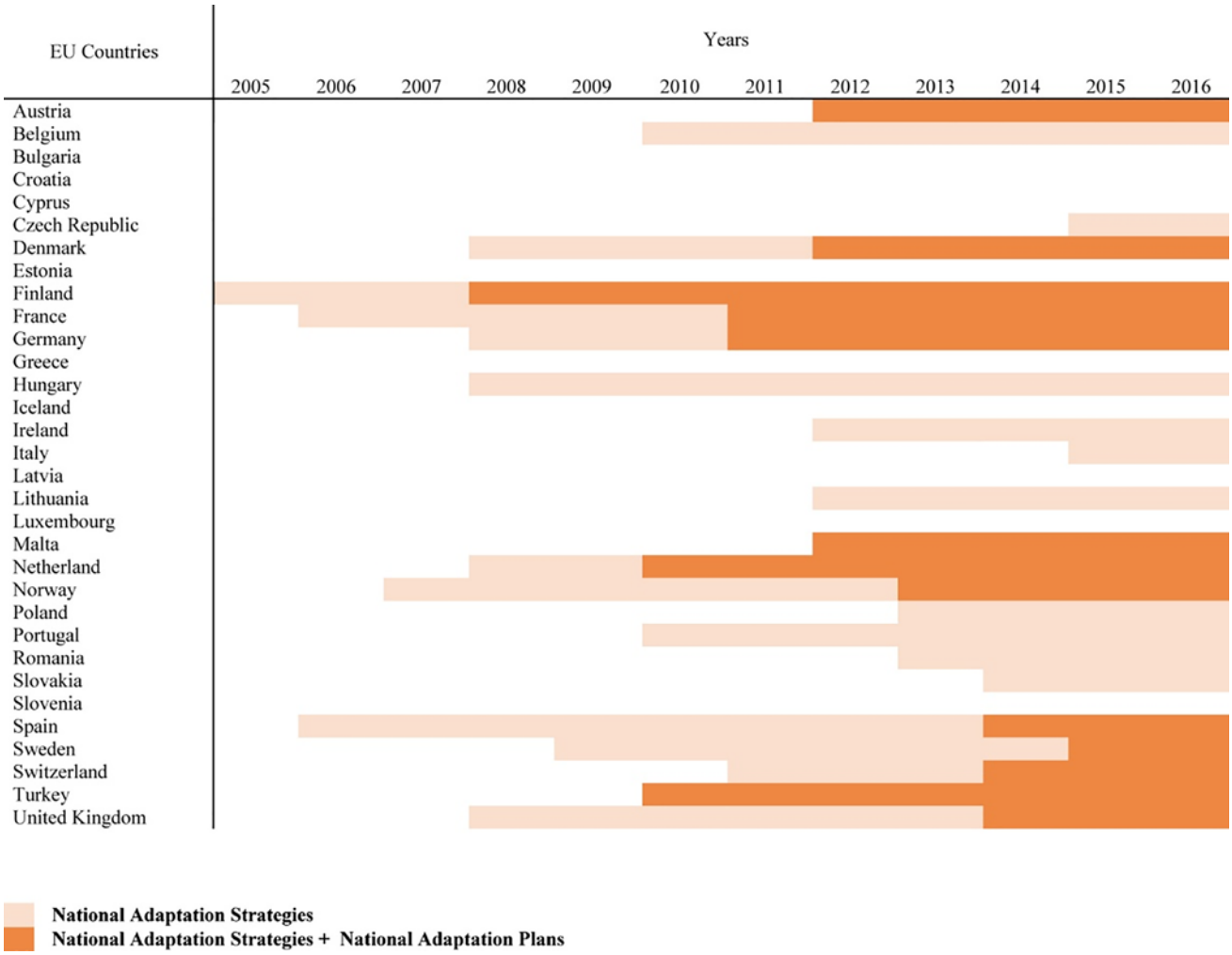

FIG. 3.1 Overview of national and sectorial adaptation strategies and plans in Europe

Even if the actualisation of policies and action plans varies according to national background and urban governance methods, an increasing quantity of experiences, programmes, and projects now directly connect local environments to the European community, possibly leading to new networks (e.g. the Covenant of Mayors; Italian network of Agenda 21) or supporting pre-consolidated associations on an international level (ICLEI - Local Governments for Sustainability; C40 Cities Climate Leadership Group; The Clinton Foundation; 100 Resilient Cities; etc.).

Based on these premises, local, regional, and sometimes national authorities have begun to define, often on an experimental basis, a series of plans and policies aimed at climate protection, which have assumed different names depending on the type and level on which they were implemented (Musco & Patassini, 2012). Regardless of the different denominations, differences in content are not substantial (van Staden & Musco, 2010) though there are different levels of attention given to mitigation and adaptation: climate strategy plans, national mitigation/adaptation strategies, sustainable energy action plans, climate action/protection plans, and climate mitigation plans. These are just few of the tools and strategies developed on a European and international level with the aim of introducing climate protection into territorial planning both on large and local scales. Generally speaking, the problem shared by all these initiatives is the fact that climate plans have quite an uneven structure, in terms of both definition and content (Musco & Magni, 2014).

Therefore, how can a correct climate plan that is actually focused on city and territory be defined? How can climate issues be integrated into ordinary territorial management tools? How can mitigation and adaptation be combined?

3.1 The City is Changing Climate: What is the Role of Local Authorities?

The relevance of local action in promoting and guaranteeing sustainable development on a global level was highlighted for the first time in 1987 by the Brundtland Report, and later, more firmly reiterated at the United Nations Conference on Environment in Rio de Janeiro in 1992 (and reiterated on its 20th anniversary in June 2012 at the Rio+20 Conference). On that occasion, the Rio Declaration launched the Agenda 21 process (UNCED, 1992), which was then spread all over the world for more than two decades, thanks also to the affirmation of a new political trend in which multi-level governance replaced the traditional top-down approach. The Agenda 21 process crystallised during the decade of 2000-2010, moving from a pioneering spirit to a more holistic vision, according to which actions against climate change that preserve biodiversity, activate adaptation policies, etc. are essential to achieve sustainable development (Davoudi, Crawford, & Mehmood, 2009).

The sustainability concept itself, which was originally based on three pillars - economic, social, and environmental (Murphy, 2012) – grew to include the same key themes of Rio+20: green economy, mainstreaming, and a new institutional framework with multi-level governance (Andonova & Hoffmann, 2012).

Local authorities were fully recognised as the main actors in the fight against climate change in 2007 with the Climate Roadmap, again in 2009 with the Covenant of Mayors and, above all, in 2011 with the commitments undertaken in the Global Cities Covenant on Climate - the Mexico City Pact 2011 and the Bonn Declaration of Mayors (ICLEI,

2013). They recognised that local administrations play a strategic role in tackling climate change due to their role in the development of plans and regulations, which can influence processes and innovative solutions for adaptation and mitigation. The Bonn declaration identifies four main features that can define the involvement of local administrations (Angel et al., 1998; Collier, 1997; DeAngelo & Harvey, 1998; Feldman & Wilt, 1993; Harvey, 1993; Lambright, Changnon & Harvey, 1996; Nijkamp & Perrels, 1994; Wilbanks & Kates, 1999):

– Firstly, cities are places that consume high levels of energy and produce a lot of waste. The influence of local authorities on these processes varies according to national circumstances, but can entail following: energy provision and management; transport supply and demand; territorial planning; building regulations; waste management and consultations offered to the local community.

– Secondly, local authorities have been committing themselves to sustainable development for almost twenty years, trying to transpose global rhetoric into local practice through the processes of local Agenda 21 (with clear implications for climate change mitigation as well).

– Thirdly, local authorities can push national governments through the development of local projects that prove, on small scale, the costs and benefits of reducing greenhouse gas emissions.

– Fourthly, local authorities have notable experience in dealing with environmental impact as part of their energy management, transport, and land use policies.

In brief, local administrations can exert pressure to encourage the reduction of greenhouse gas emissions, as they have direct impact on the national governments' capability of reaching internationally agreed targets. This led to a substantial redesigning of the local administration's involvement in climate change strategies. Moreover, local governments not only respond to national political targets, but they also represent an important place for the management of international and global issues.

Local administrations join transnational networks created by local organisations, with the aim of spreading political programs and promoting the exchange of best practices on a national and international level. The quantity and quality of these global networks reflect new, innovative cross-governance forms, with which the traditional distinction into global, national, regional, and local levels, will have to deal in the near future.

4 Problems in the Implementation of Climate Policies and Instruments

The previous section revealed the clear process of building 'correct' and efficient climate policies. However, even if integrated adaptation and mitigation policies have been recognised as necessary, their actual and mass implementation still looks problematic (IPCC, 2014; UNFCCC, 2008)

In fact, even if such policies are blooming, both in developing and developed countries, they often don't yield concrete results, just like 'empty shells' of pure propaganda (van Staden & Musco, 2010). The difficulty in effectively actualising concrete policies was usually explained by referring to a series of limiting factors such as: ecological factors (natural bonds), economic factors (poverty level, lack of financial resources), technological factors (insufficient knowledge, unavailable adequate technology) and institutional weakness (Clar, Prutsch & Steurer, 2012). Using these limitations as parameters to assess which countries have the highest level of implementation efficiency, it would seem almost obvious that the less developed countries would be the ones to face major difficulties, being under-equipped for the autonomous planning of successful climate policies. On the contrary, according to the OECD (Agrawala & Fankhauser, 2008), these countries are generally less susceptible to the problems related to climate policies and are able to actualise them with success. For this reason, the vision that considers only the factors above has been judged as being too simplistic and has been questioned by some scholars (Hauser & Jadin, 2012; Kerr, 2011), who demonstrated that in highly developed countries (e.g. Norway), state and public administrations aren't tackling the vulnerabilities to climate change with specific political responses in a systematic (and systemic) way. This contributes to enforcing the idea that, in addition to economic, ecological, and technological barriers, there could also be political or normative obstacles as well as institutional (e.g. inaccurate governance), and behavioural barriers.

The correct actualisation of climate policies can therefore be hindered by a single type of barrier (acting individually in a specific context), or by multiple barriers interacting simultaneously. Below (Fig. 4.1) are some of the main factors that contribute to creating barriers in the actualisation of climate policies.

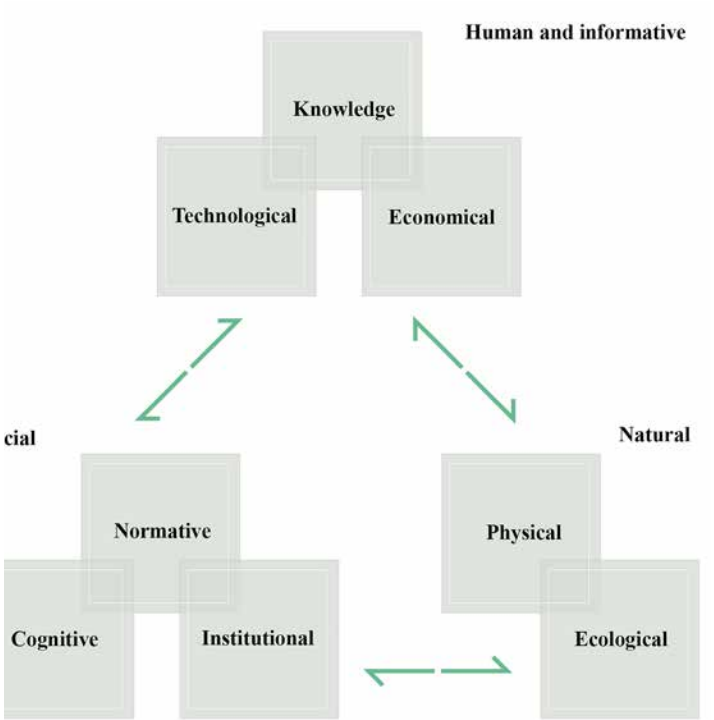

FIG. 4.1 Conceptual summary of the limitations and barriers to adaptation *(Magni & Musco, 2017)*

BARRIER TYPE	BARRIERS AT LOCAL AND REGIONAL LEVEL	BARRIERS AT NATIONAL AND LEVEL
Institutional	Lack of a subnational level mandate to address adaptation problems and coordination problems between municipalities.	Narrow interpretations of subsidiarity leave little room for flexibility.
	Institutional structures that hinder the coordination of relevant issues (vertical / horizontal).	Newness and instability of the adaptation agenda where the role of the supranational level (e.g. EU or US Congress) is still in development phase.
	Laws and national or regional regulations that lead to maladaptation and increased vulnerability.	Sectoral policies with interests already acquired.
Political	Local authorities affected by particular interests.	Level of government affected by particular interests.
	Pressure to maintain business as usual.	Preferred stakeholder and political interests emphasize business development as usual.
	Pressures from short-term electoral cycles on effective risk management	At national or supranational level, emphasis is not given to adaptation as is done for mitigation, eco-efficiency, innovation and growth.
	Lack of willingness to accept costs and changes in behavior.	Lack of willingness to accept the costs.
Economical	Lack of resources or funding to address the identified problems.	Lack of resources, including the immediate challenges of financial austerity.
	Differences between perceived and real costs and benefits.	Uncertainty about the costs of climate change. Problems in determining a sufficient level of intervention.
	Difficulties in integrating adaptation into the various budget lines.	Difficulties in implementing the mainstreaming of adaptation actions in the different lines of the budget.
	Intersectoral competition to receive funds in view of no increase in the budget.	Intersectoral competition to receive funds in view of no increase in the budget.
Technical-Scientific	Lack of technical or scientific information relevant to the local scale	Lack of up-to-date and comparable information on national, regional and local vulnerability adaptation.
	Lack of adequate understanding of climate risks.	Effective communication of the impacts of climate change.
	Scientific uncertainty; Lack of technical skills or access to know-how.	

TABLE 4.1 Barriers hindering climate adaptation processes

These factors, listed in Table 4.1, generate a series of problems within the design and implementation process (CEPS, 2008) which are alternately defined as 'limits' (Moser & Ekstrom, 2010), 'obstacles' (Hulme, Neufeld, & Colyer, 2007; Moser & Ekstrom, 2010; Storbjork, 2010), or 'barriers' (Moser, 2009).

The difference between definitions is quite relevant. While 'limits' are normally considered to be physical factors that can resist any kind of change (including adaptation policies) and that can hardly be overcome (Adger et al., 2007), 'barriers' are more related to behaviour and to cultural and political factors and can therefore be overcome (Moser & Ekstrom, 2010).

Even if the terms 'barriers' and 'challenges' are often used as synonyms (Moser & Ekstrom, 2010), a distinction should be made between 'political barriers' and 'governance challenges', to better understand their features. The former can be faced with no need for deep changes in policy development (e.g. by raising the awareness of the political party responsible party for adaptation and mitigation issues). The latter are instead more related to general adaptation and mitigation features, basically calling into question the traditional forms of development and the actualisation of these sector policies.

This process requires institutional changes or governance innovations in the organisation, structure and decision-making relating to public policy as a whole (Mayntz, 2004; Schedler, 2007; Treib, Bahr & Falkner, 2007). According to what emerged from the analysis of climate policy-oriented literature (Magni, 2016), four main governance climate policy challenges (mainly adaptation) have been identified, albeit not exhaustive:

- a better horizontal integration of climate policies in every public policy sector;
- a better vertical involvement of the legal levels of territorial governance;
- increasing and integrating the decision-making expertise;
- engaging a wider range of non-state actors, who are involved in tackling climate changes, but usually lack the necessary capability to get started on their own.

5 European Reflections: Addressing the Risks and Opportunities of Climate Change

A significant number of measures, policies, and actions related to adaptation, also takes place on a local level in addition to national and regional activities. Transpositions on a local level follow the national strategies, with the definition of specific strategies for specific territories. Adaptation policies cannot be generalised and require a tailor-made definition in relation to the areas involved in their implementation (Musco, 2008).

On a city level, the issue of adaptation has been addressed in detail by the European Environment Agency report *Urban adaptation to climate change in Europe* (EEA, 2012a), which provides numerous examples of the local actions adopted in various European countries, as well as by the Climate-ADAPT platform (EU, 2016), where all European initiatives on this issue are catalogued.

There are many examples of European cities that implemented adaptation strategies and local action plans and that are now in the process of developing them. Some of these specific initiatives are part of pre-existing climate strategies, or became an integral part of them, as happens when adaptation strategies complete the mitigation ones already in place. Here are some examples: the Dublin climate change strategy (CODEMA, 2014) includes adaptation targets that modify and improve the pre-existing mitigation policies. In Finland, various municipalities and regions launched climate strategies that, even if responding mainly to the mitigation issue, integrate adaptation principles through specific sector measures. In other countries like France, Germany, Hungary, Norway, Romania, Spain and Switzerland, some cities have set up for the creation of collaboration networks to share and actualise climate change mitigation and adaptation initiatives. An example is provided by Norway, which has developed a six-year a collaboration program involving the government and 13 of the country's largest cities called *The Cities of the Future* (Mikkola & Randall 2016). Spain too has created a network of cities, the *Red Española de Ciudades por el Clima* - RECC, which produced a series of guidelines to help local authorities promote adaptation and identify their vulnerabilities to climate change. Some of these networks are the result of international projects, others have been created by national government bodies. Many involve research institutes and NGOs, in addition to gathering local institutions. For example, in France, Club ViTeCC is a network of policy-makers and local scientists created by CDC Climate Research, ONERC, and Météo France, to make research on climate change economy understandable and employable by decision-makers and service providers.

Other cities have developed, or are developing, adaptation plans and strategies specific to determined key sectors, focusing on the most relevant vulnerabilities of specific regions. Brussels, for example, is developing a plan for rainfall management, the *Plan Pluie* (Bruxelles Environnement, 2008). Hungarian cities have plans for water management and early warning systems in case of abnormal temperature rise (Wilhite & Svoboda, 2007). Many Estonian cities have developed adaptation plans for storms and floods. Coastal towns like Tallinn, Pärnu, and Haapsalu, which have suffered the heavier effects of extreme weather events, have been the most active in implementing adequate adaptation measures.

MUNICIPALITY	COUNTRY	PLAN	NETWORK
Alba	**Italy**	Local Adaptation Plan to Climate Change	Agenda 21, EU Cities Adapt, Mayors Adapt
Almada	**Portugal**	Almada's Adaptation Strategy	ICLEI, Agenda 21, CCP, EU Cities Adapt, Mayors Adapt
Hamburg	**Germany**	Climate Action in Hamburg	ICLEI
Amsterdam	**Holland**	Climate Change Adaptation Action Plan (AAP)	C40, CCP, Agenda 21, GRaBS Project,
Ancona	**Italy**	ACT- Adapting to Climate Change in Time	ICLEI, Agenda 21, ACT Project , EU Cities Adapt
Antwerp	**Belgium**	Implementation of EU Commitments: Covenant of Mayors and Mayors Adapt, A Tailored Approach 2015-2020	ICLEI, Mayors Adapt
Arnhem	**Holland**	City Structure Vision 2020-2040	Mayors Adapt,
Arnsberg	**Germany**	Integrated Climate Protection Concept	Mayors Adapt
Barcelona	**Spain**	Barcelona Resiliente	C40, ICLEI, 100 Resilient Cities, Agenda 21, GCCC, CCP, EU Cities Adapt, Mayors Adapt
Birmingham	**England**	Birmingham Climate Change Strategic Framework	ICLEI, CCP, Agenda 21, EU Cities Adapt,
Bologna	**Italy**	Bologna Local Urban Environment Adaptation Plan for a Resilient City – Blueap	ICLEI, CCP, Agenda 21, EU Cities Adapt,
Bratislava	**Slovakia**	Adaptation action plan Bratislava	EU Cities Adapt, Mayors Adapt
Bullas	**Spain**	Local Adaptation Plan to Climate Change	ACT Project, Mayors Adapt
Copenhagen	**Denmark**	Copenhagen Climate Adaptation Plan	C40, ICLEI, Agenda 21, GCCC , CCP, Mayors Adapt
Dresden	**Germany**	Regional Climate Change Adaptation Programme Dresden Region	ICLEI, CCP, Agenda 21, EU Cities Adapt
Dublin	**Ireland**	Climate City Plan	ICLEI, EU Cities Adapt, Mayors Adapt
Edimburgh	**Ireland**	Resilient Edinburgh: Climate Change Framework 2014-2020	ICLEI, Mayors Adapt
Frankfurt	**Germany**	Climate Change Adaptation Strategy	Mayors Adapt
Freiburg	**Germany**	Action Plan for Climate	ICLEI, CCP
Gibraltar	**England**	Adaptation strategy for Gibraltar	ICLEI, 100 Resilient Cities, Agenda 21, Mayors Adapt
Glasgow	**Scotland**	Climate Ready Clyde Vision	Agenda 21
Greater Manchester	**England**	Greater Manchester Climate Change Strategy (GMCCS) / Climate Change Strategy Implementation Plan (CCSIP)	ICLEI, CCP, Agenda 21, Mayors Adapt
Hannover	**Germany**	Climate Change Adaption Strategy for the City of Hannover	ICLEI, Agenda 21, CCP, EU Cities Adapt
Lahti	**Finland**	Lahti City Strategy 2025	CCP, Agenda 21, Mayors Adapt
Leicester	**England**	City of Leicester Climate Change Strategy	C40, 100 Resilient Cities, Agenda 21, CCP, GRaBS Project
London	**England**	Managing risks and increasing resilience Plan	C40, Agenda 21, Mayors Adapt
Madrid	**Spain**	Plan de Uso Sostenible de la Energia y Prevenciòn del Cambio Climatico	ICLEI, EU Cities Adapt, GRaBS Project
Malmö	**Sweden**	Malmö Climate Plan	Mayors Adapt
München	**Germany**	Strategic Guidelines on Climate Change Mitigation and Adaptation	ICLEI, Agenda 21, Mayors Adapt,
Newcastle	**England**	Climate Change Strategy and Action Plan 2010-2020	ICLEI, Mayors Adapt,
Nijmegen	**Olanda**	Water and Sewer Plans Nijmegen	Agenda 21, EU Cities Adapt
Padua	**Italy**	Piano clima	C40, ICLEI, 100 Resilient Cities, GCCC
Paris	**France**	Plan Climat de Paris	C40, ICLEI, 100 Resilient Cities, Agenda 21, EU Cities Adapt, Mayors Adapt,
Rotterdam	**Holland**	Rotterdam climate proof	ICLEI, Agenda 21
Zaragoza	**Spain**	Zaragoza Strategy for Adaptation to Climate Change	Mayors Adapt
Stuttgard	**Germany**	Climate Change Adaptation Concept (KLIMAKS)	C40, Mayors Adapt
Stockholm	**Sweden**	Stockholm action plan for climate and energy 2012–2015	ICLEI, Mayors Adapt
Växjö	**Sweden**	Climate Change Adaptation Plan 2013	ICLEI, Agenda 21, EU Cities Adapt
Vitoria-Gasteiz	**Spain**	Plan de Adaptación al Cambio Climático de Vitoria-Gasteiz	ICLEI, Mayors Adapt

TABLE 5.1 Local adaptation initiatives in Europe *(Magni, 2016)*

Adaptation actions and projects have also been actuated on a local scale or as part of the political agendas of European municipalities. These initiatives focus on specific adaptation problems: reducing the heat island effect in urban areas; implementing application and design of green roofs; improving water efficiency and supply in areas subject to drought, etc. For example, Saragossa has set up awareness campaigns that combine the commitment of citizens and enterprises with the update of water costs included in the *Water Saving City programme* (Benedi, 2008). This program was launched in 1996 by the NGO *Fundación Ecología y Desarrollo* with the support of the municipality, and managed to reduce water consumption in Saragossa by 30% in only 15 years, despite a 12% increase in the population over the same period (Kayaga et al., 2008; Kayaga, 2010). The key factors behind its success were the active promotion of a water saving culture, the full participation of the interested parties and the creation of a central coordinating unit. Other examples of plans implemented by European cities are illustrated in Table 5.1.

The table above shows how such initiatives sometimes have a strong relationship with the processes launched by the Local Agenda 21 (van Staden & Musco, 2010) or other projects or networks, and now considered consolidated (if not almost obsolete).

Adaptation to climate change entails the adoption of measures aimed at facing present and future effects and vulnerabilities, as well as the variability that occurs without climate change in an ever-changing society. Adaptation doesn't only mean protection against negative impacts, but also being more flexible to the change and taking advantage of its possible benefits (Galderisi, 2014).

As some of the above-mentioned cases demonstrate, the more rapidly adaptation measures are implemented, the better the preparation to face future environmental challenges and guarantee opportunities to the cities and their communities (World Bank, 2011, 2015).

The transition or evolution from the Covenant of Mayors (established in 2008 to reduce greenhouse gas emissions) to the Covenant of Mayors for Climate and Energy (introduced in 2015 to integrate mitigation actions with adaptation actions) is an example that proves that adaptation and mitigation are increasingly considered as complementary factors as well as a priority within the EU to tackle climate change. At the same time, European society will have to face many changes, included those related to its economy, population, environment, and climate. Adapting to these changes will be a challenge as well as an opportunity for Europe, and requires the strengthening of the flexibility and adaptation capability of the economic sector, cities, and companies (Klein, Schipper & Dessai, 2005).

Some of the good practices analysed (Breil & Swart, 2015; Magni, 2016; Olazabal et al., 2014) highlight the necessity of integrating adaptation and mitigation initiatives into the wider scenario of resilient urban development by connecting long term actions and policies, which

aim at the reduction of greenhouse gas emissions, with short and medium-term strategies to reduce the impact of climate events. In fact, despite the need to develop cross-sectorial strategies, most cities have developed mitigation strategies focused on sectorial areas (e.g., Sustainable Energy Action Plans, or Energy Plans) or 'innovative projects', while only a few cities are developing plans or local integrated cross-sectorial strategies to improve urban resilience.

Bologna, Barcelona, and Rotterdam have been analysed in Table 5.2 as virtuous examples of climate proof processes to better understand the strong and weak points of the current adaptation initiatives responding to imbalances caused by climate change.

	BOLOGNA	BARCELONA	ROTTERDAM
GOVERNANCE CHALLENGES			
Vertical integration			
Horizontal Integration			
Integration of knowledge			
Involvement of stakeholders			
BARRIERS AND HINDERING FACTORS IN CLIMATE POLICIES			
Lack of information for decision-making			
Lack of economic resources			
Fragmentation of decision-making			
Regulatory and institutional constraints			
Absence of leadership			
Uneven risk perception			

TABLE 5.2 Comparative synthesis of climate proofing pathways undertaken by some of the local European contexts analysed *(Magni, 2016)*

The study carried out on the experiences presented in Table 5.2 and 5.3, clearly shows that the initiatives and projects currently underway seem to significantly contribute to the promotion of cross-sectorial and multi-target strategies to face climate change by paving the way for an integrated approach to climate issues. Numerous measures, especially those that increase green infrastructures, testify to this double role, by contributing to both mitigation and adaptation and reaffirming the strong connection between adaptation actions and the context (environmental, social-economic) on which they are working. Interventions and adaptation policies have been elaborated by public bodies to better respond to different necessities and specific regional and local conditions, thereby avoiding a one-size-fits-all approach for all contexts (Magni, 2016).

The peculiarity of the city of Rotterdam, for example, where 90% of the municipal area is below sea level, has led to considering urban adaptation actions to climate change as the key target of most economic development projects. In Barcelona, instead, the actions to improve city resilience focus on a broad range of targets related to the management of urban services and public assets and a better resilience to climate change. Both cases agree in allocating a driving factor to improving

urban response to climate change and increasing the involvement capabilities of citizens.

The involvement of the interested parties alone (policy makers, NGOs, companies, citizens) has been one of the central points of Bologna's adaptation experience (Caranti, Di Pietro, Fini, & Gueze, 2014). This action has also promoted an improved consistency with adaptation plans and created a sense of responsibility regarding climate policies.

The initiatives to improve the cities' capability to transform had a different consideration instead. What is becoming increasingly clear is the necessity of a great step forward towards development models with low carbon emissions to reduce greenhouse gas emissions, energy consumption, and climate impact on urban areas (Rosenzweig et al., 2015). To achieve this, a leading role must be assigned to urban planning, as it could represent a fundamental tool to harmonise targets in different spatial and temporal spheres, achieve more flexible processes to involve interested parties and, above all, integrate currently existing policies, initiatives, projects and sector instruments, thus avoiding a useless waste of resources (Desouza & Flanery, 2013).

This kind of flexibility can be also fostered by the employment of different adaptation measures. For example, integrating 'grey' (i.e. technological and engineering), 'green' (ecosystem-based approaches) and 'light' (management and political) approaches is often a good way of dealing with connections of natural and social systems.

BOLOGNA	BARCELONA	ROTTERDAM
– Bologna Local Urban Environment Adaptation Plan for a Resilient City – Strategia locale di adattamento ai cambiamenti climatici – Piano di protezione civile – SEAP – Piano Strutturale Comunale (PSC) – Piano Operativo Comunale (POC) – Regolamento Urbanistico Edilizio (RUE)	– Plans d'Acciò per a l'Energia Sostenible (PAES) – Plan de Energia, Cambio Climatico y Calidad del Aire – Plan de sostenibilidad del Area Metropolitana de Barcelona (PSAMB) – Plan de Resiliencia y adaptaciòn al Cambio Climatico	– National Adaptation Strategy + Delta programme – Rotterdam Climate Change Adaptation Strategy – Water plan 2 – Rotterdam Climate Initiative

TABLE 5.3 Examples of tools implemented as part of local adaptation practices *(Magni, 2016)*

6 Towards a Shared Methodology to Support Climate Proof Planning Tools

Most of the documents analysed in this chapter have been drafted at a moment when climate change theories and knowledge evolved faster than territorial government politics and instruments. This often meant that the so-called 'innovative' experimentations strongly contributed to improving the theoretical apparatus rather than addressing adaptation practice unlike what they were initially meant to do. In the 2000s the range of actors involved in adaptation practices and policies has remarkably expanded to include ministries (not only for

the environment) and experts (both public and private) for a sustainable territorial development. This in turn means less academic theory about adaptation in favour of a "learn by doing" approach supported by the analysis of vulnerability related to actual experimentations on a local level. Over the years, the lack of information on how to effectively implement adaptation strategies and plans became increasingly clear (Silva Villanueva, 2011; Solecki, Leichenko, & O'Brien, 2011). For this reason, the United Nations Framework Convention on Climate Change (UNFCCC), with its related activities, prepared a theoretical framework on adaptation as a practical guide to support decision-making bodies as well as those not included in the immediate application of UNFCCC. The framework includes different steps to be undertaken by local, regional, and national administrations.

On a government level, these steps allow the understanding of how decisions can be implemented for mitigation and adaptation to global climate change by improving the quality of life of communities. Fig. 6.1 shows some applications of this technical framework as defined by different territorial organisations.

step	UNDP Toolkit	ClimAID	ACT	SEAP_Alps	Climate-ADAPT Platform	UKCIP
1	Define Problem	Identify current & future climate hazard	Avviare il processo	Assessing Risk & vulnerability	Preparing the ground for adaptation	Identify problems & objectives
2	Identify Cause	Inventory vulnerabilities &opportunities	Stabilire una Baseline delle conoscenze	Identifying adaptation options	Assessing risks and vulnerabilities to climate change	Establish decision- making criteria
3	Identify and Articulate Normative Response	Prioritize vulnerabilities	Valutare rischi e vulnerabilità	Assessing adaptation options	Identifying adaptation options	Assess Risk
4	Identify Barriers	Identify and categorize adaptation strategies	Identificare le azioni di adattamento	Implementation	Assessing adaptation options	Identify options
5	Formulate Expected Results	Evaluate and prioritize adaptation strategies	Implementare azioni di adattamento	Monitoring & Evaluation	Implementation	Appraise options
6	Review Steps and Complete Checklists	Link strategies to capital and rehabilitation cycles	Monitorare, valutare aggiornare il piano		Monitoring and evaluation	Make decision
7		Create an adaptation plan	Coinvolgere gli stakeholders			Implement decision
8		Monitor and reasses	Integrare adattamento politiche settoriali			Implement decision

FIG. 6.1 Comparison of climate proofing planning methodologies *(Magni, 2016)*

The different steps (that vary in quantity and nomenclature) do not necessarily need to be carried out in order: some of them can happen simultaneously, but in any case, should be viewed as a cycle. The idea is in fact to launch a process that passes through each scheduled step and defines the targets achieved.

Gradually, the process should improve further and finally achieve a climate-proof or resilient community. In order to define a general and updated methodology (the UNFCCC proposal dates back to ten years ago) that steps away from specific examples, the macro-steps provided by the adaptation planning process can be summarised as follows:

D Building a knowledge base on the subject of adaptation;
E Evaluating the impacts of climate change on a micro and macro level;
F Evaluating vulnerability and related adaptation capability;
G Identifying possible adaptation options (adaptation measure planning);
H Executing measures;
I Monitoring and efficiency assessment.

6.1 Università Iuav di Venezia Methodology for Climate Plan and Policy Design

The concept of adaptation and its integration into territorial government instruments represents a rather complex issue, which takes advantage of the contribution of various disciplines and is still undergoing international debate (Béné, Godfrey Wood, Newsham, & Davies, 2012; EEA, 2012b; Mukheibir & Ziervogel, 2007; Olhoff & Schaer, 2009; Revi et al., 2014).

FIG. 6.2 Methodology to support local communities in defining climate-related plans *(Magni, 2016)*

In fact, there is no unanimously satisfactory approach, as the wide range of definitions in related literature and multiple methodological approaches testify (e.g. vulnerability analysis, risk assessment, etc.).

For this reason, choosing what works best for their needs is in the hands of the single communities (Corfee-Morlot, Cochran, & Teasdale, 2009): some may decide to implement the entire cycle of adaptation policies, while others may prefer leaving one step aside or simplifying it, or even performing only a risk and vulnerability assessment. The choice will depend on several factors such as the availability of financial resources, technical skills, observed data, etc.

In this context, a working team from the Università Iuav di Venezia, part of the SEAP Alps Project (a project organised within the INTERREG Alpine Space program and funded by the European Regional Development Fund), developed for the Metropolitan City of Venice a methodology to assist local communities in formulating Sustainable Energy Action Plans (SEAP), as well as other types of plans related to climate such as the Local Adaptation Plan (LAP). This methodology (Fig. 6.2) was built following the indications provided by the methodologies presented in Fig. 6.1 and in the SEAP Alps Methodology: Integration of adaptation in SEAPs in particular. Below is a representation of the six key steps of the local adaptation process.

7 Conclusions

The critical review in this chapter identified a series of approaches to climate planning, starting with the analysis of a series of methods, tools, guidelines, manuals, and other materials related to adaptation. They were all developed by and for different territorial actors such as different levels of territorial government (local, regional, national), NGOs, universities and research institutes (public and private). It was observed that, unlike the first scientific publications and tools relating to climate change drafted in the 1990s, in which risk assessment was the main source of information for climate planning, some recent approaches (even if still considered uncertain) now also recognise social, economic, and environmental changes as essential factors to maximise the effectiveness of a real adaptation process.

Even if there is more awareness with regard to the entity of the global problem, it is clearer than ever that mitigation and adaptation will have to deal with local development, not only to face climate change, but also to deal with the fluctuations of many other non-climate factors that influence human well-being.

However, if this new approach to climate change doesn't systematically modify the planning processes, results on a local level will be barely effective at best and could even worsen the situation. The risks related to non-sustainable development and to the lack of territorial equity cannot in fact be eliminated through actions that only consider the impacts of climate change. For this reason, the methodological approach to climate-proof planning is gradually moving away from a mere assessment of impact and vulnerability towards a forward-looking approach that incorporates an inter-sectorial vision (so-called 'mainstreaming'). According to this, the various tools, methods, and approaches that have been developed and adopted over the last period also focus on information integration (horizontal or vertical) as one of their main targets. This work wants to highlight how, despite all the limitations and barriers, there are many available methods and tools to try and overcome these obstacles, and offers methodological indications on how to make cities and territories climate-proof. Among them:

- Thanks to the wide availability of adaptation methods and instruments supplied by networks such as the CLIMA-ADAPT platform, it will be possible to avoid mistakes during the methodological preparation of the measures to undertake;
- Due to the considerable gaps in the knowledge concerning adaptation, it is necessary to proceed with a serious training of policy makers before moving on to the planning phase. This will make sure that the methods and tools built will make it easier to achieve the expected targets;
- While there isn't a unique approach to support climate-proof territorial planning, there is a variety of approaches that contribute to reaching the final target;
- It is necessary to devise measures and actions according to resource availability, evaluate the co-benefits of adaptation (thus increasing the benefits perceived) and identify solutions for a more effective employment of resources;
- Monitoring is a fundamental component for the planning and application of correct measures because it allows the assessment and modification of the strategies put in place within a specific context and maximise their effectiveness.

The research path presented moves on from the assumption that urban planning and territory sciences are dealing with the consequences of climate change.

This relationship reflects the change cities are facing today, towards the improvement of life conditions. Climate imperatives intervene in this complex matter by adding tension, upsetting balances and increasing the vulnerability of these already widely stressed 'microcosms'. This in turn involves urban planning processes, even if the choices made by city and territorial governments have, up to now, neglected (or left to voluntary and punctual actions) the relationship between climate and territory planning. The initiatives applied, despite confirming the decision of some subjects (cities, states, etc.) to embrace a new path, didn't lead to adequate political responses from both a qualitative (instruments and policies) and quantitative (expansion of global involvement) perspective.

Climate-proof processes present quite uneven situations for countries where adaptation plans and strategies have been introduced, and others where risks and impacts are being underestimated in spite of the significance of ongoing phenomena (Musco & Magni, 2014).

Among the issues emerged from these first trials, there is definitely the necessity to overcome the specificity of partial planning, which is only oriented towards energy consumption, often without an actual relationship with planning. The main reasons for this can be attributed to the lack of public and shared awareness on climate variability (Kahan, Jenkins-Smith & Braman, 2011; Renn, 2011) and its territorial repercussions (IPCC, 2007), to the late response to climate disasters due to the lack of capacities and resources (Bulkeley & Kern, 2006; Corfee-Morlot et al., 2009), and to the lack of public policies and regulations on urban and territorial planning to manage the climate

change (Lebow, Patel-Weynand, Loveland, & Cantral, 2012; Winkler, Anderson, & Hatfield, 2012).

Anyway, the intrinsic potentialities of the cities can be recognised beyond these limitations (Adger et al., 2007 Moser & Ekstrom, 2010): if adequately planned and managed, cities can in fact contribute to reducing the causes of climate change (mitigation) and efficiently protect themselves from expected local impacts (adaptation) (Adger et al., 2007).

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Urban/Rural Dichotomy and the Forms-In-Between

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ABSTRACT **The urban/rural classification of spatial units aims to define and connect homogeneous units that have similar characteristics and are at an approximately equal level of development. Nevertheless, reviewed systems for urban/rural classification do not always include the criteria needed for aggregation of spatial units into homogeneous groups. To depict the scope and methodology of existing rural/urban divisions in more detail, this paper applies the latest version of the Eurostat classification approach called 'Degree of Urbanisation' on the example of the Republic of Slovenia. The work reveals some advantages and disadvantages of the tested methodology, mainly regarding local level treatment. Namely, the results show that the identification of urban and rural areas, based only on population or population density data, does not take into account other aspects of urbanity and rurality, and hence does not provide sufficient information for distinction at a local level. Therefore, identified homogenous classes do not fully capture spatial complexity and diversity. At the same time, the boundaries between the city and the countryside are increasingly disappearing because of the urbanisation and suburbanisation phenomena, thus additionally aggravating the delimitation of urban and rural areas. To deepen the understanding of 'blended' environments that are both urban and rural, i.e. that are neither only urban nor only rural, this paper distinguishes between several identified forms that can be categorised between the urban and the rural form: the state of urban rurality; blending processes at the urban edge, including urban-rural continuum; remote urbanity; and rural urbanity, and then unfolds discussion about the causes of their emergence, processes, flows and states occurring in their development, development outlooks, and sustainability potentials.**

KEYWORDS urbanity, rurality, classification, Slovenia, urban-rural blending

1 Introduction

The determination of homogeneous spatial units gives an insight into the state of development of a region or a country, as well as to the further development and adjustment of the policies. Only those spatial strategies that are adapted to specific homogeneous zones address detected spatial problems successfully and use available potentials for achieving the 'territorial cohesion' (Commission of the European Communities, 2008) on different spatial levels. The aim of territorial cohesion is to ensure the harmonious development of all European territories and to enable the citizens to make best use of natural spatial resources. Nevertheless, significantly different characteristics, needs, and opportunities between the regions require upgrading of the universal approaches and the adoption of region-specific attitudes in designing and implementing spatial development policies (EC, 2010). To that end, certain priority areas have been identified at the European level (EEA, 2004, 2006). Rural/urban regions, therefore, represent one of six main European regional typologies (Dijkstra & Poelman, 2013; EC, 2010).

Urban/rural division classifies space according to the development level. Although the boundaries between the city and the countryside have been increasingly disappearing in recent decades (Perpar & Kovačič, 2002; Ravbar, 2005) because of urbanisation and the accompanying suburbanisation, the differences between urban and rural areas are still relevant both in spatial and developmental terms. Different countries use different criteria and methodologies to distinguish between urban and rural areas in accordance with their own circumstances, and a single definition that would be applicable to all countries therefore cannot be made (UN SD, 2017). Among the most relevant criteria that are used for distinguishing urban from rural are: settlement size, population size, population density, socio-economic characteristics, level of infrastructural development, land cover, etc. The divisions on urban/rural, both in highly developed and in developing countries, becomes increasingly complex as the boundaries between these two entities become increasingly blurred in spatial, social, economic, and cultural terms, i.e. in the terms of 'circumstances of living' (UN SD, 2017).

2 The Overview of Urban/Rural Classifications

"... The difference between city and village as physical forms is not nearly as large as in social or functional terms. The concept and the archetype of settlements' organisation is essentially governed by same rules, same guidelines. It seems almost impossible that a onetime man used to build cities by applying criteria different than those used for villages. A city could only be formed at certain level of civilisation development, at the stage of labour division, emergence of property rights, crafts, trade, and ruling class. This aspect of civilization development and the history of city emphasize, in particular, economic and cultural shifts that later conditioned a different way of building, that is, a physical image of settlements" (Drozg, 1995, p. 20).

To explore urban/rural characteristics and to delineate urban and rural areas, different classification systems and approaches have been developed. The overview of urban/rural typologies and approaches to urban/rural classification helps to deepen the understanding of differing characteristics of rural and urban areas in a consistent, transparent way. At the same time, it shows that no single urban/rural typology can be used for all geographies (Pateman, 2011).

The project entitled *Urban-Rural Relations in Europe* (Bengs & Schmidt-Thomé, n.d.) aimed to investigate relations between identified urban and rural areas across the territory of the European Union. Certain identified areas were further studied on the basis of four approaches that were associated with four phases of discussion about urban/rural spatial relations. The first approach, oriented towards development of rural typology, was based on existing literature and empirical analyses. The second approach aimed to define areas as delineated statistical units, by using established indicators. The third approach was based on statistical analyses and calculated an index of rurality, while the fourth represented the neutral determination of rural boundaries on the basis of combining data on population density, population distribution, and accessibility. Correspondingly, a comprehensive set of indicators for urban/rural classification was produced. Although it was initially assumed that derived indicators could depict structures and flows between urban and rural areas in a satisfactory way, the project results were shown separately for each EU country and thus did not have notable comparative value.

Institutions such as the Statistical Office of the European Union (Eurostat) and the Organisation for Economic Co-operation and Development (OECD) also draw attention to the significance of delineating urban and rural areas. Their aim is to establish definitions and criteria according to which the comparable European areas, as a basis for policy-making in the fields of urban and rural development, would be possible to define. Accordingly, both Eurostat and the OECD have developed methods for determining urban and rural areas, based on population density.

The Eurostat's 1991 concept is built on the criteria called 'degree of urbanization'. It recognises three spatial types according to the density criterion:

- densely populated areas;
- intermediate areas; and
- sparsely populated areas (RAMON, n.d.).

The OECD's 1994 concept is based on the classification of territorial units, either according to the population density or to the degree of rurality, but also takes into account the size of urban centres in a region. The OECD method includes a two steps classification, made for two hierarchical spatial levels – local and regional. The method was introduced and defined in detail, in the *Green Paper on Territorial Cohesion* (Commission of the European Communities, 2008).

The OECD classification scheme recognises predominantly urban areas, intermediate zones, and predominantly rural areas.

Since the development of original concepts, both Eurostat (Fig. 2.1) and the OECD methods have been complemented and amended several times, in order to eliminate deficiencies and improve methodology (Dijkstra & Poelman, 2008, 2013, 2014; Regional Statistics Team, 2013; Statistics Explained, 2013).

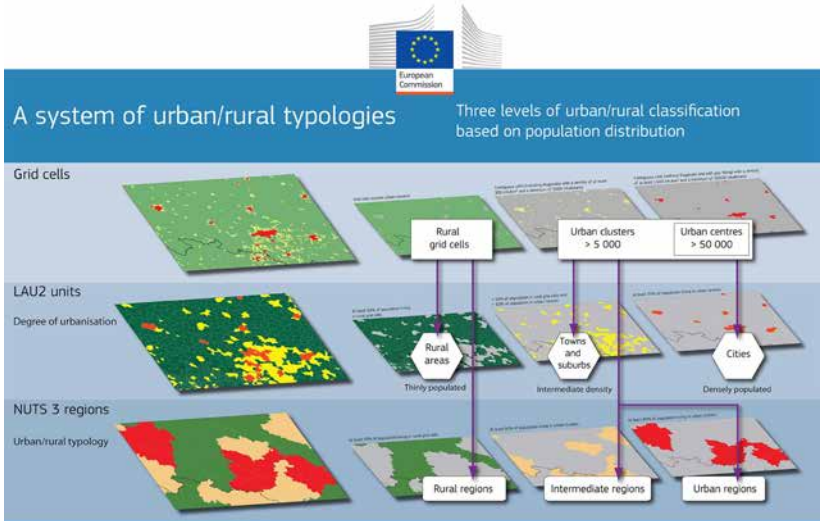

FIG. 2.1 Representation of the three levels of urban/rural, Eurostat classification *(Eurostat, 2012)*

Even though common European classification systems exist, different countries continue to typify urban and rural areas on a national level, because of the particularities found in spatial planning systems, settlement patterns, landscape characteristics, etc. Geographical classifications help to understand better the differences between rural and urban areas, with regard to employment, income, services, and population, on a national level. A detailed overview of current definitions and approaches adopted by countries across the world is presented in the *Inventory of Official National-Level Statistical Definitions for Rural/Urban Areas* prepared by the International Labour Organization (ILO, 2015).

The inventory gives an insight into different national practices. In France, for example, methodology and definitions of zoning in urban areas are provided by the *L'Institut national de la statistique et des études économiques* (National Institute of Statistics and Economic Studies) (INSEE, 2017). Up until October 2011, the INSEE methodology distinguished between predominantly rural areas (including small urban municipalities and rural municipalities) and three types of predominantly urban areas: urban centres, peri-urban rings, and multipolar municipalities. Since October 2011, zoning in urban areas provides only a vision of cities' influences and so it divides a territory into four major types: space comprising large urban areas, space comprising other areas, multipolar municipalities, and isolated municipalities lying beyond the influence of urban centres. Within the types: space comprising large urban areas and space comprising

other areas, centres, and peripheries are additionally distinguished. In Greece and Spain, classification is made only according to the size of the population on municipal and community levels. While the definitions of urban/rural areas vary a little between the two countries, they both use the same threshold values. Urban areas are defined as municipalities with 10,000 or more inhabitants. Semi-urban areas in Greece and intermediate rural areas in Spain are municipalities with 2,000 to 10,000 inhabitants, while rural areas have fewer than 2,000 inhabitants. In Norway, settlement types are determined on population size and the distance between buildings. A hub of buildings is registered as an urban settlement if it is inhabited by at least 200 persons (60 - 70 dwellings) and the distance between the buildings does not exceed 50 metres. A rural settlement is any settlement that is not categorised as urban. Delimitation of urban settlements in Norway is independent of administrative boundaries. *Instituto Nacional de Estadistica* (National Statistics Institute) of Portugal defines predominantly urban areas, medium urban areas, and predominantly rural areas, by classifying administrative districts according to two criteria: population size, and population size relative to district size. According to Scott, Gilbert, and Gelan (2007), there were more than 30 definitions and classifications of urban/rural areas across the UK in 2007. While some classification systems covered only certain areas (for example, the Commission for Rural Communities uplands areas), others encompassed the territory of the whole country but did not exclusively focus on rural and urban issues. Today, there are two main classification types used to divide the UK territory into urban and rural areas. To cover small area data and local authority level data, seven main classification types exist (Pateman, 2011).

3 Application of the Method 'Degree of Urbanisation': Slovenia Case Example

If the territory of the Republic of Slovenia were divided equally between 211 municipalities, then every municipality would be approximately 100 km^2 in area, and if the total population (as recorded in 2012) were evenly distributed over municipalities, then every Slovenian municipality would have just under 10,000 inhabitants, around 800 enterprises, and 4,000 dwellings. This linear (equal) distribution of settlements' characteristics, however, does not occur in real spatial conditions.

A diversified mosaic of statistical and spatial characteristics in Slovenia makes for an interesting study. A relatively small territory of the country is recognisable by large terrain and relief diversity, different types of landscapes, abundant heritage, and species-rich natural systems. Almost 90% of Slovenian territory is at an altitude of over 300m. Although flat contiguous valleys and basins represent only about 20% of its total surface, they are home to nearly 60% of the total population. Divergent, yet relatively unfavourable, natural conditions contribute to the dispersal of settlements, specific structure of land use, and diversity of cultural landscape. According to the number of inhabitants and low

average population density (98 inhabitants/km^2), Slovenia ranks among the least populated EU member states. The typical settlement pattern in flat valleys and basins is compact. In pre-Alpine and Dinaric-karst areas, settlements are sparse, small, and dispersed (MAFF, 2013).

3.1 Slovenian Urban/Rural Classifications and Definitions

One of the first delimitations between urban and rural areas in Slovenia was carried out for census purposes in 1981. On that occasion, the Statistical Office of RS (SORS) defined 224 urban settlements. That number was reduced during the 1991 census when only 182 settlements (3% of the total number of settlements) were defined as urban, according to criteria such as size, morphology, density, and employment. The level of urbanisation in 1991 was 50.5% (this was the percentage of population living in urban settlements). On the other hand, less than 10% of the Slovenian population was labelled as living in agricultural areas. Since 2002, this number has been reduced to below 3%. The data presented demonstrate that Slovenia has one of the highest proportions of deagrarized population in Europe, that is the population living in non-urban (rural) settlements, but employed in industry and services in (nearby) urban centres and who commute to work daily (Pichler-Milanović, Drobne, & Konjar, 2013).

Revised definitions of 'urban settlements' and 'settlements in urban areas' were launched in 2003, yet accompanying classification was used exclusively for statistical surveys and analysis. Criteria for the classification of urban settlements were organised into four groups: number of inhabitants, morphology (population density, built-up areas), functions (number of jobs, daily migrants, transport connections, services), and structural criteria (e.g. number of farms) (Pavlin, Milenkovič, Klasinc, & Grm, 2003). In 2003, 156 Slovenian settlements were defined as urban, of which 104 were urban areas and an additional 52 were defined as settlements in urban areas (i.e. the statistical definition of towns). Additionally, four types of urban settlements were defined: 1) settlements with more than 3000 inhabitants; 2) settlements with 2000-3000 inhabitants, and a surplus of jobs for the number of employed persons; 3) centres of municipalities with at least 1,400 inhabitants and a surplus of jobs for the number of employed persons, and 4) a combination of criteria for determining (sub)urban settlements that form urban areas.

Another classification for settlements in Slovenia is made on the basis of political definitions. The Local Self-government Act (1994) identifies a town as a larger urban settlement that, in terms of population size, economic structure, density, and historical development, differs from other settlements. The minimum population size necessary to qualify a settlement as a town is 3000 inhabitants. Town status is obtained by the decision of the National Assembly of RS (exceptions are those settlements to which the status of the town had been given before the Local Self-government Act, i.e. the historic towns). According

to the political classification, Slovenia currently has 58 urban settlements with town status.

The third type of urban/rural definitions and divisions in Slovenia is administrative. Since 2012, at the administrative level, Slovenian territory has been divided into 212 municipalities of which only 11 are urban (according to the administrative definition of towns).

Slovenian urban/rural characteristics and classifications are explored in different research areas, such as spatial planning, urbanism, economy, etc. Usually, these urban/rural classifications are based on only one characteristic, and so they do not provide an appropriate overview of the complex urban/rural system in the county. To better explain the variety of existing urban/rural typologies and their application in research, some selected methodologies are presented hereinafter.

Perpar, Kastelec, and Udovč (2013) developed a typology based on the economic and developmental performance of Slovenian municipalities, and proposed four classification groups: municipalities with the lowest economic and developmental performance; municipalities with a slightly better economic and developmental situation than the first group of municipalities; sustainability-oriented municipalities (with favourable demographic structure, and economic and environmental status); and municipalities that currently have the best economic and developmental conditions. Despite numerous policies implemented during the last decade, Perpar (2014) has noted that differences in the spatial development of Slovenia are still evident, both between urban and rural areas, and between eastern and western parts of the country. With the goal of ensuring sustainable development, it is necessary to understand the key factors that cause these differences and to prepare effective programmes and development policies for different types of territories (Perpar, 2014).

Although the major part of research on spatial characteristics and classifications deal with urban aspects and levels of urbanity, rural areas are equally important, because of their relation to food security, environmental hazards, cultural landscape preservation, etc. (Fikfak et al., 2017). Kovačič et al. (2000) have derived a classification system of Slovenian rural areas according to their development characteristics and possibilities. The purpose of their research was to determine and delineate different types of rural areas, thus dividing the entire Slovenian territory into developmentally homogeneous areas. In the first phase, three basic typological classes of rural space were identified: suburbs, typical rural settlements, and areas subjected to rapid depopulation. With such spatial delineation, urban areas were intentionally eliminated from further division and determination of types of rural areas. Subsequently, Perpar and Kovačič (2002) carried out a comparative analysis of identified rural areas by using demographic, agricultural, and social indicators. The analyses showed that the differences between the defined types of rural areas are obvious and significant in the planning of rural developments.

Gabrijelčič and Fikfak (2002) proposed another delineation of rural areas based on the degree of responsiveness, the form of phenomena, and the nature of necessary development measures. Accordingly, five types of rural areas were identified: rural areas in the vicinity of densely populated towns, rural tourist areas, rural areas with mixed activities, predominantly agricultural rural areas, and difficult-to-access rural areas.

The European project *Rural Development Statistics,* initiated in 2006, applied the urban/rural typologies of Eurostat and the OECD to the territory of the Republic of Slovenia. The aim of the project was to establish the indicators needed for development planning and monitoring in rural areas (SORS, 2017). The project was carried out by the Statistical Office of the Republic of Slovenia, which delineated and typified urban and rural areas of Slovenia for statistical purposes. Rural areas were determined according to the OECD and Eurostat spatial concepts with the goal of establishing a system of comparable statistics for the whole geographical territory of the European Union (SORS, 2017). While the OECD methodology was used to classify statistical regions (NUTS 3) based on their urban/rural type (Fig. 3.1), the Eurostat methodology 'Degree of urbanisation' was used to classify municipalities according to the population density type (Fig. 3.2).

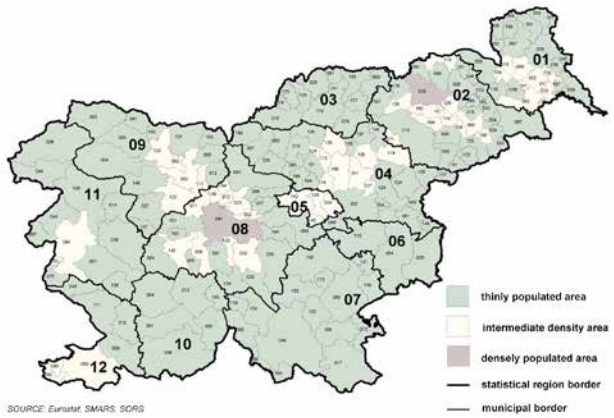

FIG. 3.1 Urban/rural OECD typology, statistical regions (NUTS 3) in Slovenia *(Merc, 2006)*

FIG. 3.2 The Eurostat's 'Degree of urbanisation' typologies, municipalities in Slovenia *(Merc, 2006)*

Since their first application in Slovenia in 2006, the OECD and Eurostat methodologies have been improved several times. Local administrative units (to which population size and population density was previously linked) were replaced by a population grid that is considered a more accurate basis for characterising the areas and regions. In some cases, additional criteria such as accessibility have been added to advance classification detailing.

3.2 Eurostat Methodology Tested on the Example of Slovenia

The Eurostat methodology (RAMON, n.d.; Regional Statistics Team, 2013) is based on population density data and on two additional criteria – the spatial cohesion of units, and the scale of border population. Dijkstra and Poelman (2014) proposed to complement the Eurostat methodology, by which Slovenian municipalities are classified into three groups, based on the degree of urbanisation, along with accessibility criteria. An advanced accessibility model (Drobne, 2003; Drobne & Paliska, 2014) was used for accessibility calculation. The classification of Slovenia was carried out in ESRI ArcGIS software package using raster density of population density data from 2010.

The method is based on the process of combining population density raster cells (size 1 km x 1 km) into the following groups or clusters (Fig. 3.3):

- **urban clusters** – a coherent set of raster cells with a population density of at least 300 inhabitants per km^2 and a minimum of 5,000 people;
- **high-density clusters** – a group of raster cells with a population density of at least 1,500 inhabitants per km^2 and at least 50,000 inhabitants; and
- **rural grid cells** – clusters of cells with population density more then 0, outside the high-density clusters and urban clusters.

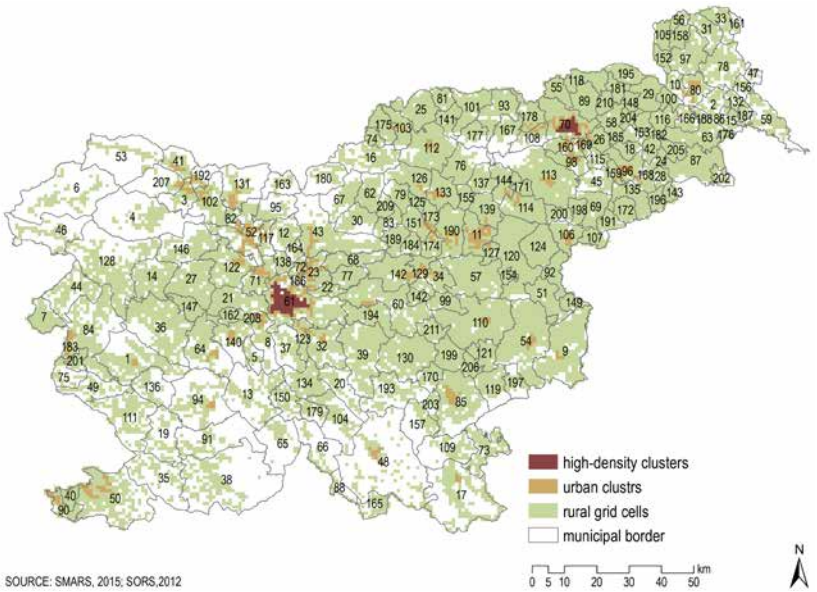

FIG. 3.3 Classification of raster cells based on population density in Slovenia *(Konjar, Zavodnik Lamovšek, & Grigillo, in press)*

The classification of spatial units is then carried out according to the proportion of the population living in identified clusters (Fig. 3.4):

- **densely populated areas** (cities and larger urban areas) – municipalities in which at least 50% of the population lives in high-density clusters;
- **intermediate density areas** (towns and suburbs, small urban areas) – municipalities where fewer than 50% of inhabitants live in rural grid cells and fewer than 50% of inhabitants live in high-density clusters; and

– **thinly populated areas** (rural areas) – municipalities that have more than 50% of inhabitants living in previously defined rural grid cells.

By introducing additional accessibility criteria, a possibility opens for the delimitation of two additional types of municipalities: remote areas with intermediate density, and remote thinly populated areas (Fig. 3.4). Remote areas are delimitated based on the share of the population living in or outside the 45-minute access area to urban centres. The significance of remote areas for the development of Slovenia is recognised in the project *Importance of Small and Medium-Sized Towns* (Prosen, Zavodnik Lamovšek, Žaucer, Drobne, & Soss, 2008). A municipality is classified as remote if more than 50% of its population lives outside the 45-minute access area.

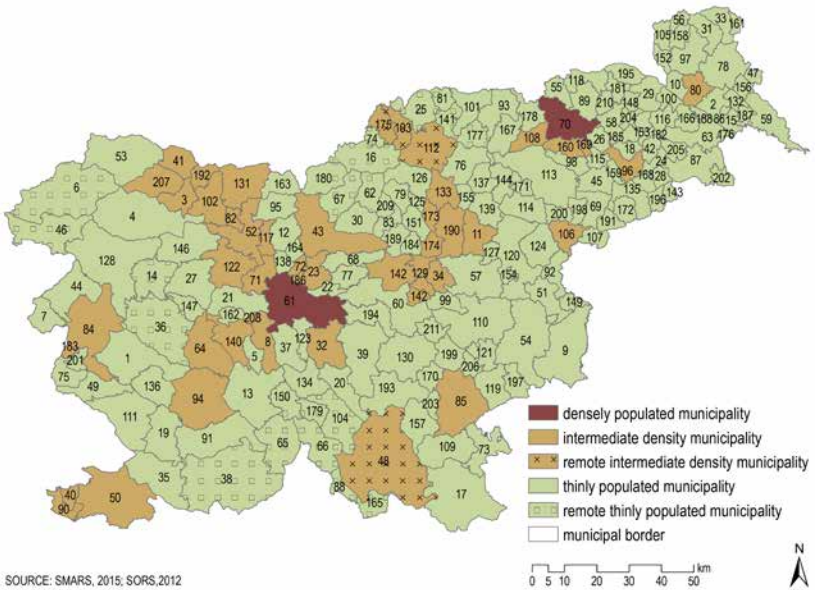

FIG. 3.4 Application of the Eurostat classification methodology. Degree of urbanisation in Slovenia *(Konjar, Zavodnik Lamovšek, & Grigillo, in press)*

3.3 Results Analysis

The implementation process and the analysis of results provide an insight into the strengths and limitations of the applied method. The use of raster data (population grid) has been recognised as a major advantage of the method, which eliminates the influence of spatial units on classification. The basic method (without accessibility criteria) is, however, based on only one type of criteria. The classification thus delimits municipalities in classes only according to the population density data. As it is almost impossible to describe the space by using only one criterion, the methodology fails in recognising some rather small, but important, centres in the Slovenian urban system, with a key function on a regional, or even national, level. At the same time, some of the municipalities are classified as intermediate density municipalities (e.g., Gorje (207), Prevalje (175), Kočevje (48), or Rogaška Slatina (106)) (Fig. 3.4), taking into account only the high percentage of inhabitants living in their rather small municipality centre and neglecting the vast rural hinterland of the municipalities. The reason is the high

concentration of inhabitants only in the major town, which impacts upon the high percentage and thereby on the classification. These examples show the main disadvantage of the tested Eurostat methodology that uses density capita as the only criterion and so does not take into account other aspects, such as the thinly populated rural hinterland of classified spatial units.

INDICATORS	CATEGORY				
	Densely populated area	Intermediate density area	Remote intermediate density area	Thinly populated area	Remote thinly populated area
Number of municipalities	2	41	4	141	22
Population in 2012	392.157	731.232	51.704	792.628	87.775
Population density in the municipality in 2012 (inhabitants/km^2)	928,3	179,9	60,8	65,8	30,3
Total increase of population for the period 2003-2012 (10 years)	14.622	39.360	-417	26.427	-1.324
Total increase per 1000 inhabitants for the period 2003-2012 (10 years)	37,3	53,8	-8,1	33,3	-15,1
Persons in employment by municipalities of residence. Mobility from the municipality.	25.309	145.322	8.381	183.993	16.680
Persons in employment by municipalities of employment. Mobility to the municipality.	137.487	141.057	7.475	88.111	9.646
Number of companies in 2012	46.390	63.529	3.633	53.455	6.298
Public road network density in 2011 (km by km^2)	4,3	2,2	1,1	2,0	1,1
Revenue per capita in 2011	996,1	958,7	1.126,7	1.022,1	1.152,6
Investment per capita of the municipality in 2011	245,1	291,1	474,6	404,5	437,1
Population living in urban areas determined by the Eurostat methodology (in 2012)	370.079,0	523.462,3	31.940,9	79.554,1	0,0
Share of population living in urban areas determined by the Eurostat methodology in 2012 (%)	94,4	71,6	61,8	10,0	0,0
Agricultural area (fields, gardens, permanent plantation, meadows, other agricultural land) per capita in 2012 (m^2/inhabitant)	365,3	1.772,0	3.222,4	5.630,2	6.621,7
Built-up and related areas per capita in 2012 (m^2/inhabitant)	257,6	445,7	497,7	722,1	705,9
Municipality inhabitant average accessibility to cities with at least 10,000 inhabitants (min)	5,4	11,0	39,9	23,1	51,5
Average price per m^2 of unoccupied building land in the municipality (EUR)	123,0	72,2	30,7	30,8	24,0

TABLE 3.1 Indicators by 'Degree of urbanisation' classification categories in Slovenia *(Source: MAFF, 2012; SORS, 2012)*

Additional analyses of the classification were made using a selection of indicators, typical of, or at least strongly connected to, the characteristics of urban area or the level of urbanity. Table 3.1 shows 16 selected indicators that give information about five urban/rural categories defined by the Eurostat classification methodology – 'Degree of urbanisation'.

Notable differences between categories additionally enlarge when compared to the number of municipalities that form each category, especially regarding the total size of the population and the total number of companies per category. Based on the indicators shown, it is possible to observe typical characteristics of each recognised category. This helps to understand the ongoing processes that affect distribution of population and wealth. At the same time, understanding these processes can help to anticipate spatial conflicts that may emerge if identified trends continue. For example, when observing the following indicators, 'total increase of population (10 years)' and 'total increase per 1000 inhabitants', the data demonstrate that the highest increase in population occurs in 'intermediate density areas' (53,8/1000 inhabitants). This finding can be attributed to the scope of the suburbanisation process that happened in the period between 2003 and 2012, as well as to the desire of young Slovenian families and other population structures to live in the countryside and have their own house, possibly with a big garden. Another specificity of Slovenia can be observed when comparing the proportion of the population living in urban areas as determined by the Eurostat methodology in 2012. The share is relatively high in the first three categories that include major regional centres and towns: in 'densely populated areas', it amounts to 94.4%; 71.6% in 'intermediate density areas'; and 61.8% in 'remote intermediate density areas'. The share rapidly drops to 10% in the category of 'thinly populated areas', and even to 0% in 'remote thinly populated areas'. At the same time, these last two categories include 163 of Slovenia's total of 210 municipalities, which shows a large share of the population living in rural areas, according to the used Eurostat indicator. On the other hand, the indicators of 'persons in employment' – by municipalities of residence – point at a large number of mobilities for work in other municipalities. Actually, more than 52% of commuting workers in Slovenia come from 162 municipalities that are classified as 'thinly populated areas' or 'remote thinly populated areas'. Most of them are employed in companies located in 'densely populated' and 'intermediate density areas', as observed by the indicator 'mobility to the municipality' that shows the number of employed persons by municipalities of employment.

4 Discussion

When comparing Eurostat's categories, it seems clear that there are important differences between urban and rural municipalities. Even with these differences, strict spatial division, based on administrative boundaries, does not always portray a real situation (e.g., Fig. 4.1), as

functionality of space is often omitted from classification. Furthermore, strict division based on administrative boundaries neglects that very few units are in fact strictly urban or strictly rural, and that in majority of cases the administrative units actually represent a combination of both types, a 'territory in-between'. In Europe, for example, much of the territory "is neither distinctly urban nor rural but something 'in the middle' or 'in-between'" (Wandl, Nadin, Zonneveld, & Rooij, 2014, p. 50). By utilising classification methodology based on a single criterion (usually the 'resident population density'), an explanatory value is considered as insufficient (OECD, 2011; Scholz, 2009), and the territories-in-between are overlooked (Wandl et al., 2014).

FIG. 4.1 Ljubljana case example: Hrušica (middle) and Bizovik (right) neighbourhoods form parts of Ljubljana urban area, but the situation on the ground points to typical examples of the urban-rural continuum.

Urban/rural classification represents a basis for the definition and implementation of spatial planning policies. Such customised policies define specific processes for each type of area according to the urban/rural dichotomy, in spite of all identified shortcomings. Consequently, the policies do not take into account the real nature of the territories-in-between.

4.1 Urban-Rural Blending

In conditions in which 'urban' and 'rural' terminology has no fundamental defining basis (UK ONS, 2016), it seems even more difficult to grasp the meaning of those areas that are neither rural nor urban, or are both urban and rural. Territories–in–between combine various forms of spatial development, for which planners and researchers use different descriptions, such as urban-rural interface, rurbanisation, suburbanisation, sprawl, urban–rural relations, urban–rural fringe, peri–urbanisation, etc. (Hiner, 2014; Madaleno & Gurovich, 2004; Wandl et al., 2014). To perceive diversity and complexity, and to provide adequate development policies, clearer definitions and redefined methodologies for measurement and comparison of blended territories are needed.

With appropriate planning, blended environments have the potential to capture the most valuable characteristics of both urban and rural contexts. On the other side, urban-rural hybridisation, when overlooked, may result in undesirable conditions. In a constantly transformable, urbanising world, blended territories could become a very frequent

spatial form in future, for which reason the causes of their emergence, processes, flows and states occurring in their development, and the development outlooks, are important to consider. According to these factors, the following forms of urban-rural blending can be identified: the state of urban rurality; blending processes at the urban edge, including the urban-rural continuum; remote urbanity; and rural urbanity.

4.2 The State of Urban Rurality: Rural Space in Transformation

The transformation of rural into urban environment is a well-known process in the history of urban development. Broadly speaking, the whole modern society can be regarded as a "thoroughly transformative environment characterized by rapid, widespread and ongoing reconfiguration affecting all practical-symbolic aspects of human existence" (Dawson, 2016, p. 17).

Under the influence of the global trend towards urbanisation, rural settlements are transforming and acquiring, to a greater or lesser extent, the characteristics of urban settlements. On the other hand, by examining scientific literature and by analysing settlement flows, which help to understand demographic trends, the transformation of social environment, and the urbanisation process, it has been found that the term 'urbanisation' does not only refer to the growth of cities, but to the emptying of remote rural settlements (e.g., across the Western Balkans territory). Therefore, the introduction of urban metabolism (e.g. Levine, Hughes, Mather, & Yanarella, 2007) into a rural environment is a way to prevent its further deterioration and abandonment.

The flows and outcomes of rural transformation into a state of urban rurality are diverse. With the introduction of urban elements into a rural space in the planning process, several sensitive issues emerge, such as the preservation of traditional, cultural, and landscape values, and the application of the principles of sustainability and resilience. Planning process aimed at reaching the state of urban rurality may be considered as particularly crucial for achieving sustainability and resilience of rural communities.

4.3 Blending Processes at the Urban Edge

In suburbanised areas, the most common denomination of the state of spatial development is the 'patterns of transition', representing a result of dynamic dispersing processes flowing from densely populated urban centres towards the countryside. Most authors agree that the phenomenon of suburbanisation may be understood as a spatial expression of societal changes. The manifestations of these changes are reflected not only in urban growth, or the expansion of single-family houses on the outskirts of urban areas (as is the case in Slovenia, for example), but also in the modification of employment structure, both in urban centres and their outskirts.

Another process that provokes spatial changes in peripheral areas is defined as 'de-urbanisation' or 'counter-urbanisation'. These two terms portray the displacement of population from metropolitan to rural areas, or, as described by some authors, the displacement outside the reach of daily migration (Rebernik, 2008). The most common factors that cause counter-urbanisation are: improved road transport network, improved access to rural settlements, ever-longer daily migration, lower costs of rural living, decentralisation of jobs, development of employment opportunities in rural areas, higher incomes and higher living standards, higher share and higher incomes of the retired population, desire to live in a single-family house in a rural setting, rural nostalgia, rejection of the urban environment, etc. (Pacione, 2001; Rebernik, 2008).

Local flows that are related to the changes in societal life (e.g., in the Balkan area from the 1970s) are known as 'urban sprawl'. This phenomenon can be understood as the physical expansion of sites, where the built-up areas of lower densities (including, besides dwellings, the facilities for production and commercial purposes) grow faster than the number of inhabitants. Nonetheless, this process can be considered only as a part of a larger process associated with the much more complex concept of suburbanisation. In fact, sprawl is nothing more than a wasteful land occupation in the suburbs, a consequence of the growth of uncontrolled settlements and the transfer of economic activities from urban to rural areas (Ravbar, 2005, p. 32) (Fig. 4.2).

FIG. 4.2 Sprawling edges of Priština, 2016

The causes of sprawl phenomenon are economic, social, environmental, and legal (Pichler-Milanović, 2007). Types and manifestations of sprawl are to a largely conditioned by the very (primarily social) causes of its emergence. By understanding the causes of urban sprawl formation, the measures for its management can be formulated.

4.4 Remote Urbanity: Non-Rural Forms in Agrarian Landscape

The form of 'remote urbanity' refers to the insertion of distinctive urban and other non-rural elements into typical rural settings, such as remote residential developments (e.g. Kosanović, Popović, & Fikfak, 2016), commercial or production complexes, etc. The difference from other previously defined processes is reflected in the high contrast, and disconnection, between the newly built space and surrounding agricultural landscape (Fig. 4.3). Despite the fact that agricultural land is intensively exploited, inserted urban elements predominate over the agrarian.

FIG. 4.3 Ručetna vas (the name of the settlement includes the word 'village'), municipality of Črnomelj, Slovenia. Visual disconnection between inserted non-rural element and surrounding dispersed rural pattern

Remote urbanity, as a type of urban sprawl, emerged after the Industrial Revolution (e.g. satellite housing settlements as models of Howard's 'garden village'). Further remote urbanisation, in particular housing construction and the related development of supply and service activities, continued after World War II (in the case of the Balkan area). Today, the negative impacts of remote urbanity are brought into relation with the usurpation of fertile agricultural land, pollution generation, alteration of the identity of agrarian landscape, endangerment of rural heritage, and visual intrusion of agrarian landscape. Accordingly, remote urbanity can critically be defined as a habitat fragmentation agent, an instant urbanity with self-organisation and consequent spread of environmental, social, and economic problems.

4.5 Urban-Rural Continuum

In recent decades, the 'rural–urban continuum', characterised by the absence of clear boundaries between rural and urban space, has been accepted as a new form of territory. The intertwining of rural and urban has enabled a greater economic stability of the countryside and a new, richer cultural environment. The idea of rural–urban continuum in society proceeds with the transfer of characteristics and qualities of countryside into urban environment, which is closely related to food

production and self-sufficiency of broader functional urban areas (Fig. 4.4). Nonetheless, accessibility to goods and services in rural-urban areas is generally lower, as mobility and transport options are more modest. This hinders accessibility, both time wise and in physical terms.

The urban-rural continuum is a well-studied phenomenon. Numerous studies on this new form of territory have been undertaken from various disciplinary perspectives, including geography, environmental and spatial planning, and urbanism (Andexlinger et al., 2005; Magnago Lampugnani, Noell, Barman-Krämer, Brandl, & Unruh, 2007; Campi, Bucher, & Zardini, 2000; Couch, Leontidou, & Gerhard, 2007; Woods, 2009; Zonneveld & Stead, 2007). The conducted research has broadened characterisation beyond the population density in order to examine three main spatial qualities: morphology of mixed built and open spaces; connecting and separating role of infrastructure at different scales; and the specific mix of functions on regional level (Wandl et al., 2014).

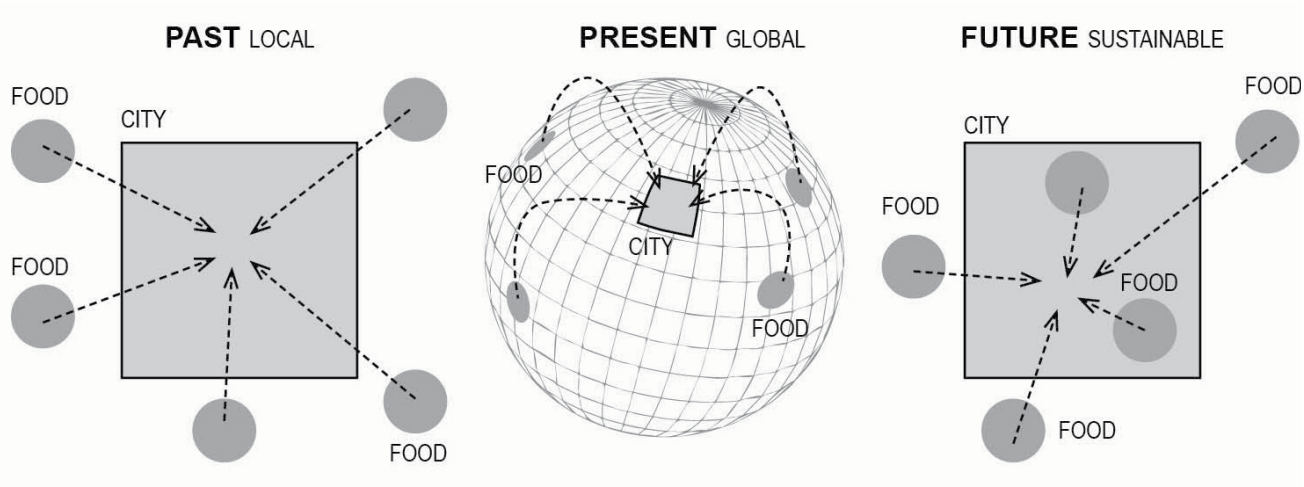

FIG. 4.4 A changing relationship and connectivity between urban and rural *(Fikfak, Mrak, & Zavodnik Lamovšek, 2012)*

4.6 Rural Urbanity

The form of 'rural urbanity' refers to the preservation of existing, or the insertion of new typical rural elements, i.e. the parts of rural heritage into urban matrix, such as vegetable gardening (Fig. 4.5), livestock farms, beekeeping, production of species and herbs, or cultivation of crops. Depending on the origin, rural urbanity could be considered as a process that is integrated into the urban-rural continuum, or as a form inserted among typical urban functions. To that end, Lehmann (2010, p. 103) has noted that "new situations do not necessarily have to be 'designed'; they often emerge and develop by themselves out of the potential of authentic urban places and of what already exists". By inserting rural forms, in line with contemporary urban and architectural design strategies (e.g., Torreggiani, Dall'ala, & Tassinari, 2012), the urban environment seems to nostalgically tend to evoke rural features through sustainability and resilience building measures, in particular through the construction of ecological networks, food supply,

air and water purification, regulation of microclimatic conditions, etc. According to Tzoulas et al. (2007), there is an intricate and inextricable relationship between urban green infrastructure and its impact on human well-being, thus rural urbanity represents a desirable state of an urban environment.

An increase in gardening within urban Western societies in recent years may be seen as an antidote to anxieties and perceived risks associated with changes in lifestyle, including the development of technology, globalisation, and wider environmental degradation (Bhatti & Church, 2004). Recent migrants from rural to urban environments may see the domestic garden primarily as a food resource and not as an aesthetic feature per se (Head, Muir, & Hampel, 2004).

FIG. 4.5 Urban agriculture, Ljubljana, 2017

5 Conclusions

Diverse spatial features offer a variety of opportunities for development, but the development is, from the other side, also influenced by different economic, social, and environmental factors. Recognition and understanding of the differences in space is essential for the smart exploitation of potentials and for the determination of the course of sustainable development. Continuous spatial changes, and the consequent growth in development disparities, represent an additional justification of the need to identify differences among spatial forms.

Despite contemporary criticism, rural/urban classification continues to be used as an elementary territorial division, in line with ongoing spatial transformations and concurrent socio-economic, environmental, and cultural factors. Nonetheless, urban/rural classifications often do not include 'sophisticated' flows, states, and conditions existing in a certain area, especially when urban and rural characteristics are blended or overlapping. The significance of the territories-in-between, the nature

of their metabolism, the impacts they generate, and the course of their development therefore must not be overlooked.

Guidelines for spatial planning should promote non-confrontational interlacing and co-existence of different spatial and cultural patterns and accompanying social structures. Smart urban-rural blending (in spatial, economic, and socio-cultural terms, as presented in this paper) creates a new relationship between natural environment and activities in built space. The interlacing of rural and urban culture in agrarian areas allows for greater economic stability and a richer cultural environment. Equally significant, the introduction of rural urbanity promotes environmental regeneration as an advanced form of urban sustainability.

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Sustainability of Rural Areas _

Exploring Values, Challenges, and Socio-Cultural Role

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ABSTRACT **In spite of the challenges that rural areas encounter today, their characteristics are of great importance globally. From food production to natural, social, and cultural values, and to distinctiveness and diversity, rural areas play an essential role in the sustainable development of global society, and therefore, the preservation of such areas is necessary. Starting from the consideration of the 'rural' concept, this paper identifies and describes the main values of rural areas, further discusses their major contemporary challenges, and finally explores the paths towards more sustainable rural environments, offered through the research work, policies, strategies, development plans, etc. The importance of the social dimension of rural sustainability has been recognised, and particular attention in the work has been assigned accordingly to the characteristics of rural communities. Having regarded that the major part of contemporary spatial research focuses on the urban environment, which is accompanied by decreased interest in rural studies, the intention is to contribute to the alleviation of this recognised imbalance.**

KEYWORDS rural area, rural community, value, sustainability, strategy

1 Introduction

In the literature, the notion of 'rural' is most often defined by contrasting the notion of 'urban'. For example, Ratcliffe, Burd, Holder, and Fields (2016) consider a *rural area* as any geographic area that is outside of small towns. This would mean that every non-urban area is rural. Such observation, nevertheless, does not offer the clarification of this notion, especially when considering the global transition from rural to urban, which contributed to the emergence of mixed settlements that are neither urban nor rural, or are both urban and rural.

The determinants of human settlements are changing through time, together with socio-economic circumstances. This leads to the continuous remodelling of the perception of rural and urban areas. Today, different countries around the world establish their own definitions of rural areas, which are most often based on determined thresholds of population density and the accompanying economic and social conditions, and obtained by statistical analyses of administrative units. In Canada, for example, a rural area is a territory located outside a settlement of at least 1000 inhabitants and with a population density of at least 400 citizens per square kilometer (Statistics Canada, 2009). In the United States, a rural area has fewer than 2500 inhabitants and a population density that can vary as much as 999 to 1 person per square mile (Womach, 2005, p. 223). A rural area in the UK is that which is outside a settlement of more than 10000 inhabitants (Department for Environment, Food and Rural Affairs, 2016). With the aim of making a consistent basis, the Organization for Economic Co-operation and Development (OECD) has developed a new regional typology that classifies the regions of member countries into 'predominantly rural', 'intermediate' and 'predominantly urban' regions (Directorate for Public Governance and Territorial Development, 2011). The first step of OECD classification methodology consists of identifying the local rural units with a population density below 150 inhabitants per square kilometre (or 500 inhabitants for Japan and Korea, to account for the fact that the national population density in these two countries exceeds 300 inhabitants per square kilometre). According to the share of the population living in rural local units, the regions are later classified as predominantly urban (the share below 15%), intermediate (if the share of the population is between 15% and 50%), and predominantly rural (if the share is higher than 50%).

Although population density represents a significant indicator, its exclusive utilisation in distinguishing urban from rural is insufficient. In actuality, the word 'rural' is affiliated to many different meanings (Hart, Larson, & Lishner, 2005). Pizzoli and Gong (2007) have argued that the joint use of other factors such as agriculture and economic specialisation, human resources and skills, land cover, and spatial dimensions of social life, would significantly improve accuracy in the approximation of probability of areas being either rural or urban. Following population density, agricultural landscapes, high vegetation, open spaces, low density of buildings, underdeveloped infrastructure, individual houses, low-rise buildings, and integration of living and other

functions (Konečný, n.d.) are only physical or material characteristics of rural areas, while the aspects that concern social construct, economic situation, and traditional and cultural values account for immaterial or intangible characteristics.

2 Why Does Rural Matter?

In spite of challenges that rural areas encounter today, their characteristics are of great importance globally. From food production to natural, social, and cultural values, and to distinctiveness and diversity, rural areas play an essential role in the sustainable development of global society. To preserve rural areas, it is crucial to highlight their values and to address the problems that jeopardise these values (Section 3), so that the possibilities for solutions can be explored (Section 4). In this regard, the recognised values of rural areas are listed in Fig. 2.1.

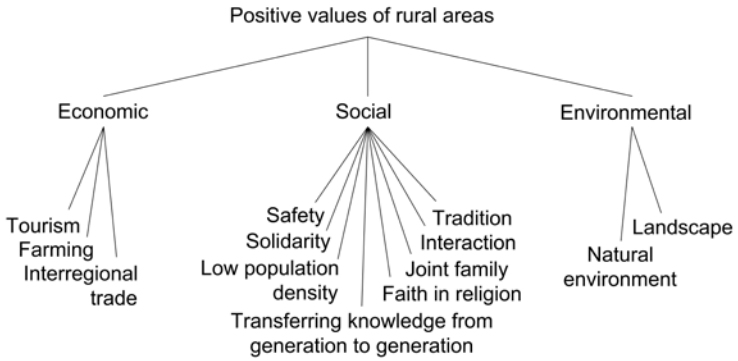

FIG. 2.1 The values of rural areas

By comparing urban and rural areas in the United States, Berry and Okulicz-Kozaryn (2013) have concluded that people who live in small towns and rural peripherals are happier than those in large cities. For Okulicz-Kozaryn (2015a), lower population density contributes to the feeling of happiness, while urbanisation is connected with the feeling of dissatisfaction. Further, Lederbogen, Haddad, and Meyer-Lindenberg (2013) have argued that high population density and overcrowding in urban areas leads to an increase in violence, a loss of work, and a sense of insecurity and danger. In contrast to the natural ambience of rural areas, the lack of vegetation and high concentration of environmental pollutants in urban areas aggravate physical and mental health and wellbeing. According to results of the study presented by Schaller (2012, pp. 36-39), higher level of stress in urban areas can be connected to a higher level of measured blood pressure, compared to rural areas.

Social interaction between rural residents is characterised by greater stability and continuity, because of more profound relationships and more face-to-face contact. Common experiences, customs, traditions, and knowledge shared between the inhabitants of rural areas thus represent the foundations of rural communities, and the transfer of these values from generation to generation helps to preserve rural

A

B

FIG. 2.2 A+B: Traditional houses in village Sredska, a distinctive representation of material rural culture

A

B

C

FIG. 2.3 Diversity of rural landscapes: (A) productive landscape on Kosovo plain, (B) coastal rural landscape, fishermen's hamlet Bjelila in the Bay of Kotor, and (C) rural settlement Ljubinje on Šar-Mountain.

culture and identity, and hence diversity. On the one hand, cultural diversity means more flexibility, less vulnerability, strengthened resilience, and therefore better social stability (Lisocka-Jaegermann, 2006), while on the other hand it can also be significant in improving the sustainability of ecosystems (Berkes & Folke, 1994).

While local knowledge and other traditional cultural values such as customs, personal values, beliefs and norms of rural communities represent intangible rural heritage, traditional handcrafts, significant buildings and other heritage artefacts and sites form parts of material rural culture (Fig 2.2). Rural landscape is a close determinant of rural areas (Fig 2.3). It includes both material-physical reality and immaterial existential values and symbols (Antrop, 2006). As such, rural landscape is not only a mere picture of the environment, but also a living and changing structure (Palang et al., 2006). For rural inhabitants, "landscapes appeared both as an expression of the farming systems and as the material basis of social, cultural, and political units" (Claval, 2005, p.13). The significance of rural landscape is reflected in the achievement of place attachment, strengthening the identity of a community, and improving its resilience (Palang et al., 2006).

Even though, nowadays, food production is notably less dependent on human resources, it still makes up a general characteristic of rural areas. Gardening, agriculture, and farming are important both for economic development of a country (Rural Regeneration, 2012) and for the local development of rural areas. Food production and local food markets therefore provide various economic and social benefits (Young-Chool & Hak-Sil, 2015; Feagan, Morris, & Krug, 2011; Brown & Miller, 2008).

3 Rural Issues Today

Contemporary problematic rural issues can be classified as economic, environmental, and social (Fig 3.1). Compared to the previously discussed values of rural areas, a major concentration of both values and challenges has been observed in the social domain. Such an observation assigns priority to the consideration of the social factors of rural sustainability. Nevertheless, casual relations between the three groups of identified problems require their holistic analysis.

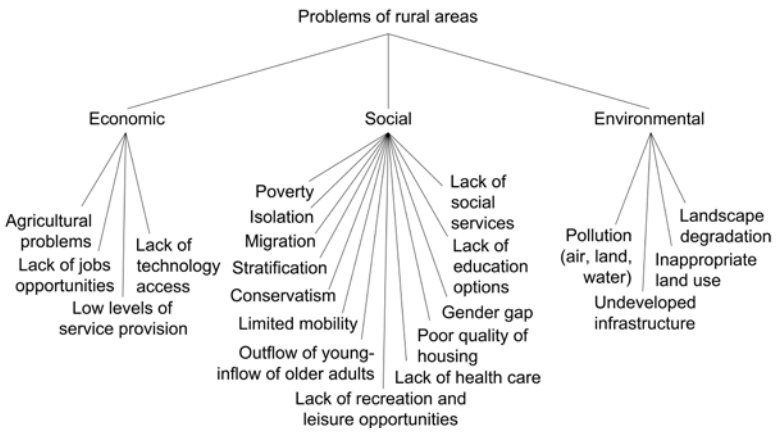

FIG. 3.1 Rural problems today

The process of deruralisation (also referred to as depopulation, rural flight, or rural exodus) represents the manifestation of migration of rural population, which many authors call 'the new phase of globalization' (Czaika & Haas, 2014; Overbeek, 1995; Stalker, 2000). On the other hand, migration is a consequence of different economic, social, or environmental problems existing in rural areas. If current trends of the depopulation of rural areas continue, the world could, according to predictions, become 100% urban by the year 2152 (Kovács, 2009, p. 20). The process of deruralisation could, therefore, cause the disappearance of a large part of cultural tradition, which would consequently result in a 'poorer' and monotone society with no identity (Kovács, 2009, p. 33). Having regarded that deruralisation is happening simultaneously with urbanisation, rural sustainability can only be reached simultaneously with urban sustainability (Bryant & Granjon, 2009).

The urbanisation of rural areas changes the habits, behaviours, and needs of rural inhabitants, and transforms rural culture. Uncontrolled

inflow of urban culture into rural areas affects local material and immaterial cultural heritage and causes the loss of rural traditions and local rural diversity.

Agricultural problems and the lack of job opportunities, technologies, and services in rural areas create economic challenges that can directly be connected to global concern with the increase of poverty and dissatisfaction with rural life. Rural economy is mainly dependent on natural resources. Horticulture, crop production, mining, farming, forestry, fishing (Surchev, 2010), and, more recently, tourism (Briedenhann & Wickens, 2004), are the main sources of income for rural inhabitants. Inadequate maintenance and management, and community's attitude towards these resources intensively transform rural landscapes (Smith, Convery, Ramsey, & Kouloumpis, 2016) and cause unsustainable development of rural areas.

Inappropriate and uncontrolled land use and the lack of waste management in rural areas, commonly associated with small-scale, fragmented (Pašakarnis, Morley, & Maliene, 2013) agricultural production, result in pollution of air, water, and soil, while, from the other side, agricultural industrialisation and large-scale production reduce the number of people engaged in agricultural activities, thus reducing the employment opportunities for rural residents.

Agrarian landscape is nowadays subjected to transitions and transformation for many different reasons (e.g. Kosanović, Fikfak, & Popović, 2016; Lekić, 2015). This makes rural inhabitants "become more suspicious of change, as conditions in the present and for the future are unstable" (Palang et al., 2006, p. 353) and increases their vulnerability. Nevertheless, the degradation of rural landscapes may also happen because of the new residents who are not interested in rural values in the same way as farmers or permanent residents (Gorka, 2016).

Although a low-density built environment means more intensive presence of natural elements, it is, at the same time, often connected to undeveloped infrastructure, limited mobility of inhabitants, and consequently to their isolation. Rural poverty is not indicated only by the lack of job opportunities, but also by the fact that rural workers earn lower wages than urban workers (Thiede, Lichter, & Slack, 2016). Scotland's case study points to issues concerning the legitimacy of the influential rural institution of private land ownership and its governance approaches, highlighting the lack of community involvement in estate management (McKee, 2015). Poverty, migration from village to city, limited mobility of inhabitants, lack of health care and education, poor quality of housing, outflow of young people and inflow of older adults, differences in status between men and women, lack of social services, lack of leisure and recreation opportunities, conservatism and stratification are all current concerns of rural communities. To achieve rural sustainability, it is necessary to conceptualise new visions of the overall way of living, and not only to those that relate to economy and technology (Čolaković – Prguda, 2015). If human consciousness and lifestyles do not change, their relation to environmental, economic, and social concerns in favour of sustainability will not improve.

4 Towards Sustainability of Rural Areas

Sustainability-related plans for rural areas should primarily address the prevention of further deruralisation. To that end, it is believed that the intensification of research about social-cultural issues could assist in providing better outcomes towards the achievement of sustainability of rural areas.

According to Viederman (1993, p. 37), the community is of crucial importance for survival. Assuming that "rural sustainability, like urban, is a social construction" (Bryant & Granjon, 2009, p. 162), the sustainability of rural communities should be understood as a cornerstone of the sustainability of rural areas.

Whether it is a place of living or work, interests, attitudes, actions, habits, or customs, community is characterised by shared commonality. To form and sustain a community, according to Peck (1987), means to cross a path from pseudo-community where the politeness is dominant, to chaos – when the emotional skeleton goes out, to emptiness – the time of silence and transition, to the real community marked by deep respect and care. However, nowadays, this process is interrupted, and even reversed, for different reasons. For example, Okulicz-Kozaryn (2015b) explains how community disappears as the size of the city and the capital increase. This can further be connected to the shifts in identity and belonging as important agents that bond communities from the inside. Therefore, there are certain codes of behaviour and, more deeply, the desired emotions (like empathy) connected to identity and attachment, that play a role in sustaining the existing and building new, sustainable, rural communities. The inevitable process of urbanisation must be redirected from undermining to enhancing the survival of rural communities.

Daskon and Binns (2009, p. 494) have pointed out the importance of interaction of culture, sustainability of living conditions, and community development. According to theses authors, the transfer of traditional cultural values to future generations is crucial to strengthening the safety of a community, and to its sustainability. Previously, Berkes and Folke (1994, p. 7), argued that local knowledge allows people to cope with the challenges inherent in their environment. By using traditional skills and knowledge, a community adapts better to newly emerging situations, which strengthens its resilience (Daskon & Binns, 2009). As tangible and intangible values of an area are entangled in landscape, it represents an important segment of community identity. "Local traditional communities have a strong identity, clearly expressed by the landscape and landmarks" (Claval, 2005, p.18). For these reasons, the preservation of agrarian landscape as cultural heritage must be prioritised in sustainability strategies.

4.1 An Overview of Strategies and Research Findings

Early concerns for rural areas in different international agendas have been expressed in terms of: proper management, planning and improvement of rural settlements, educational programmes, agricultural waste management, improvement of agricultural mechanisation, and exchange of knowledge and experiences in agricultural skills (United Nations, 1972); promotion of sustainable agriculture and rural development by initiating increased food production, improving its security in a sustainable way, using economic encouragements and developing new technologies (United Nations, 1992); inviting various institutions, agencies, government and non-governmental organisations to help boost productivity and farmers on a sustainable basis (Economic and Social Council, 1995, p. 40); etc. A growing interest in rural issues on a global scale was expressed at the Rio+20 United Nations Conference on Sustainable Development, organised in 2012, where a need to create a policy that will strengthen sustainable forms of agriculture by transforming unsustainable, industrial farming practices into systems that protect biodiversity, increase soil fertility, and ensure safe and nutritious food for all have been initiated (United Nations, 2012).

Recent recognition of the social problems in rural areas has resulted in the development of a number of strategies, plans, policies, and various forms of activities aimed at enhancing the development of sustainable rural communities worldwide (e.g. Housing Executive, 2016; Partnership for Sustainable Communities, 2011; The Irish Rural Dwellers Association, 2012; The Rural Coalition, 2010).

Researchers advocate various possibilities of promoting the sustainability of rural areas while assigning a central role to rural communities, such as: age-friendly and inter-generational support within the community (Spina & Menec, 2013; Camarero, Cruz, & Oliva, 2014); improvement of educational opportunities and family role for young adults to remain in their rural communities (Homan, Hedrick, Dick, & Light, 2014); contribution of rural businesses and social enterprise that increase job opportunities in rural areas (Steinerowski & Steinerowska-Streb, 2012; Steiner & Atterton, 2014, 2015); importance of local leaders role and their relationship with the processes of governmentality (Beer, 2014); importance of community landownership for reconstructing rural development in a sustainable manner (McMorran, Scott, & Price, 2014); the benefits of rural branding (Eugenio-Vela & Barniol-Carcasona, 2015; Swinney, Lang, & Runyan, 2012); etc. According to Swinney, Lang, and Runyan (2012, p. 43), the "strength of feelings between residents can guide further community development", and work on place branding, with community involvement, can strengthen its identity and influence economic development. Another research study has shown the significance of collective memory in the development of community identity and the perception of, and method of coping with, environmental threats (Messer, Shriver, & Adams, 2015). For Sunblad and Sapp (2011, p.531), "practices and development strategies that create greater levels of interaction among and between neighbours might prove to strengthen local residents' attachment to

their communities". Community attachment is also related to the "lower odds of problem substance use and delinquency in rural youth" (Van Gundy, Stracuzzi, Rebellon, Jenkins Tucker, & Cohn, 2011, p.293), while having a connection to place "highlights the people-place relationships that are a driving force for sustainable practice" (Baldwin, Smith, & Jacobson, 2017, p. 39). Thus, primary sense of empathy, strong identity, and attachment capacity are the characteristics of rural communities that improve their resilience and sustainability.

The study of rural areas in central Italy reveals the importance of traditional farming systems and several other activities such as craftsmanship in contributing to the sustainability of rural areas, proposing strategies that "would be capable of strengthening residents' sense of place and transforming the local community into a more resilient and adaptive socio-ecological system" (Gobattoni, Pelorosso, Leone, & Ripa, 2014, p. 412). Another study, referring to the context of economic crisis, resulted in a set of factors, closely linked to the resilient character of the territories, according to which rural areas may develop (Sánchez-Zamora, Gallardo-Cobos & Ceña-Delgado, 2014).

The potential of rural tourism and its contribution to spatial development on local and regional levels have also been widely recognised (e.g. Gadžić, 2016). According to Reeder & Brown (2005, p. i), "tourism development contributes to rural wellbeing, increasing local employment, wage levels, and income, reducing poverty, and improving education and health".

Pender, Weber, and Brown (2014) have pointed out the necessity of better data and research on rural wealth creation and the importance of using the approaches that are suited to particular rural areas and, furthermore, gave an insight to contextual factors and wealth endowments influencing potential for emerging energy industries. Van Berkel and Verburg (2010) have emphasised notable variations between European regions regarding rural development and proposed an approach that "draws upon a number of theoretical and descriptive studies and expert knowledge which is translated into rural development capacities and presented in maps" that would "offer policymakers an alternative perspective to target rural development policy and by understanding diverse rural potentials for multiple and mono-functionality uses" (van Berkel & Verburg, 2010, p. 457-458).

In a brief analysis of several European innovative projects for rural areas, Esparcia (2014, p. 1) has noticed that "some findings suggest that innovation is particularly common in food production, as well as in the environmental and energy sectors". An evaluation study of the implementation of the *European Innovation Partnership* for agricultural productivity and sustainability shows that the "bottom-up and farmer-led approach is truly distinctive and highly appreciated by stakeholders" (European Union, 2016, p. 2). In addition, evidence from a number of studies (Glasbergen, 2000; Gertler, 2001; Steinerowski & Steinerowska-Streb, 2012; Steiner & Atterton, 2014, 2015) shows positive outcomes

from the influences that rural private enterprises and rural cooperatives have on rural sustainable development.

Nevertheless, some studies reveal the shortcomings of current rural development policies and their application. Exploring the application of the EU rural development policy, in the context of territorial cohesion perspective, in the case of the Czech Republic during the long-term period of 2004–2013, Pelucha, Kveton, and Safr (2015, p. 26) noticed that "EU's rural development policy is not a policy of development or broad-based rural", as it is rather applicable to agricultural aspects. Sotte, Esposti, and Giachini (2012) pointed to the problem of putting a focus on agricultural development in the time of 'post-industrial rurality', and suggested that the policy-makers should cooperate more intensively with researchers in order to make rural development policies more effective. The document *Policy Recommendations for Sustainable Rural Communities in Europe* explored the energy challenges of rural areas, finding that the EU policy framework has insufficiently explored these issues (Future of Rural Energy in Europe, 2012). In addition, this document acknowledges the possibilities and justifies proposals to reduce the weight of energy expenses on rural households, which would have a series of benefits for rural society. It is necessary to re-examine the priorities that contribute to the sustainability of rural areas and their communities. Therefore, a transdisciplinary approach to planning for the sustainability of rural communities and the implementation of a greater number of strategies targeting specific areas are necessary.

5 Conclusions

Compared to the urban environment, the rural environment offers greater natural diversity, better contact with the natural environment, healthier places, cultural specificity, nurtured tradition, traditional values, and rich heritage. This idyllic rural picture, however, undergoes intensive changes with the onset of global urbanisation that immeasurably transforms the rural environment, together with a number of its economic, social, and environmental determinants. Therefore, any consideration of rural areas is essentially a consideration of their survival, endurance, and sustainable transformation. The socio-cultural role of rural areas in these states is crucial, as evidenced by a number of studies that seek opportunities for improving rural environments and preserving positive rural values as parts of global cultural tangible and intangible heritage. The purpose of social characterisation is to firstly assist in achieving the sustainability of rural communities, and then to actively engage sustainable communities in achieving the sustainable development of rural areas.

Several obstacles and challenges have been set in front of the goal of achieving rural sustainability. They concern the insufficiency of applicable strategies and often inadequate application of adopted strategies, a large number of narrowly profiled research studies that do not examine the problem systemically, as well as the introduction of

new contemporary spatial theories that tend to change the concept of rurality in relation to its entire history. This paper has shown that the importance of rural areas for global sustainable development is high, and that, accordingly, the primary set of actions for sustaining them should be directed towards reducing the trend of deruralisation. At the same time, it is necessary to raise awareness of the importance of rural areas worldwide and to engage significantly larger number of experts, researchers, policymakers, governmental and non-governmental organisations in the processes of solving the contemporary rural issues. Although the actions towards sustainability of rural communities, and therefore towards sustainable development of rural areas, should simultaneously target economic, environmental, and socio-cultural aspects, effective and proactive approaches to problem solutions should be tailored according to local barriers, priorities, potentials and goals, having considered contextual specificities and the diversity that needs to be preserved.

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A Shared Wellbeing _

A Path Toward More Resilient Communities and Sustainable Spaces

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ABSTRACT **Today, the concept of sustainability is directly connected to quality of life and the perception of it. It is an issue that refers to the individual sphere and is directly related to living habits. The *aporia* of the traditional welfare system, as well as the growing complexity of social needs, has moved people toward new research strategies and ways to create an increase in wellbeing. New ideas about the creation and placement of residential dwellings in communities have emerged through the recognition that group community spaces can be used to strengthen relationships between citizens and their environment. On one hand, it means recognising the value of *living close* as a basis for sharing needs and resources. On the other, it offers the possibility of a rearticulated urban geography of local 'lumps' partially autonomous and partially connected. That is to say that it envisions new ways for people to be connected and autonomous at the same time, to enjoy the green space that private housing allows, while simultaneously enjoying the enriched community advantages that accompany dense urban living.**

KEYWORDS wellbeing, sharing practices, neighbourhood, proximity

1 Introduction

The concept of sustainability, as suggested by the Brundtland report (Brundtland commission, 1987), refers to an attempt to balance the satisfying of present needs and the ability of future generations to satisfy their own. This definition puts the emphasis on the responsibility of the current generation to ensure the perpetuation of individual and collective wellbeing. In this sense, the environment plays a key role in qualifying the spatial quality as well as in finding resources.

This means, on the one hand, working on technological innovations to optimise the economical availabilities, while on the other hand, working on living habits to improve lifestyle, and direct it toward more conscious and resilient forms. Indeed, collective behaviours have had the power to modify individual needs and, above all, to influence the production and promotion of strategies of wellbeing. A change based on new connections among citizens, and between citizens and space. Such a *thickening of relationships* (Bianchetti & Sampieri, 2014), built on local resources and communities, also changes the spaces in which they occur to become more resilient places: spatial forms hardly inscribed into traditional polarised categories (private – public, indoor – outdoor), mutable and easily characterisable, able to promote innovative practices. Here the term 'community' is used to refer to social groups that are not related to the familial, cultural, or religious relationship; they are rather small and *simple societies* (Durkheim, 1893) sometimes without close adhesion or participation rules, rather than linked by affinities and proximity. They are not, indeed, polyfunctional buildings, typical of a previous and public welfare system, but rather 'adaptive' structures that are constantly evolving.

Furthermore, they rarely refer to traditional top-down or bottom-up policies, nor to conventional subsidiary strategies: indeed, in some nations, the autonomous initiative of citizens in support of the common interest is also recognised and regulated by law (Arena, 2007), for example in Art. 118 of the Italian Constitution. This means not just involving people in participation processes, but also an acknowledging the value of individual or associate actions to the collective wellbeing.

This phenomenon has been observed in several European cities and finds its justification in a widespread and overall change of individual and collective needs, and is related to wellbeing research strategies. Indeed, there are many experiences that move, in some way, to balance the weakening of social ties, the economic crisis, and the loss of value and meaning attributed to space. As Abraham Maslow (1954) would observe, the satisfaction of people's own needs, and the willingness to apply their resources in the field, is an important 'engine', capable of moving the social, cultural, and economic system of society.

To sum up, the shared production of wellbeing can be seen as a starting point to observe the change in building urban forms of resilience through the rooting of cooperative practices. This claim, however, must first explain what it means today to talk about wellbeing and

what its articulations are. The first part of this paper moves inside this question. The second focuses attention on spatial fallouts of the change of living habits toward such cooperative forms. Each section starts with a definition of the topic and continues with an articulation of it in three different, but strongly linked, aspects. Increasing our understanding and appreciation of the complexity of these issues is the main objective of this paper.

2 Welfare and Wellbeing

Today, wellbeing is a broad concept that easily weaves individual actions and perceptions with collective ones. However, for several decades the idea, and the production, of initiatives to improve quality of life have been delegated to the public welfare state. Especially in the last century, it has played a central role in improving living conditions, even if it has now lost much of its relevance (Munarin & Tosi, 2014). In Europe, the concept has been subject to critical examination for decades, sometimes in relation to its costs, and occasionally concerning its opportunities and objectives. It is not within the ambition of this work to resume a story of the welfare state, nor the arguments that it has crossed, but it is important to remember that over the years there have been alternations and sometimes the coexistence of different models and strategies. For a more detailed reconstruction of the historical evolution of the welfare state, Rimlinger (1971) or Ferrera (1993) are suggested sources, while Esping Andersen (1990-1999) provides an analysis of different welfare regimes. For example, in the United States, the model is predominantly liberal (Esping Andersen, 1990) and is based on a limited public involvement that has often been seen as an improper, or even disempowering interference, on citizens; it is admitted just to help the groups who are not able to access private forms of welfare.

Today, the consolidation of past requirements (safety, privacy, self-representation) and the rising of new concerns (ecology, sustainability) have made public intervention more complex and difficult. Several scholars, from different points of view, have recently observed the emerging variety of new fleeting urban needs related to the evolution of the social and cultural system (Sennett 1970; Bauman 2000; Amin & Thrift N. 2002). This condition has moved toward more autonomous and self-made actions at the individual dimension as well as at the collective one. The availability and access to each of these assets determine the level of each individual's wellbeing and that of the community as a whole. Therefore, it is hard to define the boundaries of the public welfare state, but it is also very complicated to understand who can play the promoter or producer role of wellbeing. Certainly, wellbeing is also related to access to several goods that are sometimes public, and other times are not. To understand this point better, it is important to clarify the difference between private goods, club goods, commons, and public goods (Mas-Colell, Whinston & Green, 1995). Private goods are characterised by rivalry and excludability, in other words, they are goods that cannot be used simultaneously by different people and can

only be used those who have paid for them. Club goods are excludable and are somewhat related to rivalry, while the commons are rival goods that are not excludable i.e. they are exhaustible or alterable: air, water. As far as public goods are concerned, they are neither excludable nor rival. It should also be noted that the concept of property needs some further specifications (O'Sullivan, 2007) to understand whether the owner has the capability to access or to restrict access (exclusivity), or whether he or she can manage it (management), or modify and sell it (alienation). To sum up, wellbeing, in both its research and its production, is something that relates to individual needs and resources, as well as to the mutual influences among people. Furthermore, the advantages of aggregation have moved humans to cooperate in order to improve their conditions.

2.1 Individual Utilities

To understand the complexity of aspects concerning wellbeing, it is important to begin taking care of the density of features that it brings with it, while also referring to individual aspects. Though it may seem far from the sharing and collective forms previously introduced, it is the fundamental point for our discussion. Indeed, individuals are direct cultural and social contributors to their personal quality of life because they are bearers of needs, preferences, and resources. As suggested by the first economic theorem of wellbeing, every individual, according to their own needs, assigns a value to the good such that the consumption of it, and the expense of accessing it, make him happier, or at worst make him no less happy, than he was before its use (Milgrom & Roberts, 1992; Mas-Colell, Whinston & Green, 1995). According to this theory, the individual quality of life depends directly on the use of goods, and could be measured on the basis of the cost of accessing each of them. Indeed, the market regulates itself - the 'invisible hand' of Adam Smith (1995) - the free interaction among different individuals to access to a specific good defines the price of it, according to the availability of people to pay to use it, realising an equilibrium where the overall satisfaction of persons is better than it was previously; it means that at least for one person the situation is improved.

The fragmentation of the urban tissue, the large diffusion of private transport modes and the individual use of collective spaces are just some implications of the particularistic needs on the territory and on its use.

However, as suggested by the economist Amartya Sen (1983), the quality of wellbeing cannot just be a matter of goods, income, and utilities but is also related to the constituent elements of life: the material goods, intended not only as objects of consumption but rather as tools that the subject is able to use, become instruments to achieve 'capabilities'. In other words, the ownership of a specific good does not automatically imply the ability of each subject to obtain an advantage. It means recognising the complexity of the individuals and the different results that everyone can get according to their abilities (Sen, 1983). Indeed, this theory measures happiness on the basis of the pursuit of

functionings and *capability,* where the former relates to the results acquired at a physical and intellectual level (health, nutrition, longevity), and the latter "*reflects the alternative combinations of functionings the person can achieve*" (Sen, 1993, p.31). Furthermore, he suggested not only a multi-dimensionality and a more structured concept of 'quality of life' that relates to the multiplicity of levels of individual wellbeing, but also the relevance of the context in which the subject lives and acts. He recognised several levels of interaction among individuals, each offering different concepts: 'standard of living', 'wellbeing', and 'agency'. The first relates mainly to "*personal wellbeing related to one's own life*" (Sen, 1987, p. 29) and weaves the idea of 'freedom' - intended not only as objects of consumption but rather as tools that the subject is able to use - with the capability aspect. The *wellbeing* concept adds the concept of *sympathy* (Sen, 1982) or the inevitable interdependence between individuals (Sen, 1983). In other words, it identifies the presence of strategic interactions that influence everybody's quality of life and its perception. Wellbeing, in this sense, gains value from the relationships with others or from the participation "*in other people's emotions that alters our perception*" (Smith, 1995, p. 84). Further adding to the *commitments,* the focus shifts toward 'agency'. This concept relates to individual actions that are not directly connected to a specific benefit for those acts. It means identifying the presence of influences that are significant enough to move people to separate personal choices and their own wellbeing. The direct consequence of this approach is to think less of individual socioeconomic conditions, and more of collective aggregates.

2.2 Collective Interactions and 'Commonality' Forms

A second aspect to keep in mind when thinking about wellbeing is how the closeness among individuals could influence the satisfaction of everybody's needs. Sometimes the proximity of people promotes forms of interaction not directly connected to conscious collective practices, but which are able to influence the collective perception and the quality of life. Indeed, there are many reasons that move people to aggregate themselves: 'staying close' provides mutual benefits to individuals. Usually, we refer to pooling, matching, and learning advantages (Duranton & Puga, 2004). The first benefit describes the result of the sharing of *indivisible goods* or resources whose division among the members of a given group would not provide the same advantage (for example, the presence of a big sports structure offers many more options in comparison to several small private facilities). The second benefit refers to the advantage offered by a broader market, with more alternatives, that increases the chances of each person satisfying his needs. Proximity also facilitates communication and dissemination of culture, as well as the exchange of ideas. These benefits influence not only the single person but also the whole community and under aggregates of space in *resonance*. For example, one of the values of the agglomeration is making easier access to resources whose ownership is not alienable or excluded.

Proximity, connected to individual affinities, is sometimes able to achieve a tight connection between inhabitants and space through its modification in response to shared needs. It is not always a matter of collectively approved transformations as much as a progressive and repeated sedimentation of small additions, removals, and alterations that only in some cases are able to produce forms of identification between citizens and territory.

The repetition of daily actions on shared spaces gives rise to *commonality* (Todros, 2014) forms that retrieve the concept of *ideoritmia* (Barthes, 2004). The similitude of life's rhythms and spatial proximity sometimes builds 'light' sharing forms, not connected by formal joining but nonetheless able to change the space and the way of using it. These are flexible and intermittent connections that on one hand confirm the contemporary difficulty of weaving durable bonds (Sennett, 1970; Bauman, 2001) but, on the other hand, describe the birth of heterogeneous and temporary ties, linked by 'elective' or 'postmodern' affinities (Ambrosini, 2005). In these experiences, the *extimité* (Bianchetti, 2015; Lacan, 1986) becomes not only an expression of individual freedom in public space (Beck, 1998) but also a more comprehensive search for a balance between collective security and protection of individual autonomy: a free association that connects people without forcing them to sacrifice their singularities. In other words, in these situations, people can negotiate their desire to expose themselves, constrained not by strict membership rules but rather by informal conviviality guidelines (Laurent, 1993) realised within an *open* social organisation.

A significant case may be the neighbourhood of Les Grottes in Geneva, which, today, has rich cultural associations and cyclo workshops, but was originally a place of squatters and informal transformations (Bianchetti, 2012).

2.3 Sharing Forms

Beyond these informal and frequently unstructured practices, wellbeing is pursued through more conscious cooperative forms. Furthermore, some of these suggest considering not only the satisfaction of individual needs but also a collective idea of welfare (Evert, 2001). Accepting this point of view means recognising the overcoming of utilitarianism in the assessment of welfare – which has further references in the thoughts of John Rawls (1971), Robert Nozick (1974), Ronald M. Dworkin (2000) and Ralf Dahrendorf (1959) - and to focus the attention on processes rather than outcomes. Recognising the value of cooperative incomes means assigning to the individual not only the role of 'bearer of needs and requirements' within a collective aggregation, but also that of bringing skills and resources to be made available for his own and for common fulfilment.

The reasons for this transformation refer to both changing needs and availabilities and an overall weakening of the traditional pillars on

which the European civil society had founded the care of individual and collective welfare - the public intervention, the private initiative into the free market, and the nuclear family (Esping Andersen, 2002). This change in condition relates to circumstances both exogenous (de-collectivisation of work, job insecurity, social atomisation, financialisation, and offshoring of markets) and endogenous (change of balance between taxpayers and users), and has given rise to the *third-sector* initiative and to self-organisation. This situation pushes an alternative to modern market logic and to the usual state redistribution, offering cooperation forms, sharing actions, and 'reciprocity' practices (Polanyi, 1944). This phenomenon can now be seen within a broader scenario where shared actions are an expression of different strategies of welfare production, which are rarely an application of pre-built templates and more often describe an 'incremental nature' (Cottino, 2009) or the result of *cross-interaction* dynamics (Crosta, 2007). These are places where reference to the community persists thanks to the production - very often self-organised - of services. As collected in research such as 'shared territories' (coordinated by Cristina Bianchetti) or We Trades (promoted by the Goethe Institut), the European context is rich with such experiences that power up the urban tissue, encouraging the relationship between the people and their space. A flurry of activities and concerns that are sometimes triggered as an evolution of the old welfare state structures (e.g. public baths, libraries), while other times were born from unpublished local associations gathered around practices or specific interests (e.g. the self-made, culture, art). Some of these activities have realised an unusual use of space through the re-appropriation of outdated places: the porosity of the spaces combined with original collaborations between associations, informal groups, and local inhabitants have promoted flexible and temporary, social and spatial, structures. Indeed, the plurality and intermittence in participation as well as the alternation of roles (user, promoter, and organiser) have furthered their ability to adapt themselves and last over time (Devoti, 2016). The presence of *ungoverned* spaces, as well as the location in marginal areas of urban centres, seem relevant aspects of their birth (Devoti, 2016). Sometimes these experiences have born to prevent distress, or to solve specific social or political or spatial problems: i.e. the lack of services or the decay of public spaces. This emerging 'dynamism' is not unique, triggered by heterogeneous interests and intentions and *"crossed by inconsistencies and instabilities*" (De Leonardis, 1998, p.8), made up of socialisation spaces and collective habits. From the social point of view, the recognition of the value of local communities, in search of wellbeing, allows supply and demand to be brought, but at the same time opens up more chances of discrepancy at the urban scale. This claim finds confirmation in the variety of organisational and spatial structures, as well as in the different relationship that links these experiences to the history of the territory. On the other hand, the roots in the background and the reliance on local resources warrant the sharing of values and the resilience of such practices.

Within these experiences, the *individual identity* (Munarin & Tosi, 2010) is being redefined through the interaction between individuals. Here,

the processes of welfare research and production simultaneously contribute to maintain a social cohesion (Bauman, 2001) and to review the values attributed to the *quality of life*. Although the need for a revision of the welfare system in favour of a new 'wide approach' (Esping Andersen G., 2002) was recognised by the European Council in March 2000, the ability to propose and tackle the change of these experiences suggests a more comprehensive review of the state-citizen relationship (Bianchetti, 2011). In fact, it seems to reformulate the social contract within a new relationship of autonomy or addiction no longer uniquely describable in the private-public dualism, but connected to a broader conception of the *common* (Lefebvre, 1968) that more freely intertwines the collective sphere with the individual one. In his work, the sharing in everyday life is the basis on which to define the citizenship and consequently to qualify the space. Indeed, the *urban space nature* essentially rotates around the relationship between *use value* and *exchange value*. In other words, it is related to both: the repeating of collective practices and the rational production process.

In Europe, there are several examples of co-workings, co-housings, or purchasing groups, but there are also less elitist forms that are more relevant to the social and spatial net. For example, the Case di Quartiere in Turin are relevant experiences able to promote and receive welfare practices, and to change the space toward more controllable and customisable forms. Here, the social cohesion, as the result of a collective path, often started by the public initiative, has made available local resources and has seemed able to produce commons (Ostrom, 1990). In other parts of Europe, similar experiences work as autonomous poles, only occasionally connected with the municipality, while in Turin they have recently created an urban network to coordinate activities. This choice certainly does not want to reduce the differences between them, but rather emphasise local specificities and encourage interactions. In other words, this context does not offer particular safeguards on the prevention of risks of a majority tyranny (De Tocqueville, 1992) nor on a dissimilarity at the urban scale (Saraceno, 1998). The close connection to local capital establishes a greater closeness to the inhabitants' needs but limits the potential of replicability and homogeneity.

The community, populating and experiencing these realities, is certainly tied together by the sharing of space and proximity, so much to suggest a re-framing of the neighbourhood concept around an idea of coexistence *lumps*.

3 Communal Lumps

As we have just said, the self-made welfare system seems to rebuild the relationship between territory and people, sometimes just as an auto representation form of group of individuals. By the early 20th century, the Chicago school had already given a significant contribution to the study of the relationship between space and community (e.g. Wirth, 1939; Harvey, 1929; Anderson, 1928). In the elaborate studies produced in those years, the city was seen as an organism in which the *natural areas* were characterised by portions of the population that were socially and culturally homogeneous. The studies conducted by Wirth on ghettos (1928), by Harvey on the slums (1929), and on loitering zones (Anderson, 1928), suggested the presence of several factors that were not inducted or planned (e.g. the migratory processes characterised by social groups, professions, and jobs affinities), and which contributed to the organicity of specific areas. This approach, not underestimating the role of the conflict, was related to the spatial organisation of social life, laying the theoretical basis for the identification of homogeneous partitions within the urban tissue: a matter that summons the concept of neighbourhood. However, defining these partitions requires a special discernment, especially in terms of the specific forms and issues to which they refer. Indeed, traditionally they could be defined according to the historical patterns or the original settlements, or by topographical, historical, economic, functional, or socio-cultural aspects. The meaning of neighbourhood itself has been repeatedly reinterpreted, both conceptually and at the project level, sometimes emphasising the housing component, while at other times the cultural or functional features. Moreover, the idea of homogeneous social groupings is now no longer considered adequate to describe a morphology of space (Cremaschi, 2008). Even from an administrative point of view, the tendency seems to unify local partitions, a policy that somehow delegates to local groups the taking care of their own specifics.

It should be added that the local communities are now expressions of *cross-conditions* and *particularistic behaviours* that are universalised into large social and *liquid* (Bauman, 2000) networks: they are built on *organic* forms rather than *mechanical* solidarity (Durkheim, 1893). In any case, it is already hard to understand how extensive such *lumps* are and what shapes they take. We could see several distinctive strategies: one strategy relates to what divides them, a second focuses attention on the differences between homogenous parts, and a final one refers to agglomeration strategies.

3.1 Boundaries

The study of social fragmentation in the existing urban fabric was often approached within a heterogeneous literature aimed at identifying the reasons for separation. According to the *ecological perspective* of Massey and Denton (1988), there are exogenous causes (separation as a result of an attitude of rejection) and endogenous causes (spatial division as an expression of an attempt to preserve cultural identity).

Parkin, in 1979, observed the way in which like-minded people maximise the gains and opportunities narrowing the group - social closure - and produce economies that are spatially recognisable within urban enclaves. Similarly, Coleman's theory of 'rational choice' (1979) showed how segregation is the result of the choice of different groups to live with similar people according to ethnicity and social class. In other words, the collective identification is linked to culture and income. Moreover, Boal, Murray, and Poole (1976) showed how the separation within the urban fabric was the index level of the conflict within a society. More recently Mike Davis (1998), observing urban segregation in American cities at the end of last century, proposed the scheme called *ecology of fear* where fear is a basic element of distinction. In the most segregating forms, the boundaries are determined by the presence of a *militarized* and *dichotomized* space (Davis, 1998), where the contrast is between the slum and the fortress city (Caldeira, 2000): a double distinction between the suffering subjects and the acting ones (Bauman, 2001). Today these division strategies seem to coexist with new ones. The different physical (proximity to specific services) and economical (cost of housing, for example) features of the space favour the establishment of different groups in areas suited to their needs. Furthermore, the contemporary processes of social identification seem to be less radical when compared to the last century, open to greater flexibility and welcoming. The reasons for that change are attributable to a growing complexity in society (Bauman, 2000) and to a rising 'centrality of practical dimension' that weaves *formal rules and exceptions* (Cremaschi, 2008).

The idea of pursuing a spatial separation of forms, functions, and social groups appeared between the 19th century and the first part of the 20th century, as a *viable solution* to control the development of settlements (Calabi, 2013). Today, however, it seems necessary to think of a different logic, not only of separation, but also maybe not exclusively of *mixité* or *compactnes*s (Barattucci, 2013). These are, together with the *citizenship*, the main keywords used to perceive a 'sustainable development', according to the Italian urbanist review of the main documents produced by international organisations during the 20th century (the Aalborg Chart of 1994, the Lipsia Chart of 2007, the Kyoto protocol, or the strategy Europe 2020).

3.2 'Bubbles' and 'Globes'

As suggested by Sloterdijk (1998, 1999, 2004), *live* means building *spheres*, whether they are unitary structures within which individuals can shape a sense of *intimacy*, the *bubbles*, or places where collective groups defend themselves from the insensitivity of the external world: the *globes*. What is really interesting about the historical and philosophical reconstruction of the human culture, proposed by Sloterdijk, is the idea of bringing it back to an inclusive figure: the *sphere*. This approach suggests thinking about 'what unites' and not just about *what divides*. It does not mean evading forms of separation: sections, socially or culturally homogeneous, are in any case able to

create value scraps in the urban fabric. In other words, the presence of relationships among people, at least as forms of self-representation, can reconstruct recognisable spatial and social structures. Today, territorially homogeneous social organisations seem at best attributable to the *communities of practice* mentioned by Marco Cremaschi (2008). These groupings are held together by *common* and occasional practices that are seldom able to shape common values and identities. A network of rules, *arts of doing*, as well as of conflicts, hard to describe in the abstract, sometimes encourage a sense of belonging (Cremaschi, 2008). Here, the coexistence is built on people's ability to establish forms of mutual and continuous acknowledgment.

The presence of cooperative practices within shared spaces reconstructs new spatial configurations starting from the possibility to build new *localities* (Appadurai, 1996): spaces in which the density is not (only) a demographic issue but a social and relational one.

However, apart from their influence on the spaces, it is quite difficult to recognise these practices. It is for this reason that several scholars have observed the concentration or the occurrence of certain places, functions, activities, and exceptions. Some approaches (Bianchetti & Sampieri, 2014) have focused their attention on explorations, visits, investigations, while others (Hidalgo & Castañer, 2015) have used open data (e.g., POI or photos on search engines) and have applied clustering models to recognise the extent of these poles. However, many of these studies rarely wonder about how the conformation of the space affects the observed phenomena, more often they are limited to establishing their shape and location.

3.3 Proximity

The idea of proximity, referring to wellbeing issues, leads to focussing the attention on the way in which the space incites new synergies among inhabitants. The concept allows a clear reference to a local dimension without, however, a direct reference to territorial boundaries.

In other words, the density the forms of interaction between people and space have the power to enrich the urban tissue, realising *lumps* (Devoti, 2015) characterised by blurred, sometimes straddled, boundaries. Furthermore, the concept of proximity allows the assumption of a geography made of nodes that are often complementary and seldom coincident with the partitions - functional, administrative - of the urban fabric. The meaning of this remains to be seen.

As suggested by Sloterdijk (1999), it comes down to describing the shape and the extension of a narrow space around the house. Perry, in 1923, suggested a city made up of small agglomerations designed in order to make collective spaces accessible on foot. The design structure had clear distribution rules and an endowment of services that made local communities independent: each portion had a surface of 160 acres and a radius no longer than a quarter of a mile. However, with the

spread of private transport and the consequent reduction of distances, interest in the issue seemed to have been lost until the economic crisis changed things. New attention on ecological matters and emerging wellness needs have now given rise to new strategies to promote a quality of life that is more connected to neighbourhood matters: social networks, soft mobility, new economy, and so on.

Recently, the research on the quality of urban space and landscape, coordinated by Christophe Girot and Elena Cogato Lanza (2014), have proposed proximity as a social, physiological, aesthetic, and functional tool to improve wellbeing at a local level. According to their work, it refers not only to mobility aspects but also to perceptual features. In particular, they have highlighted the importance of synesthetic aspects in qualifying the urban environment. The atmosphere indeed, in their research, defines comfort as an "*immersive practice in which urban landscape is explored as an envelope endowed with intrinsic environmental and climatic qualities*" (Girot, n.d.). Moreover, they underlined the value of *dwelling* as the opportunity to use and consider the space as an interior. This condition helps subjects to attribute an intimacy feature to some places. Experiencing this concept of proximity is something beyond the measurable: it is barely represented by traditional tools. However, the proposed spatial model, a square with a side of 1.5 kilometres, is certainly not exhaustive, when trying to understand the complexity of the aspects described. It is clearly a simplification, useful to understand some of the proximity features but leaving behind others, such as the influence of the morphology of spaces or the presence or absence of some facilities in the definition of these *lumps*.

4 Conclusions: a Wellbeing Soft Machine

To sum up the idea of sustainability weaves perceptive and shared aspects. The wellbeing research processes play a significant role in defining the quality of life and in promoting resilient practices and spaces. Indeed, the local activation promotes common life habits changes and ascribes new, shared values to the space. As stated, it means considering a plurality of factors contributing to individual and collective wellbeing: some depend on individual preferences, others on the interaction between them. When the collaboration acquires a greater level of awareness, it creates new temporary communities. This thickening of relationship concerns the sense of belonging to a group, as well as to a specific space. The environment becomes not only the background of the shared practices, but it acquires a key role to observe and promote the quality of the life.

Today, the complexity of wellbeing processes has moved towards a set of small, flexible, and adaptive places, moreover self-organised and based on local capital. The trend would seem to create secure, controllable, customisable spaces and devoid of multifunctional places deprived of any connotations. Within these experiences, both temporary and changing communities are gathering. The realised social and spatial

structures are indeed resistant to forms of institutionalisation and hardly explainable in the abstract. However, they are places able to justify a constellation of aggregations that are probably not enough well connected to describe a polycentric system, nor so strong and structured as to realise independent districts, but able to realise a fragmented urban system of nodes partially autonomous and partially connected. In fact, it is impossible to ignore that the heterogeneity of these experiences in Europe, but also within the same urban setting (the main case study is again the previously described *Case di Quartiere* in Turin), is the expression of cultural and social differences, as well as of their rooting in a specific area. In other words, the strong connection between these experiences and their background (i.e. the demography of the district, the local recent history, the current public welfare system) on one hand determines their effectiveness, but on the other, it limits the chance to replicate them elsewhere.

This 'soft machine' (Burroughs, 1961) is the answer to the need of a new economic and spatial structure that helps the individual in thinking, producing, and expanding wellbeing. It could be considered as an *apparatus* that is able to recognise the changes over time and to receive unexpected and incremental results.

This system is certainly evidence of the individual need to express the *instrumental freedoms* (Sen, 1999) within shared spaces and small aggregations. This is not only a return to the territory as an opportunity for enhancement of local specificities, but a push toward an improvement of tools to describe, design, and take care of the collective space.

This context, however, does not avoid some of the typical phenomena of exclusion and inclusion of contemporary urban centres and does not exclude the fragmentation between the city of the rich and of the poor (Secchi, 2013).

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Community Resilience and Tourism Development _

The Case of Marginal Areas

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ABSTRACT **The chapter discusses the concept of community resilience in relation to tourism, with a main focus on marginal areas. The aim here is to present how tourism development in marginal areas can contribute to the development of resilience within the local communities, ensuring their survival in the future. Few studies have been done on the relationship between resilience and tourism, and most of them have been focused on tourism as a mechanism of post-crisis recovery or as a means to enable those involved in the tourism sector to confront future shocks and reduce disaster risks.**
Here, a different approach is proposed, defining community resilience as an intentional action, aimed at responding to, and influencing, the course of social and economic change. According to this perspective, resilience is intended as a voluntary response to a slow change that is needed by marginal societies to shift from unstable economies to stable ones, preserving, in the context of this change, the local identity and thereby making it the central element of development.

KEYWORDS community resilience, tourism, marginal areas, local development

1 Introduction

According to many studies, community resilience has always been related to disasters. Only in the past few years, new theories have started to discuss the capability of communities to act in response to any form of change, be it social or environmental. Therefore, notions of community resilience now also relate to the ability of the individual or the community to deal with difficult conditions or react successfully to change. This capacity of recovering from adverse situations can echo the instinctive aptitudes of a community, or it can be the outcome of a learning process (Amir, Ghapar, Jamal, & Ahmad, 2015). In fact, resilience cannot be meant as a characteristic that is owned, or not, by a person or a group, but instead as a process that may change according to different situations or times (Luthar, 2003), and that can be intentionally developed.

Within this field of study, only a little research has focused on the relationship between tourism and resilience. Sustainability is a key area in research on tourism, and sustainable development is a frequently mentioned example of actions that help a community to become more resilient, yet the concept of community resilience is scarcely discussed in the literature on tourism development (Amir et al., 2015). Placed in this lacuna, this manuscript aims to understand the concept of resilience through the lens of tourism, which is intended here as a means for building more resilient communities, with a specific reference to marginal areas.

This approach is seldom found in literature and no study specifically faces the topic of marginal areas, which needs to be addressed in order to consider in more depth the question of how communities can build resilience.

The manuscript starts from a review of the existing literature about community resilience and resilience and tourism, then the role of tourism in marginal areas is addressed to discuss how, within this context, it can be both a factor of local growth and a tool to develop resilience, ensuring the survival of the community in the future. Finally, the case study of Alqueva is presented to argue how a marginal area, which suffered a traumatic event, is recovering with policies that tend to promote forms of sustainable tourism.

2 On the Concept of Resilient Community. A Literature Review

The concept of resilience, from the Latin *resalire*, has been vastly used in many different disciplines in the last 50 years. The concept originates from both physics and mathematics, where it refers to the capacity of a material or a system to recover its shape after an interference, and from ecology, where it refers to the ability of an ecosystem to assimilate shocks while continuing to work.

A starting point in resilience theory is represented by Holling (1973), who, when discussing the behaviour of ecological systems, introduced a differentiation and an interplay between resilience and stability. Holling (1973, p. 17) stated that "resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes", while stability is "the ability of a system to return to an equilibrium state after a temporary disturbance". According to this differentiation, a system can be very resilient but have low stability and vice-versa, i.e. the resiliency of a system is not determined by the stability of its components (population, economic activities, etc.) but by the abilities of these components to shift from one condition of (unstable) equilibrium to another.

The work of Holling has been particularly influential, giving rise to following definitions and application to a wide range of matters, such as communities and social system.

Among the different disciplines, resilience can be defined as:

- In physics, "the ability to store strain energy and deflect elastically under a load without breaking or being deformed" (Gordon, 1978, p.129) or the speed with which a "system returns to its equilibrium after displacement, irrespective of whether no, few, or many oscillations are involved" (Bodin & Wiman, 2004, pp. 34-35).
- In psychology, "an individual's ability to successfully adapt to life tasks in the face of social disadvantage or highly adverse conditions" (Windle, 1999, p. 163).
- In ecology, the "ability to persist through future disturbances" (Abel & Langston, 2001, p.1).

However, there is no commonly accepted definition that can be used across all categories. In order to try and find a definition of community resilience, the Community & Regional Resilience Institute (2013) identified five different elements, or couples of elements, which can be found in different types of classification: Being vs Becoming, Adaptation vs Resistance, Trajectory, Predictability, Temporal Nature. The CRRI (2013, p. 10) combined these elements, defining Community Resilience as the capability to "anticipate risk, limit impact, and bounce back rapidly through survival, adaptability, evolution, and growth in the face of turbulent change". When analysing a community that is exposed to a risk, we often consider the negative consequences, and not the resources that the community can put in place to resolve the crisis in its favour. Overturning this perspective, Gist and Lubin (1989) emphasised the resilience of communities that have to face events such as natural disasters. Studying the reaction of a Puerto Rican community after a massive flood, Bravo, Rubio-Stipec, Canino, Woodbury, and Ribera (1990) formulated a community strengths hypothesis that was based on the fact that the psychopathological symptoms of the members of the affected community were not particularly different before and after the flood. Norris, Stevens, Pfefferbaum, Wyche, and Pfefferbaum (2008, p. 130) defined Community Resilience as "a process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance". This definition has the advantage of

underlining the process of change and adaption more than the result, being valid both for the community and the individual because it is "content free" (Norris, n.d.). As Norris (n.d.) noted, resilience is not a permanent quality of an individual or community, but rather "it is one particularly desirable trajectory of post-event functioning that is influenced both by the severity of the stressor and by resources that can be strengthened via pre- and post-event interventions". Norris's approach has something in common with MacKinnon and Driscoll Derickson's (2012, p. 264) definition of resourcefulness as a "material property and a relational term that seeks to problematize the often profound inequalities in the distribution of resources by the state that further disadvantages low-income communities". In scientific literature, resilient communities tend to be defined by three main tendencies: tendency to resistance, referring to the capability to absorb shocks; tendency to recover, referring to the speed and ability to recover from the stressor; tendency to creativity, referring to the creativity potential of social systems while recovering after shocks. In order to establish a definition of community resilience that fits the purpose of this study, it is necessary to move the focus from shocks (tourism, inflow of visitors, in this case) to positive economic and social reactions.

Colussi et al. (2000, p. 11) defined community resilience as an "intentional action to enhance personal and collective capacity of its citizens and institutions to respond to, and influence the course of social and economic change". The "intentionality" here is central: a community that is interested in a touristic inflow can react intentionally to take advantage of a social and economic change. It is not a simple defence mechanism put in place to preserve the integrity of the community itself, but a stimulus to adapt, improve, and thrive. In sum, for our purpose, the most effective definition of community resilience should take into account both the Norris approach, for the process-focused point of view, and the Colussi definition, especially with its emphasis on social and economic change.

3 Resilience and Tourism

Tourism has hardly ever been related to the concept of resilience. Only over the past few years, resilience thinking has attracted tourism academics' attention, either as a mechanism of post crisis recovery or as a means to enable those involved in the tourism sector to confront future shocks and reduce disasters risks.

A schematic review of the theories concerning resilience and tourism is provided by Cochrane (2010), who lists various applications of the concept to tourism. Farrell and Twining-Ward (2004; 2005) initiated a discussion of resilience and complex adaptive tourism systems. The discussion was then used by Tyrrel and Johnston (2008) to generate a mathematical model, conceptualising the relationship within a 'dynamic model of sustainable tourism', on which Schianets and Kavanagh (2008) based their approach, which aimed at identifying

sustainability indicators in tourism. Moreover, the concept was applied in specific context, such as: by Perpar and Udovc (2007) with relation to rural tourism in Slovenia; by McDonald (2009), who used it to recognise relationships between stakeholders in a touristic location in Western Australia; by Calgaro and Cochrane (2009) in defining actions for building resilience in Sri Lanka and Thailand after the Asian tsunami; and by Amir et al. (2015) to discuss the development of sustainable tourism in rural communities of Malaysia.

Lew (2014, p. 15) highlights how, in recent literature about resilience, it has been recognised "that human settlements at all scale face a diverse range of predictable and unpredictable (or nonlinear) natural and social shocks, some of which are sudden and large, but others of which are gradual and moderate in their perceived". Walker, Carpenter, Rockstrom, Crépin, and Peterson (2012, p. 30) refer to these as "fast variables" and "slow variables". The latter include, among others, the response to long-term climate change, cultural shifts, and change and resilience in tourism. If the most common resilience perspective in tourism has been focused on tourism industries and tourist arrival numbers, following fast variable change (Lew, 2014; Faulkner, 2000), more recently slow variables have started to become a new matter of interest for tourism scholars. Lew (2014, p. 17-18) discusses how "communities perceive and manage slow change in the environment, culture and society in a different manner than they do under major shocks", stating how a slow change, triggered by the development of the tourism sector, is apparently more sustainable and manageable, even if "at some point, the rate of change in the natural or social environment may pass a threshold (or breaking point) after which it is perceived like a shock event". This means that, in the case of slow changes, a management plan for long-term viability and success must be defined. The required approach is that of resilience planning, which seems to be more appropriate than the sustainable paradigm. The difference between the two is focused, among others, by Lew (2014, p. 14) stating, "sustainability mitigates or prevents change by maintaining resources above a normative safe level, whereas resilience adapts to change" (see also Derissen, Quaas, & Baumgärtner, 2011).

Starting from this theoretical context, the chapter aims at discussing how the slow development of tourism can help to ensure a resilience community, with a focus on marginal area.

4 Marginal Areas. A Definition

Marginal areas may be defined as areas characterised by unfavourable economic and social conditions, that cause a situation of development delay in comparison with the external context (Antolini & Billi, 2007). The marginality of an area can be the result of a slow historical process of isolation or the outcome of an economic, social, or environmental perturbation; it can involve both a small portion of a territory or a territory as a whole.

Schematically, according to Sommers, Mehretu, and Pigozzi (1999), marginality can occur at three different scales: macro-spatial, micro-spatial, and in-situ marginality.

The macro-spatial marginality involves the regional scale and concerns the disparities between the communities located in the central places of economic activities and the communities that, due to their remote position and the lack of natural resources, are vulnerable.

The micro-spatial marginality concerns depressed areas within quite small territories, such as urban areas and metropolitan regions. Factors such as history and age are quite important in this type of marginality, even if the more visible forms of vulnerability are based on ethnic-cultural distinctions, migration status, and economic bipolarities resulting from the cyclic dynamics of economy. In Europe and North America, the micro-spatial margins are usually located in the centres of the major metropolitan areas and are often determined by the interaction between different endogen factors.

The in-situ marginality refers to an unequal development within a very small geographical unit, such as an urban block, where very high disparities in living standards can be registered in the same neighbourhood. Even in this case, factors such as ethnic-cultural distinctions and migration status, represent the principal elements of vulnerability and differentiation.

To narrow the field of investigation, among these three different scales, the chapter discusses the case of macro-spatial marginality, i.e. marginal areas at regional level, which, within a given territory, can be recognised according to the following parameters (Buonincontri, 2011):

Geographical Aspects
The distance from the main urban centres and the geo-morphological characteristics of the territory are the elements to which the idea of marginality has been mostly associated in time. A geographical position, distant from the central areas of development, and unfavourable natural and morphological conditions, are among the factors that usually have a central role in the process of marginalisation at the regional level.

Infrastructural Aspects
Strictly connected to the geographical aspects are the infrastructural ones. Marginal areas are often catheterised by difficulty in access that, first of all, are given by the geo-morphological conditions of the site, but also by the lack of adequate road and railway networks. Moreover, the scarcity of new and technologically advanced communication and information infrastructures amplifies the condition of isolation, slowing down the overall progress of a territory.

Economic Aspects
Marginal areas are normally characterised by a little diversified production structure, a poor integration between the various components of the local economy, and a difficulty in exporting local products

outside the territory itself. Agricultural activities are often predominant but are barely linked to agro-food processing, which, if reversed, could activate production and marketing of typical products. Another sector characterising the economy of marginal areas is that of handicraft. Both of these activities represent a strong element of identity that forms part of the immaterial heritage of such places. Yet, the lack of new workers and the competition created by new, undifferentiated and low-cost industrial products make craft subject to a slow process of extinction.

Demographical Aspects

Although today even the most industrialised territories are affected by an aging population trend, a decreasing birth rate, an increasing unemployment rate, and widespread commuting, these trends are more evident and long-lasting in marginal areas.

These aspects, combined together, represent a point of reference to observe and quantify the condition of marginality of an area at regional level. In sum, a difficult geo-morphological position, the scarcity of infrastructures, and the lack of economic activities are usually the main threat for the survival of communities in marginal areas, which are already at risk of depopulation. This implies that the continuity of the community itself may depend on its ability to change and adapt to new conditions, i.e. developing resilience and finding new sources of economic and social income.

Shifting from quantitative parameters to a qualitative perspective, Buonincontri (2011) discusses how marginal areas, despite the critical situation that they have to face, often present cultural, natural, and artistic resources that, thanks to the condition of marginality, have been mostly preserved from the influence of the external context. These resources are an expression of authenticity and originality, becoming an important witness of the territorial identity. Assuming this point of view, marginality is not necessarily a crisis element, being also an opportunity. In this regard, Tìšitel, Kušová and Bartoš (2003, p. 81) argue that "regions, considered marginal from one perspective can become focal points if put into another context". In fact, the exclusion, at least partially, from the globalisation dynamics often allowed marginal areas to maintain their identity, which is a strong connection with local culture and tradition, and to preserve specific cultural landscapes. Identity is a significant resource that, if properly protected and enhanced, can become the starting point of a process of sustainable development in which tourism may play a main role, being a factor of economic diversification and a tool to enhance the strengths of marginal areas. Here, community resilience may be referred as "the ability of the community to enhance and sustain the business, exploring and disseminating what is valuable and essential for its survival" (Amir et al., 2015, p. 118). This means that the development of tourism can help the society to shift from an unstable economy to a stable one, preserving, within the change, the identity of the community itself.

5 Tourism as a Tool to Develop Resilience Communities

The good effects of tourism on local development have been widely demonstrated (Buonincontri, 2013), as well as the fact that the introduction of tourism causes major changes in the territory that a community has to face. On the one hand, the ability to react to those changes constitutes a first form of resilience, while on the other hand, in the case of peripheral and fragile territories, the development of tourism gives an opportunity for a change of the whole community, ensuring its existence into the future. As argued by Amir et al. (2015, p. 119), the resilience depends here "on the community's flexibility, that is the ability to rebound and reorganise in the event of challenges while maintaining a sense of continuity"

The core issues are those of identity and community heritage, which, in the case of marginal areas, are the two main resources on which the development of tourism can be set up, being a strategy for the community to achieve better living conditions. It has been proved how local identity can be preserved only by opening it to an external market, thereby making it the central element of local development (Gualerzi, 2006). Giving value to local identity and promoting it as a touristic resource is a tool to develop community resilience. On the one hand, this allows the community to maintain, in the present, cultural repertoires that have been passed through generations. On the other hand, this implies that the community deliberately makes an effort to keep a historic sense of place but which still affects the present. (Beel et al., 2015). This attitude can be assimilated to that of resilience planning, where "resilience may not recover to a previously undisturbed state but to something that is entirely new" (Beel et al., 2015, p. 3). Magis (2010, p. 402) defines this attitude as an intentional action that members of resilient communities "engage in to respond to and influence change, to sustain and renew the community, and to develop new trajectories for the communities' future".

In the case of peripheral areas, the change, which is needed for their survival, aims to invert the depopulation trend, to improve infrastructures, and to obtain a better socioeconomic condition of life. A possible strategy to introduce a slow and manageable change that ensures the resilience is that of a community-based tourism, which promotes the relationship between local community and visitors and involves the whole community in the shift of economy. In this way, achieving a high-quality visitor experience, preserving the natural resources, the material and immaterial heritage and improving the wellbeing of the area (Manyara & Jones, 2007). This implies incorporating "hotel management, tourism management, food and beverage and complementary services all together", without forgetting "other subsystems such as infrastructure, health, education and environment" (Amir et al., 2015, p.117), as well as developing a method of analysis of marginal areas that is aimed at recognising all the natural, historical, architectural, and artistic resources, as well as the immaterial heritage. In fact, both material and immaterial

heritage (traditions, food products, etc.) are expressions of the local identity that have to be promoted in order to give rise to a slow and sustainable change.

Within this context, we must consider that many forms of tourism exist and that not all them are compatible with fragile territories like marginal areas. Here, in fact, the form of tourism that seems to be more suitable is that of sustainable tourism, defined by UN World Tourism Organization and & UN Environment Programme (2005) as "Tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities". This idea was the basis of the Charter for Sustainable Tourism (UNWTO, 1995). The Charter (p.1) discusses the ambivalence of tourism, recognising that "it has the potential to contribute to socio-economic and cultural achievement and it can at the same time contribute to the depletion of the environment and the loss of local identity" and defines a series of operational guidelines. All the indications listed in the Charter are inspired by the principle of the respect of the cultural and natural heritage, as well as the involvement of local communities in the touristic development. Both the respect of local heritage and the involvement of communities implies a social, ethical commitment that is required when thinking of a process of recovery of marginal areas mainly based on the enhancing of their identity.

6 The Case of Alqueva, Developing Resilience

Alqueva is the central-western part of the Portuguese region of Alentejo. Located on the boundary between Portugal and Spain, it has always been a remote place, far from the main economic centres of both countries. An economy mainly based on agricultural activities, the dryness of the soil, a depopulation trend, a high rate of unemployment, the scarcity of infrastructures, and a very low per capita income are, among others, some of the factors that characterise Alqueva as a marginal area. In order to face this critical situation, in the 1950s, the Portuguese government started to plan the construction of a dam, to be placed close to the village of Alqueva and aimed at the construction of a widespread irrigation system. The building of the dam started in 1976 and, after some interruptions, was completed in 2002, when the water started to flood the territory, giving rise to one of the largest artificial lakes in Europe. The water submerged about 250 square kilometres of land, covering ancient rural architectures, archaeological ruins, and even a whole village (Pacheco, Mendes, & Rocha, 2014).

If, on the one hand, the creation of the lake has empowered agriculture, on the other hand, it has represented a traumatic event for the territory and the local community, that has now to develop resilience, finding a way, within the change, to preserve its memory and identity.

A piece of research on Alqueva, entitled Architecture, Tourism and Marginality. Design and Touristic Enhancement of Marginal Areas, was conducted at the University Iuav of Venice, Department of Architecture and Arts, with the cooperation of the University of Évora, Faculty of Architecture. The investigation aimed to evaluate to what extent the development of tourism in marginal areas could be a tool to help fragile territories to overcome a situation of disadvantage, ensuring the survival of the local communities in the future. The Alqueva case study has helped to develop a method to recognise the weaknesses and points of strength of a marginal area, trying also to understand the ongoing process through which Alqueva is now building resilience by activating the tourism sector.

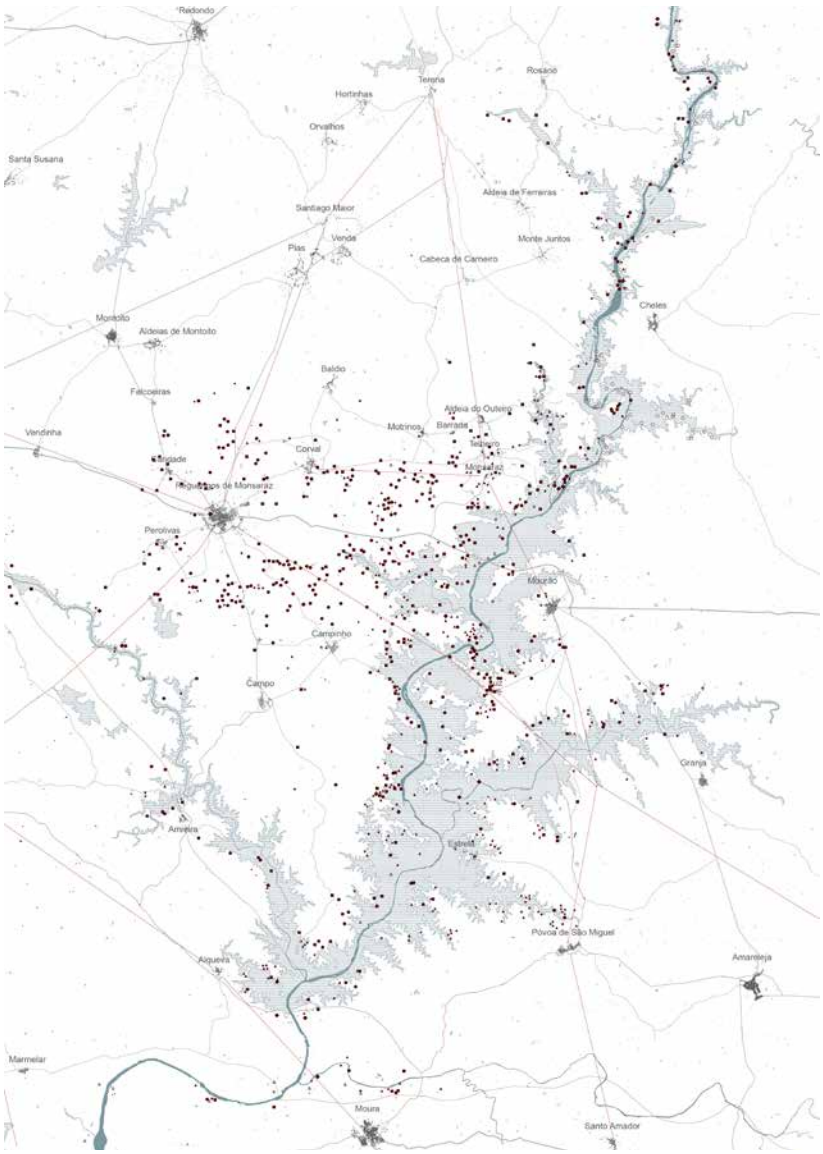

FIG. 6.1 Alqueva, map of the archaeological sites *(Image by Viola Bertini, 2016)*

The developed method of analysis consists both of the study of statistical data and the recognising and mapping of the material and immaterial resources of the territory. The mapping of the resources focused on

natural, historic-cultural, and architectural heritage to define the elements that may be a starting point for the development of tourism in the area. These elements are an expression of local identity and, exactly for this reason, they represent a strong point of interest for those forms of sustainable tourism in search of a contact with the authenticity of the place. The maps can be conceived both as a form of knowledge of the places and an operational tool to define the actions that can help a correct management of the territory, i.e. its protection and promotion.

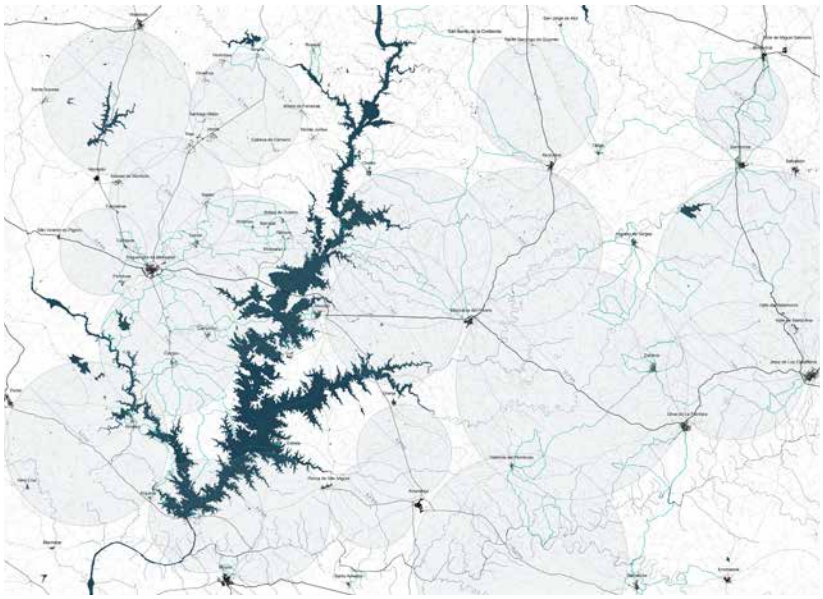

FIG. 6.2 Alqueva, map of the infrastructures and the slow mobility *(Image by Viola Bertini, 2016)*

The study of statistical data has taken into account both social and economic aspects, such as demographic trend, average monthly income, and data on tourism. The study highlighted a strong condition of social and economic marginality and a consistent growth of the tourist sector, due to the recent policies undertaken by local authorities. These policies represent an interesting example based mainly on the idea of developing forms of sustainable tourism in Alqueva that can benefit and ensure the economic and social survival of the area. The actions undertaken can be summarised as follows:

- a cross border association (Associação Transfronteiriça do Lago Alqueva) has been established, with the purpose of managing the territory as a whole;
- people and authorities started to see the creation of the lake not only as a traumatic event, but also as an opportunity for economic development both in agriculture and tourism. Consequently, new economic activities have been started in relation to the touristic use of the lake, such as touristic ports, camping areas, and boat rental facilities;
- the promotion of the area as a touristic destination has been launched through actions of territorial marketing, and increasing the number of touristic arrivals;
- the production of local agricultural products have been empowered thanks to the creation of the new irrigation system. In particular, the

production of wine has largely increased, giving rise to a form of neo-gastronomic tourism and incentivising its trade;
- the re-use of abandoned rural buildings, mainly for touristic purposes, has been incentivised, giving rise to new economic activities for accommodation;
- new areas of ecological protection have been established;
- new museums and interpretative centres have been created, as well as new touristic routes that, crossing the territory, represent a way of enhancing the local cultural and naturalistic heritage.

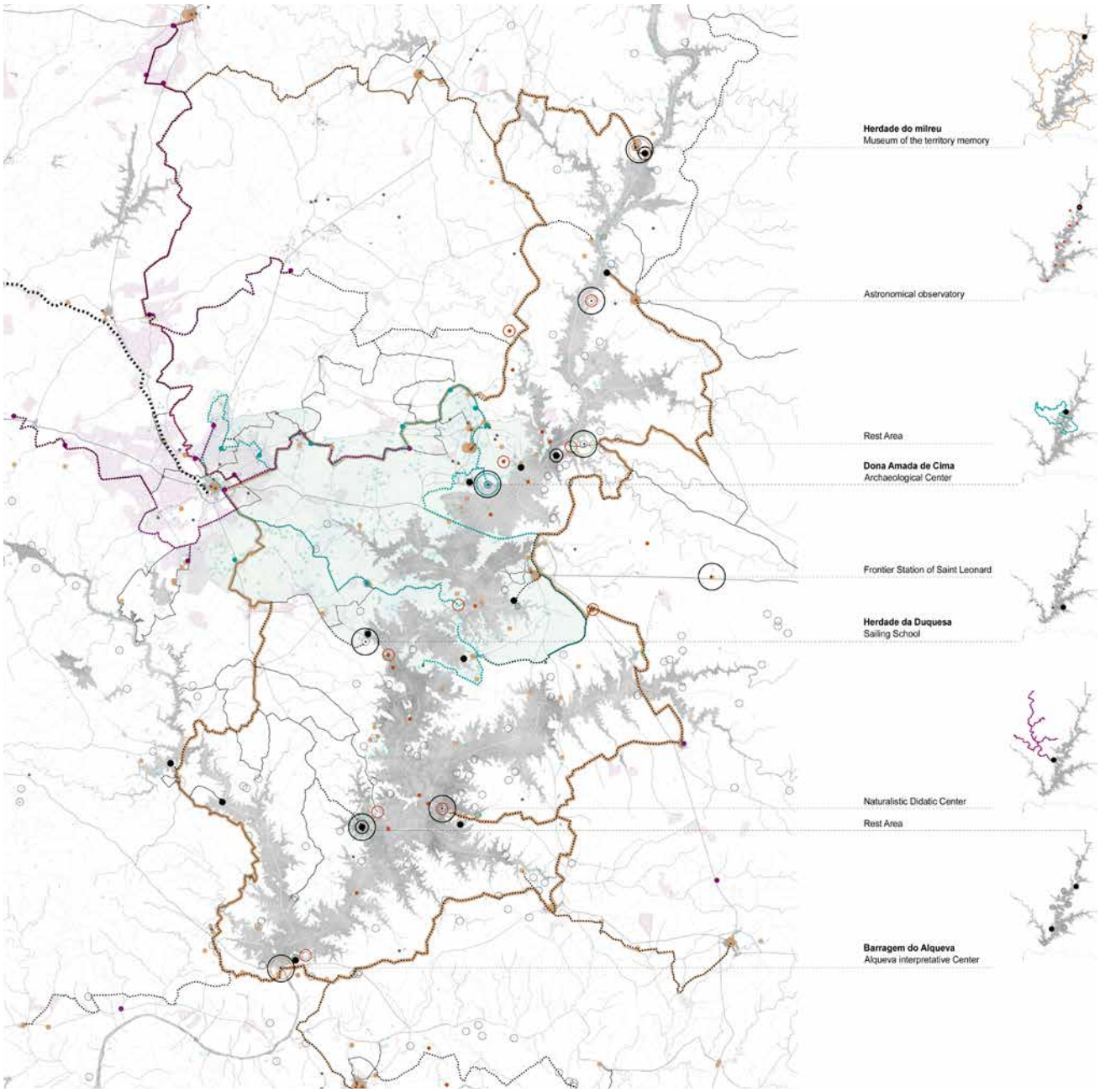

FIG. 6.3 Masterplan proposal for the Alqueva area *(Image by Viola Bertini, 2016)*

The results of these actions will be tested in the future, as they represent an interesting example. The proposed model is, in fact, one of local development mainly based on improving sustainable tourism as a way of developing resilience. Here, tourism is intended as a means through which the local community can adapt to the new situation, taking advantage of the change that took place in the territory. Moreover, tourism may be a tool to help a marginal area to overcome its implicit disadvantage, hence improving, thanks to new economic activities, the quality of life of the community. Finally, the idea of promoting sustainable tourism is a way to enhance and give value to the local material and immaterial heritage, as well as helping the conservation of the local identity.

Within this context, resilience is a voluntary act resulting from a territorial management that proposes a new development model, which is able to relate the promotion of low-intensity forms of tourism, the redirecting of agriculture towards typical productions, and phenomena of suburbanisation. This model requires "a careful reading of the historic landscape and an interpretation of the local community's needs, between a rediscovery of the genetic codes of a series of ground and buildings arrangements and the exploration of their potential transformability" (Lanzani, 2002, p. 273, translation by the author).

7 Conclusions

In marginal areas, the development of sustainable tourism can be a tool aimed at diversifying local economy, improving wellbeing, and developing community resilience. Resilience is not intended here as a response to a fast and unpredictable change, but as a voluntary choice to respond to and influence the course of social and economic change, which is needed to ensure the survival of the community itself.

In this context, a tool through which resilience can be developed is the enhancing of local identity, which is the main strength and the main touristic resource of marginal areas and, at the same time, the way by which the community can maintain a historical sense of place. This means managing and driving a change, while keeping a sense of continuity and a link with the past. The good effects of this mechanism can be measured by parameters such as demographic trend, improvement of physical and technological infrastructures, employment rate, number of new local business, etc., as well as by parameters like interventions in the field of environmental protection, actions of safeguarding and promoting of material heritage, integration of local community and visitors, etc. This process requires the bottom-up creation of an integrated system of touristic offerings and originates from correct territorial management that proposes a model of sustainable development, based on the elaboration of new cultural models of tourism, and implying a high, even if controlled, transformation of the territory rather than just its pure conservation.

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Healthy Places in the Built Environment

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ABSTRACT **Although the impact of the built environment on human health is significant, architectural and urban design still does not take sufficient account of its relevance, due to the lack of interdisciplinary knowledge and collaboration of planners and designers with the healthcare workers, environmental health professionals, and other relevant experts and stakeholders who need to be included into planning and design processes. To assist in bridging the knowledge gap, this review paper first analyses the relationship between the built environment and human health, and then considers the concept of a 'healthy place'. The impact of the built environment on human health is explained through a set of health-related determinants, whose spatial determination and description bring even closer the consideration of the right size of a 'healthy place' in the built environment. Health-related determinants of the built environment cannot be generalised, so planning and design must be adapted to the particularities of every individual place, in order to make it 'healthy'. Despite the determination by definition and the approximation of its optimal scale, the concept of a 'healthy place' remains partially abstract, because of the individual differences among its users, and well as the lack of possibility to measure the levels of health and wellbeing in relation to the built environment. Therefore, this paper opens a new debate about the threshold of a healthy place, as well as about the upper limit of a healthy place ('just healthy enough' level) above which some negative social implications, such as gentrification, could occur.**

KEYWORDS built environment, health, determinants, healthy place, neighbourhood

1 Introduction

Broadly speaking, the built environment can be understood as a system of spatial and physical conditions for human activities and the satisfaction of human needs and desires. Whether in the house, at the workplace, or during recreation, people are surrounded by elements of the built environment. Having regarded the reciprocal relationship, the impact of the built environment on its users has evolved into a distinct field of research.

Almost 2500 years ago, Hippocrates spoke in his treatise *On Airs, Waters and Places* about the importance of the impact of environment on human health (Hippocrates, n.d.). While the shaping of the built environment in accordance with the 'sense of place' represented a common practice in the past, technical-technological and socio-economic development altered the possibilities of transforming the natural into the man-made environment, and simultaneously changed mutual influences between built space and its users.

Different studies have reported that there is a close relationship between human environment and human health. The air that people breathe, the water they drink, the features of space in which people stay, the way in which built space is used, and even social interactions, are all deeply interwoven with the built environment.

The elements of built environment can both improve or impair human health, by influencing behaviour, habits, and feelings, and by direct impact on physical health. Built environment can thus be brought into relation with a growing number of chronic diseases (e.g. Perdue, Stone, & Gostin, 2003), obesity, diabetes (WHO, 2016), as well as cardiovascular diseases. On the other hand, the healing potential of a materialised space has also been reported (e.g. Leibrock & Hariss, 2011). Further, built environment can nourish human physical activity, which is directly related to health and wellbeing (Audrey & Batista-Ferrer, 2015; Carlson, Aytur, Gardner, & Rogers, 2012; Frank, Kavage, & Devlin, 2012; Wells, 2016), and can influence eating habits (Booth et al., 2001; Sallis & Glanz, 2006), social wellbeing (French et al., 2014; Wood et al., 2008), as well as mental health (Evans, 2003; Halpern, 2013). Therefore, "making health an explicit component of planning is critical" (Wells, 2016, p. 1).

The need to address the impact of a man-made environment on health through an interdisciplinary approach has resulted in the integration of scientific disciplines. *Health geography*, as a sub-discipline of *human geography*, uses the principles of geographic science to explore health issues (Hussain, 2016). *Environmental health* appears as a branch of *public health* that deals with all aspects of the natural and built environment that may affect human health. According to one definition, environmental health comprises those aspects of human health, disease, and injury that are determined or influenced by environment factors (Srinivasan, O'Fallon, & Dearry, 2003, p. 1446). These environmental factors involve various chemical, physical and

biological agents, as well as housing, urban development, land use, transportation, industry and agriculture.

While researchers and different organisations are trying to develop strategies, plans, and projects for the built environment that will not have a negative influence on human health, or will even have a positive impact, practicing professions that are directly involved in creating the built space often do not pay enough attention to this aspect. It is important that urban planners, designers, and architects, in collaboration with policy makers, environmentalists, public health advocates, health practitioners, and health promoters, address the issue of environmental impact on human health more profoundly. For this to happen, education is necessary. To that end, this paper aims to build a knowledge regarding the relationship between built environment and human health, primarily by exploring and explaining the main health-related determinants of the built environment, and considering the definition and the optimal spatial scale of a 'healthy place'.

2 Health-Related Determinants of the Built Environment

The state of health, as defined by the World Health Organisation in 1946 (WHO, n.d.), refers to "complete physical, mental and social wellbeing and not merely the absence of disease or infirmity". From contemporary point of view, different authors (e.g., Last, 2009; Mirowsky & Ross, 2003) criticise or try to upgrade the basic definition of health by the World Health Organisation. Bircher (2005), for example, defines health as "a dynamic state of well-being characterized by a physical, mental and social potential, which satisfies the demands of a life commensurate with age, culture and personal responsibility" (Bircher, 2005, p. 336).

Physical, mental, and social aspects of health are influenced by different circumstances that exist within the built systems. The negative impact of the urban environment on health is well described in the literature (e.g., Lederbogen, Kirsch, Haddad, & Meyer-Lindenberg, 2011; Okulicz-Kozaryn, 2015; Schaller, 2012). Furthermore, the studies have shown that the rise in poverty, inadequacy, and the lack of work affect people's dissatisfaction with rural life and impact their wellbeing (Kovács, 2009; Perz, 2000), in spite of benefits such as having a close connection with nature and a more peaceful lifestyle. Similarly, the quality of life in the in-between territories, when compared to urban and rural areas, is not improved (Adams, 1992; Kährik, Leetmaa & Tammaru 2012).

To determine more closely the impact on human health, it is necessary to identify influencing factors originating from the built environment. These factors are understood as determinants of the built environment that affect human health (Table 2.1).

IMPACT	DETERMINANTS OF THE BUILT ENVIRONMENT
Variable	Conditions at location in which a place is "set"
Variable	Resilience of place/Preparedness for disaster
MS	Residential density
MS	Built space typologies and distribution of physical structures
PM, S	Land use and spatial organisation
PM, S	Incorporation of nature contact into built tissue
P, M	Air, water and soil quality
P, M	Allergens and other biological contaminants
M, S	Municipal noise
P, M	Accessibility to other places/facilities, especially to health care services
P, S	Transportation
PM	Walkability and bicycle use
P	Infrastructure
M, S	Open space design and dimensioning
S, M	Common space design
S, M	Social life and common activities
PM	Green space design and dimensioning
PM, S	Sports/recreation and other spaces for physical activity enhancement
M, SP	"Intended" spaces (e. g., healing corners, educative spaces or child care community places)
M, S	Spatial equipment
P, M	Safety in relation to injury/accident occurrence
PM	Ease of moving
Variable	Safety in relation to crime, violence and social disorders
M	Flexibility and adaptability of the design
S, M	Social structure, justice and inclusion
PM	Actions and programmes for health promotion (healthy lifestyle, nutrition, obesity, physical activity, substance abuse, targeted or future predicted (e.g. Davies, 2015) sickness prevention, etc.)
S, M	Promotion of positive social values and relations
M, S	Image of the place: aesthetics/attractiveness/identity/diversity
M, S	Perception of the place (pleasant, attaching, hoping, supportive, healthy, happiness enhancing, etc., vs depressive, dark, cold, strange, etc.)
M	Scent of place as memory trigger
M	Capacity of place for support in emotional crisis and the stress absorption
M	Spiritual dimension of the place
PM, S	Hygiene
PM	Indoor environmental quality (including comfort aspects)
P	Chemical content of construction materials
PM	Quality of construction
Abbreviations: P – physical health; M – mental health; S – social health.	

TABLE 2.1 Health-related determinants of the built environment *(Kosanović, Vaništa Lazarević & Timotijević, 2015, p. 82)*

The built environment affects human health and wellbeing at different spatial scales and in different ways, primarily through the built forms, land use options, and the organisation of functions.

Infrastructure and transportation options can influence walkability, generation of air pollution, noise, and related stress, as well as the injuries, and even death outcomes during car accidents.

Traffic-related improvements are achieved by improving street lighting and connectivity (ease and safety of street crossing), traffic calming, efficient and affordable public transportation, and the practice of active travel (Audrey and Batista-Ferrer, 2015; Bunn et al., 2003; Davies, 2015; Dobbins & Tirilis, 2011).

Ease of moving and accessibility to different places/facilities in the built environment affect human health and wellbeing in various ways. The continuity of sidewalks and bicycle paths and the attractiveness of space encourage people to increase walking and cycling while reducing driving, and thus to become more physically active. Such behavioural change in turn improves social relations and public security, and reduces stress, number of fatal accidents, and crime rates (Kent & Thompson, 2012; Super Church, 2014; Audrey & Batista-Ferrer, 2015). On the contrary, in an environment that is not conducive for walking and cycling and in which the use of private vehicles dominates, people suffer more from higher body weight and obesity, as well as the chronic diseases that go with these conditions (Giles-Corti, Macintyre, Clarkson, Pikora, & Donovan, 2003; Papas et al., 2007). Besides an adequate street layout, and presence of sidewalks and bicycle paths, physical activity is enhanced through the adequate design of common open spaces, such as playgrounds, parks, and sport/recreation spaces.

Density, and spatial organisation and use (such as singular or mixed-use options) account for important qualities of the built environment, especially when it comes to the consideration of the quality of life, and health and wellbeing. Good quality design and sufficient provision of open spaces (such as public squares, ceremonial places, and public structures) and green areas reduce social isolation and estrangement, and bring multiple other benefits to the users, from enhanced physical activity, to emotional relief (Lau, Gou, & Liu, 2014; Semenza, 2005).

Green open space has been assigned particular importance in the built environment, having regarded that it provides contact with nature, acts as an ecologically significant agent, and represents a spatial platform for numerous activities with positive outcomes for physical, social, and mental health aspects. Maas, Verheij, Groenewegen, Vries, and Spreeuwenberg (2006, p. 587) have found that "the percentage of green space in people's living environment has a positive association with the perceived general health of residents". Therefore, the prevention of mental, emotional, and physical health problems could be improved by providing access to the natural environment (Pryor, Townsend, Maller, & Field, 2006). Besides open spaces (e.g., parks, community gardens, etc.), contact with nature could be strengthened with some design-specific measures at a building scale, such as biophilic design, provision of sufficient size and good position of windows on envelopes, as well as by the greening of envelopes, which is particularly relevant in densely built parts of urban environment (Frumkin & Fox, 2011; Stamenković, Miletić, Kosanović, Vučković, & Glišović, 2017). Frumkin and Fox (2011, p. 229) have noted that, besides direct benefits on human health, "providing nature contact could also yield co-benefits such as more energy-efficient buildings, improved access to healthy foods, and conservation of natural resources".

Physical and social characteristics of the built environment can both foster and harm human health. Lower socio-economic status results in poorer health and increased levels of crime and violence, which raises the risk for depressive/anxiety disorders (Morenoff & Lynch, 2004; Stockdale et al., 2007). "Crowded, noisy and dangerous places have a variety of negative impacts on people and their psychological states." (Sullivan & Chang, 2011, p. 106) The feeling of unsafety can further be related to reduced physical activity and health-aggravating conditions (Centers for Disease Control and Prevention, 1996). On the other hand, an adequately shaped, well maintained, distinctive, and safe built environment may promote social ties and values among the members of a community and hence contribute positively to the social aspect of health (Sullivan & Chung, 2011; Glasgow Centre for Population Health, 2013). To that end, the 'third places' - informal meeting places outside of home ('first place') or work ('second place'), seem to have an important, although yet insufficiently understood role for the health and wellbeing (Manuel & Thompson, 2006). Third places could be coffee shops, pubs, parks, streets, trails, squares, or any other places of informal socialisation within the built environment (Fig 2.1).

FIG. 2.1 Japanese pavilion in Slovenj Gradec, Slovenia. The result of the workshop with professors Tadej Glažar and Hiroto Kobayashi *(Image by Vid de Gleria, 2017)*

Image and perception represent another health-related determinant of the built environment, from design and materialisation of interior spaces and building envelopes, to the density of dwelling, to the perception of safety, to the appearance of built forms and their relationship with users (Kemp & Baker, 2007; Jorgensen & Stedman, 2011; Roessler, 2012; Ochodo, Ndetei, Moturi, & Otieno, 2014; Schaller, 2012). Built space typologies and distribution of physical structures influence individual's emotions and behaviour in various ways (e.g., Schaller, 2012; Roessler, 2012). Simultaneously, the spiritual dimension of a place, scent of a place as memory trigger, capacity of a place for support in emotional crisis, and stress absorption all play important roles in creating a sense of wellbeing (e.g., Smyth, 2005).

Excessive utilisation of private vehicles, increment of population concentrations, inadequate waste management, insufficiently developed infrastructure, presence of other biological and chemical contaminating factors, etc. cause the deterioration of the quality of air, water, and soil – three main elements of human environments that directly affect physical human health. With the development of connectivity, public transportation, pedestrian and bicycle lanes, and greening measures applied to different scales of the built environment, the number of vehicle uses and accordingly the level of air pollution from traffic sources could be notably reduced (e.g., Galea & Vlahov, 2005; Commission for Architecture and the Built Environment, 2009). These measures should further be combined with the promotional measures for using biofuels and transition to more efficient, less polluting vehicles (Frank et al., 2012), as well as with measures for the utilisation of renewable energy sources.

Together with an adequate level of hygiene (e.g., Prüss-Üstün & Corvalán, 2006), good air quality must be achieved at all scales of the built environment, from the settlement level, to the indoor environment of singular buildings, where the right choice of building materials, effective ventilation, optimal humidity, ways of indoor space utilisation and maintenance, provision of all types of comfort, and occupants' behaviour account for the most relevant influential factors. The role of sustainable building design in reducing potential negative impacts of a built space on the health of its users is significant, both directly and indirectly, for example through reduced energy consumption and hence reduced air pollution.

By composting organic waste and recycling other waste types, burning waste for useful energy, recycling or reusing the wastewater, securing flood protection, reducing contamination of water bodies and reduced utilisation of pesticides and fertilisers, utilisation of biodegradable products, etc., soil and water pollution are also reduced (e.g., Galea & Vlahov, 2005; Backer, 2011; Glasgow Centre for Population Health, 2013).

Furthermore, the resilience capacity of a place, i. e. the preparedness of the community for disasters, is a determinant that can make a significant contribution to health when it comes to unexpected outcomes of natural disasters (e.g., Beatley, 2011).

Actions and programmes for health promotion within the built environment are necessary in order to raise awareness about health issues, enhance social health, and educate users about nutrition, physical activity, possibilities of sickness prevention, etc. (e.g., Aboelata, 2004; Galea & Vlahov, 2005; Prüss-Üstün & Corvalán, 2006; Davies, 2015). These actions and programmes, as well as the design and production of 'intended' spaces in the built environment (e.g., healing corners, education spaces, or child care community places) are important because they encourage people to change their habits and adopt healthier lifestyles.

3 Healthy Place and its Scale

The term 'healthy place' was introduced in response to the established relationship between the built environment and people, meaning the established impact of the built environment on human health. Bearing in mind variable context specificities, and the fact that the same environment does not affect all people in a same way, the definition of a healthy place, and more importantly, of its properties, creates a complex challenge.

Generally, Frumkin, Wendel, Abrams, and Malizia (2011) have defined healthy places as "places where people can grow up, live, work, play, study, pray and age in ways that allow them to be safe and healthy, to thrive and to reach their full potential" (p. 5). By taking the medical science perspective, Kosanović et al. (2015) have studied whether the healthy places could be hierarchically characterised as basic – preventive, promotive, and curative places, in accordance with the health protection gradation. Similarly, Roslyn (1985, p. 18) has argued that a healthy place needs at least to "provide a range of opportunities for their inhabitants to shape the conditions that affect their lives…and do no harm". According to the presented observations, the threshold of a healthy place could, in a simplified way, be perceived as 'without negative impact on human health and well-being'.

However, theoretical considerations offered by different authors, as well as the definitions and interpretations of a healthy place, have not yet been largely applied in practice. A basic fact that aggravates the precise determination of a healthy place is an inability to ascertain all impacts of the environment on human health. Therefore, the following questions are kept open: What are the minimum qualities that a place should possess in order to be called 'healthy'? What is the optimal scale of a healthy place? To that end, the basic assumption that assists in drawing the answers is that a geographically scaled environment allows for a more precise determination of the impact of a place on its users. With a right, defined scale of a healthy place, it seems possible to improve the quality of living environment.

The spatial framework in which people live represents an important determinant. Living environment is highly correlated with the quality

of schools, transportation, municipal services, health care and services, and employment opportunities (Cubbin, Pedregon, Egerter & Braveman, 2008), as well as with social-economic conditions, place attachment, sense of belonging, etc. As such, a spatial framework shapes behaviour and influences human health in different important ways (Cubbin et al., 2008).

For these reasons, different authors adopt the scale of a neighbourhood as optimal for studying the health-place relations. To describe the geographic extent and environmental determinant of health, Spielman and Yoo (2009) have introduced the term 'effective neighbourhood', that is formed by complex interaction between the characteristics of people, problems, and places. The main characteristic of effective neighbourhoods, according to Spielman and Yoo (2009), is that they are defined relative to the unit of analysis and not using global criteria. For the purpose of this paper, neighbourhood should be understood as a geographically small, inhabited area, with specific natural, built, social, and symbolic characteristics (Gesler, 2003) that determine relationship between human health and place. "The geographical limits defined by the residents who identify with a specific area are an important element when differentiating themselves from others who do not live there. The clearer the physical limits of the neighbourhood, the stronger the identification". (Uzzell, Pol, & Badenas, 2002, p. 35-36). Solidarity, cohesiveness, social interaction, and a sense of belonging usually characterise such a place. In these social conditions, a neighbourhood becomes a territory for therapeutic process that is perceived as communal act (Moughtin, McMahon Moughtin, & Signoretta, 2009).

Morenoff, Sampson, and Raudenbush (2001) have argued that the neighbourhoods with higher levels of collective efficacy have lower levels of violent crime. Roslyn (1985) has explained that social support contributes to people getting less sick, taking as one example those individuals who have a sense of belonging to the community. In their review on social capital and mental wellbeing in older people, Nyqvist, Forsman, Giuntoli, and Cattan (2013, p. 394), show that "family and friends at the micro level are crucial in generating social capital and well-being in older people". Numerous other studies show that the social character of a place, such as good social relations, social support, and fulfilment of social needs are important for health improvement (e.g., Fitzpatrick & LaGory, 2002; Thoits, 2011; Klijs, Mendes de Leon, Kibele & Smidt, 2017). Places that have the greatest potential to meet social needs and therefore improve human health are the neighbourhoods, due to the specific and unique relations amongst their dwellers.

Regardless of all determinants given from the professional position for the purpose of spatial planning and design, the importance of the 'individual' should not be neglected, which is why the relations between place and health, presented in this paper through the determinants of the built environment that affect human health (Section 2), must be understood as being somewhat generalised. In addition, the perception of the scale of a specific neighbourhood (seen as an area comprising private and shared spaces) varies among individuals and

depends on their age, occupation, interests, etc. (Spielman & Yoo, 2009). Health remains both a collective and an individual issue, and its consideration in planning and design, besides its greatest importance for the neighbourhood, must be differentiated between other spatial scales, from the micro-level of residential units, to the macro level of built settlement systems.

4 Discussion and Conclusions

Human health represents an indispensable part of sustainability and resilience concepts. Bearing in mind that "resilience is a capacity as old as our origins, otherwise we wouldn't be here" (Wheatley & Frieze, 2011, p. 126), it can be argued that throughout history people have always been, at a certain level, resistant - individually, collectively, and globally. Personal resilience implies a person's ability to deal with shocks, and to bounce back from adversity, such as disease, injury, climatic disasters, family member loss, job loss, or any other surprising or unsurprising changes on an individual level. At the community level, resilience considers the ability of a group of people to cope with expected or unexpected changes. Just as individual resilience doesn't guarantee community resilience, a resilient community doesn't guarantee global resilience, and vice versa. To achieve resilience, it is important "to find a way for people and institutions to govern social-ecological dynamics for improved human wellbeing, at the local, across levels and scales, to the global" (Folke, 2016, p. 1).

Wellbeing is an indicator that is relevant to both sustainability and resilience (World Commission on Environment and Development, 1987; Biggs, Schlüter, & Schoon, 2015; Folke, 2016; United Nations, 2012). Even though the state of wellbeing can be described as "the combination of feeling good and functioning well" (Huppert & Johnson, 2010, p. 264), i.e. as a subjective evaluation of one's life, moods, and emotions (Deiner & Lucas, 1999, p. 213), it cannot be achieved without an objectively good state of health. On the other hand, the state of health is influenced by the conditions in which people live, their educational, recreational, and leisure opportunities, their homes, communities, villages, and cities, as well as their individual characteristics such as social status, age, gender, values, genes, etc. In other words, environmental, economic, and social determinants of sustainability and resilience are simultaneously the determinants relevant to human health and wellbeing. Finally, "people who are healthy are better able to learn, to earn and to contribute positively to the society in which they live" (United Nations, 2012, p. 3).

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